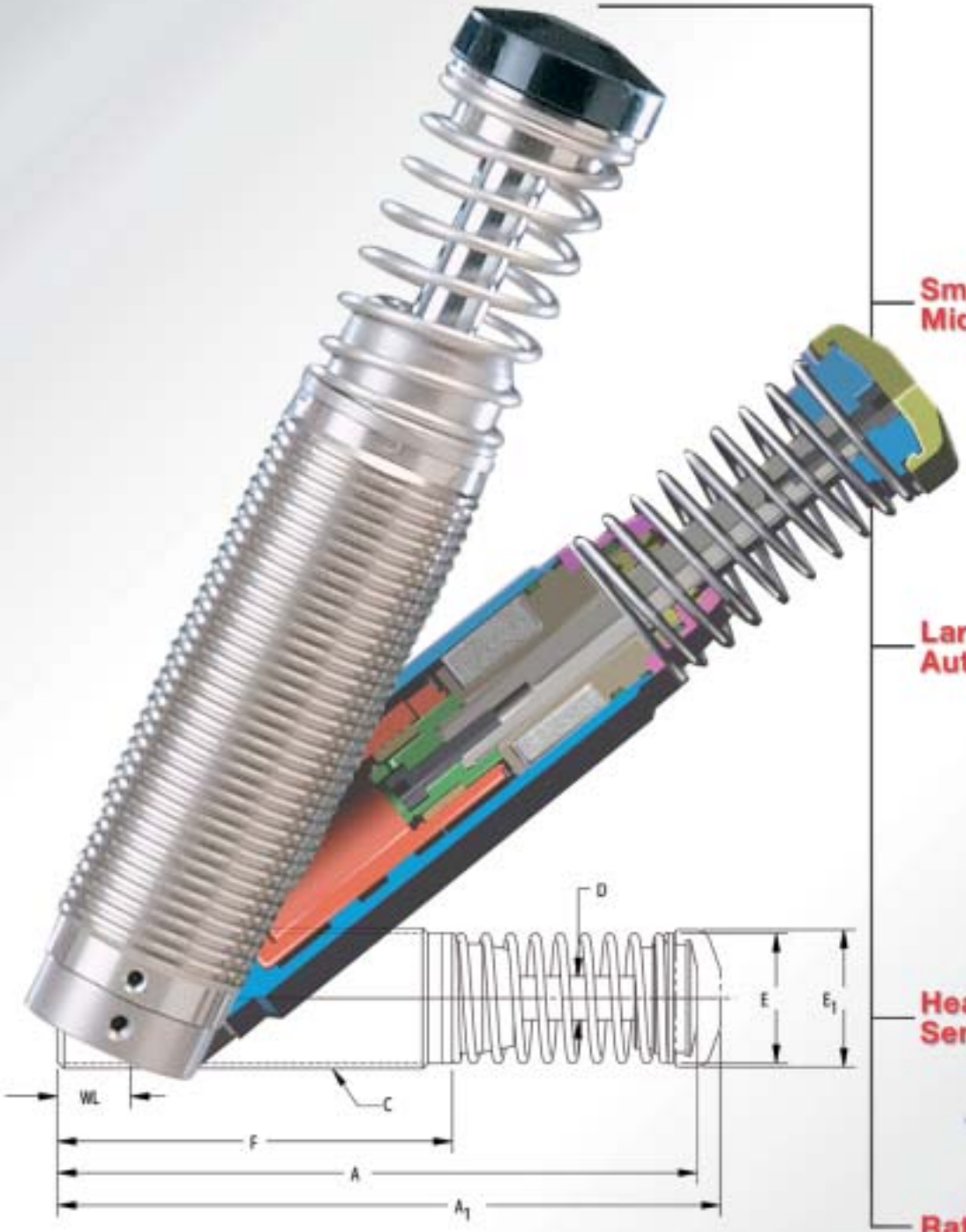


Small Bore /
Mid Bore Series

Large Bore /
Automotive Series

Heavy Industry
Series

Rate Controls

Shock Absorber

and Rate Control Product Catalog

Control & Power, Inc. – 1.877.835.5274 – www.controlandpower.com




ENIDINE
An IMC Company

Solutions in Energy Absorption and Vibration Isolation.

Enidine: Solutions in Energy Absorption and Vibration Isolation.














Solutions in Energy Absorption and Vibration Isolation.

Enidine is widely recognized as the preferred source for energy absorption and vibration isolation products.

Greater productivity and less downtime. For more than 30 years, customers have relied on Enidine products to help make their machinery and equipment perform quietly, safely and more efficiently at higher speeds. For original equipment manufacturers and aftermarket applications, Enidine offers a unique combination of product selection, engineering excellence and technical support to meet even the toughest energy absorption application requirements.

Responsive global operations. Enidine is a worldwide organization, with manufacturing facilities and headquarters in Orchard Park, New York, USA; Bad Bellingen, Germany; and Yokohama, Japan. Additional sales offices are located in California, Mexico and the United Kingdom.

Highly trained distributors. Each geographic region is supported by a well-established distributor network that shares our company's commitment to customer service and quality. All Enidine distributors receive extensive training in identifying the best product for your application.

Teamwork. Working as a team, our global engineering, manufacturing, sales and distribution network allow for timely response to your needs with uncompromised excellence.

Communication. Our mission at Enidine has always been to be an industry leader in energy absorption and vibration isolation solutions. In carrying out that mission, we've made it paramount to communicate directly with our customers, distributors, representatives, and employees to better understand and respond to your needs. This ongoing interaction has helped make Enidine the growing, vibrant, global presence it is today.

Custom solutions capabilities. If you are unsure whether one of our standard products meets your requirements, feel free to speak with one of our technical representatives toll-free at 1-800-852-8508, or contact us via e-mail at techsales@enidine.com.

Enidine engineers continue to monitor and influence trends in the motion control industry, allowing us to remain at the forefront of new energy absorption product development. Our experienced engineering team has designed custom solutions for a wide variety of challenging applications, including automated warehousing systems and shock absorbers for hostile industrial environments such as glass manufacturing, among others. These custom application solutions have proven to be critical to our customers' success. Let Enidine engineers do the same for you.

For better performance and productivity, call your local Enidine representative.

Taking the guesswork out of shock absorber selection.

The first section of this catalog covers basic energy absorption theory, explaining key concepts such as damping, while demonstrating shock absorber usage. It also covers the effects of varying weight and velocity on shock absorber performance. Once you're familiar with these concepts, and have an understanding of the type of product technology you need, please refer to the appropriate product section for technical specifications:

- Adjustable Hydraulic Series
- Non-Adjustable Hydraulic Series
- Heavy Duty (HD/HDA) Series
- Heavy Industry (HI) Series
- Rate Controls

Each section describes the unique features and benefits of models within an associated product family, including envelope drawings, technical data charts, curves, detailed sizing instructions and application examples.

For immediate product sizing assistance, we also invite you to utilize our new multi-language, windows-based Enisize software, affixed to the inside back cover of this book. With a few simple steps, Enisize will allow you to quickly calculate, size and select the correct product, recommend proper accessories and facilitate ordering.

Regular updates of Enisize are available for download at www.enidine.com. When used in conjunction with our new Global Shock Absorber catalogue, these tools can serve as an instant resource to verify calculations, help properly size and order product, and most importantly – help take the guesswork out of shock absorber selection.

Enisize sizing software.

Table of Contents

Product Enhancements

Enidine has the widest selection of industrial shock absorber and rate control products in the industry. With nearly 450 standard products to choose from and limitless custom possibilities, our products decelerate velocity up to 700 inches per second and absorb energy between one and eight million inch pounds per cycle. We constantly evaluate and refine our products to bring customers more features, greater performance and improved ease of use.

Enhancements to the small bore shock absorber series have provided softer/smoother deceleration, integrated positive stop capabilities and improved durability, reliability and performance. Wrench flats on these shock absorbers make them easier to install.

Customers have many choices when it comes to components:

- Products can incorporate nickel plating or stainless steel surfaces for corrosive environments, continuous wash down or food preparation applications.
- Alternate fluids maintain consistent damping characteristics over high and low temperature conditions.
- Attachment accessories provide a wide range of options, including clevis mounting configurations and air/oil sequencing systems.
- Soft urethane piston caps reduce noise and extend product life in high-cycle applications.

A redesign of our PRO and PM series was the direct result of input from machine builders, who said they needed to control higher velocities and larger drive forces with a smaller shock absorber.

Above all, a solid commitment to quality and superior customer service are at the heart of our business. By maintaining precise quality systems, we ensure that products perform as specified. We're so certain, we offer a lifetime warranty on workmanship and materials.

Custom designs are not an exception at Enidine, they are an integral part of our business. Should your requirements fit outside of our standard product range, Enidine engineers can assist in developing special finishes, components, hybrid technologies and new designs to ensure a "best-fit" product solution tailored to your exact specifications.

A talented engineering staff works to design and maintain the most efficient energy absorption product lines available today, using the latest engineering tools:

- Solid Modeling
- 3-D CAD Drawings
- Finite Element Analysis
- Complete Product Testing Facility

New product designs get to market fast because they can be fully developed in virtual environments before a prototype is ever built. This saves time and lets us optimize the best solution using real performance criteria.

Global Service and Support

Enidine has significantly improved its customer response times through a number of critical initiatives:

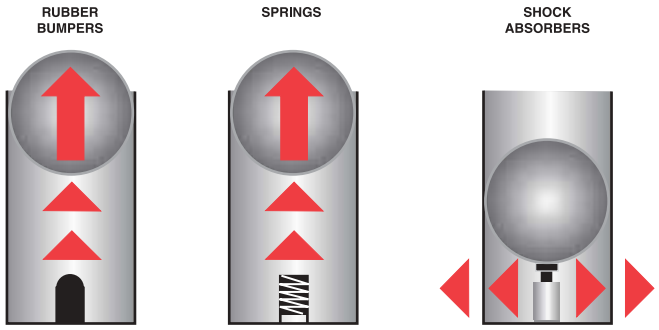
- Conversion to single-piece flow cellular manufacturing, enabling us to produce custom and standard products faster and better, with higher quality and greater efficiency.
- Enhanced customer service presence at all of our global facilities – ensuring prompt responses when you need them.
- Regular, intensive training of our authorized distributor network, making them better able to serve you.
- Global operations in USA, Germany, Japan, UK and Mexico.
- Newly enhanced Enisize sizing software, with regular updates available at www.enidine.com, to simplify the selection process and help choose the best product solution for your application needs.
- A comprehensive, multi-language web site full of application ideas, technical data, and guidance on selecting the product that's right for you. Our website also features a fully searchable worldwide distributor lookup to help facilitate fast, localized service.

These capabilities and more are at your disposal at Enidine. Let us show you how we can be of service today.

Our global customer service and technical sales departments, located within each of Enidine's worldwide facilities, provide prompt and knowledgeable answers to your questions about sizing, ordering, technical applications, and implementing the best product for your application. This highly trained and motivated multi-lingual team is your most direct and immediate interface with our company.

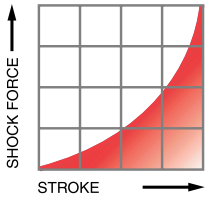
Overview of Energy Absorption Theory

As companies strive to increase productivity by operating machinery at higher speeds, often the results are increased noise, damage to machinery/products, and excessive vibration. At the same time, safety and machine reliability are decreased. A variety of products are commonly used to solve these problems. However, they vary greatly in effectiveness and operation. Typical products used include rubber bumpers, springs, cylinder cushions and shock absorbers. The following illustrations compare how the most common products perform:

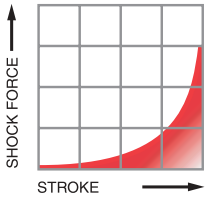


All moving objects possess kinetic energy. The amount of energy is dependent upon weight and velocity. A mechanical device that produces forces diametrically opposed to the direction of motion must be used to bring a moving object to rest.

Rubber bumpers and springs, although very inexpensive, have an undesirable recoil effect. Most of the energy absorbed by these at impact is actually stored. This stored energy is returned to the load, producing rebound and the potential for damage to the load or machinery. Rubber bumpers and springs initially provide low resisting force which increases with the stroke.



Cylinder cushions are limited in their range of operation. Most often they are not capable of absorbing energy generated by the system. By design, cushions have a relatively short stroke and operate at low pressures resulting in very low energy absorption. The remaining energy is transferred to the system, causing shock loading and vibration.



Shock absorbers provide controlled, predictable deceleration. These products work by converting kinetic energy to thermal energy. More specifically, motion applied to the piston of a hydraulic shock absorber pressurizes the fluid and forces it to flow through restricting orifices, causing the fluid to heat rapidly. The thermal energy is then transferred to the cylinder body and harmlessly dissipated to the atmosphere.

The advantages of using shock absorbers include:

1. Longer Machine Life – The use of shock absorbers significantly reduces shock and vibration to machinery. This eliminates machinery damage, reduces downtime and maintenance costs, while increasing machine life.

2. Higher Operating Speeds – Machines can be operated at higher speeds because shock absorbers control or gently stop moving objects. Therefore, production rates can be increased.

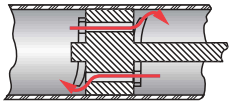
3. Improved Production Quality – Harmful side effects of motion, such as noise, vibration and damaging impacts, are moderated or eliminated so the quality of production is improved. Therefore, tolerances and fits are easier to maintain.

4. Safer Machinery Operation – Shock absorbers protect machinery and equipment operators by offering predictable, reliable and controlled deceleration. They can also be designed to meet specified safety standards, when required.

5. Competitive Advantage – Machines become more valuable because of increased productivity, longer life, lower maintenance costs and safer operation.

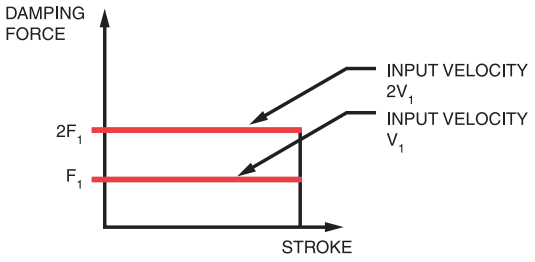
Automotive vs. Industrial Shock Absorbers

It is important to understand the differences that exist between the standard automotive-style shock absorber and the industrial shock absorber.

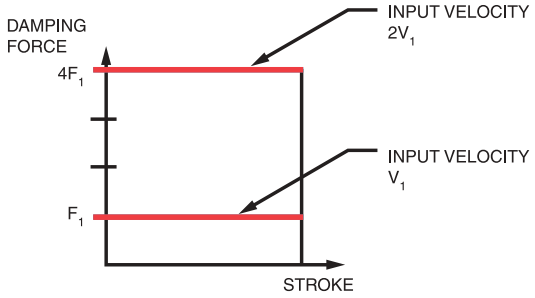


DEFLECTIVE BEAM ORIFICE

The automotive style employs the deflective beam and washer method of orificing. Industrial shock absorbers utilize single orifice, multi-orifice and metering pin configurations. The automotive type maintains a damping force which varies in direct proportion to the velocity of the piston, while the damping force in the industrial type varies in proportion to the square of the piston velocity. In addition, the damping force of the automotive type is independent of the stroke position while the damping force associated with the industrial type can be designed either dependent or independent of stroke position.



AUTOMOTIVE TYPE SHOCK ABSORBER

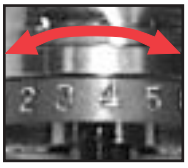


INDUSTRIAL TYPE SHOCK ABSORBER

Equally as important, automotive-style shock absorbers are designed to absorb only a specific amount of input energy. This means that, for any given geometric size of automotive shock absorber, it will have a limited amount of absorption capability compared to the industrial type. This is explained by observing the structural design of the automotive type and the lower strength of materials commonly used. These materials can withstand the lower pressures commonly found in this type. The industrial shock absorber uses higher strength materials, enabling it to function at higher damping forces.

Adjustment Techniques

A properly adjusted shock absorber safely dissipates energy, reducing damaging shock loads and noise levels. For optimum adjustment setting see useable adjustment setting graphs. Watching and "listening" to a shock absorber as it functions aids in proper adjustment.



To correctly adjust a shock absorber, set the adjustment knob at zero (0) prior to system engagement. Cycle the mechanism and observe deceleration of the system.

If damping appears too soft (unit strokes with no visual deceleration and bangs at end of stroke), move indicator to next largest number. Adjustments must be made in gradual increments to avoid internal damage to the unit (e.g., adjust from 0 to 1, not 0 to 4).

Increase adjustment setting until smooth deceleration or control is achieved and negligible noise is heard when the system starts either to decelerate or comes to rest.

When abrupt deceleration occurs at the beginning of the stroke (banging at impact), the adjustment setting must be moved to a lower number to allow smooth deceleration.

If the shock absorber adjustment knob is set at the high end of the adjustment scale and abrupt deceleration occurs at the end of the stroke, a larger unit may be required.

Shock Absorber Performance When Weight or Impact Velocity Vary

When conditions change from the original calculated data or actual input, a shock absorber's performance can be greatly affected, causing failure or degradation of performance. Variations in input conditions after a shock absorber has been installed can cause internal damage, or at the very least, can result in unwanted damping performance. Variations in weight or impact velocity can be seen by examining the following energy curves:

Varying Impact Weight: Increasing the impact weight (impact velocity remains unchanged), without reorificing or readjustment will result in increased damping force at the end of the stroke. *Figure 1* depicts this undesirable bottoming peak force. This force is then transferred to the mounting structure and impacting load.

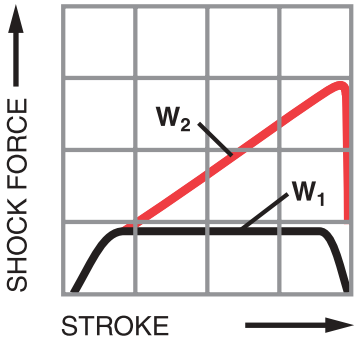


Figure 1

Varying Impact Velocity: Increasing impact velocity (weight remains the same) results in a radical change in the resultant shock force. Shock absorbers are velocity conscious products; therefore, the critical relationship to impact velocity must be carefully monitored. *Figure 2* depicts the substantial change in shock force that occurs when the velocity is increased. Variations from original design data or errors in original data may cause damage to mounting structures and systems, or result in shock absorber failure if the shock force limits are exceeded.

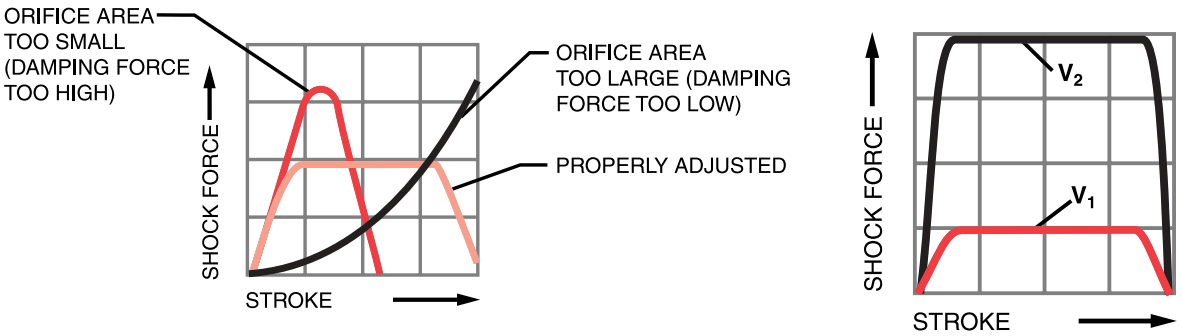


Figure 2

SHOCK ABSORBER SIZING

Follow the next six steps to manually size Enidine shock absorbers:

STEP 1: Identify the following parameters. These must be known for all energy absorption calculations. Variations or additional information may be required in some cases.

A. Weight of the load to be stopped (lbs.).
B. Velocity of the load upon impact with the shock absorber (in./sec.).
C. External (propelling) forces acting on the load (lbs.), if any.
D. Cyclic frequency at which the shock absorber will operate.
E. Orientation of the application's motion (i.e. horizontal, vertical up, vertical down, inclined, rotary horizontal, rotary vertical up, rotary vertical down).

NOTE: For rotary applications, it is necessary to determine both the radius of gyration (K) and the mass moment of inertia (I). Both of these terms locate the mass of a rotating object with respect to the pivot point. It is also necessary to determine the angular velocity (ω) and the torque (T).

STEP 2: Calculate the kinetic energy of the moving object.

$$E_K = \frac{W}{\mathbf{772}} \times V^2 \text{ (linear) or } E_K = \frac{I}{\mathbf{2}}\omega^2 \text{ (rotary)}$$

(Note: **772** = 2 x acceleration due to gravity)

Utilizing the Product Locators for Shock Absorbers located at the beginning of each product family section, select a model, either adjustable or non-adjustable, with a greater energy per cycle capacity than the value just calculated.

STEP 3: Calculate the work energy input from any external (propelling) forces acting on the load, using the stroke of the model selected in Step 2.

$$E_W = F_D \times S \text{ (linear) or } E_W = \frac{T}{R_S} \times S \text{ (rotary)}$$

Caution: The propelling force must not exceed the maximum propelling force listed for the model chosen. If the propelling force is too high, select a larger model and recalculate the work energy.

STEP 4: Calculate the total energy per cycle $E_T = E_K + E_W$

The model selected must have at least this much energy capacity. If not, select a model with greater energy capacity and return to Step 3.

STEP 5: Calculate the energy that must be absorbed per hour. Even though the shock absorber can absorb the energy in a single impact, it may not be able to dissipate the heat generated if the cycle rate is too high.

$$E_TC = E_T \times C$$

The model selected must have an energy per hour capacity greater than this calculated figure. If it is not greater, there are two options:

1. Choose another model that has more energy per hour capacity (because of larger diameter or stroke). Keep in mind that if the stroke changes, you must return to Step 3.
2. Use an Air/Oil Tank. The increased surface area of the tank and piping will increase the energy per hour capacity by 20 percent.

STEP 6: If you have selected an HP, PM, SPM, TK, or PRO Series model, refer to the sizing graph(s) in the appropriate series section to determine the required damping constant. If the point cannot be found in the sizing graph, you must select a larger model or choose a different series. Note that if the stroke changes, you must return to Step 3.

If you have selected an adjustable model (OEM, HP or HDA series), refer to the Useable Adjustment Setting Range graph for the chosen model. The impact velocity must fall within the limits shown on the graph.

RATE CONTROL SIZING

Follow the next five steps to manually size Enidine rate controls:

STEP 1: Identify the following parameters. These must be known for all rate control calculations. Variations or additional information may be required in some cases.

A. Weight of the load to be controlled (lbs.)
B. Desired velocity of the load (in/sec.)
C. External (propelling) force acting on the load (lbs.), if any.
D. Cyclic frequency at which the rate control will operate.
E. Orientation of the application's motion (i.e. horizontal, vertical up, vertical down, inclined, rotary horizontal, rotary vertical up, rotary vertical down.)
F. Damping direction (i.e., tension [T], compression [C] or both [T and C].
G. Required stroke (in.)

NOTE: For rotary applications, please submit the application worksheet on page 81 to Enidine for sizing.

STEP 2: Calculate the propelling force at the rate control in each direction damping is required. (See sizing examples on page 10).

CAUTION: The propelling force in each direction must not exceed the maximum propelling force listed for the chosen model. If the propelling force is too high, select a larger model.

STEP 3: Calculate the total energy per cycle

$$E_T = E_W \text{ (tension)} + E_W \text{ (compression)}$$
$$E_W = F_D \times S$$

STEP 4: Calculate the total energy per hour

$$E_TC = E_T \times C$$

The model selected must have an energy per hour capacity greater than this calculated figure. If not, choose a model with a higher energy per hour capacity.

Compare the damping direction, stroke, propelling force, and total energy per hour to the values listed in the Rate Controls Engineering Data Charts (pages 71-76).

STEP 5: If you have selected a rate control, refer to the sizing graphs in the Rate Controls section to determine the required damping constant.

If you have selected an adjustable model (ADA), refer to the Useable Adjustment Setting Range graph for the chosen model. The desired velocity must fall within the limits shown on the graph.

SYMBOLS

a = Acceleration (in./sec.^{2})
A = Width (in.)
B = Thickness (in.)
C = Number of cycles per hour
d = Cylinder bore diameter (in.)
D = Distance (in.)
E_K = Kinetic energy (in-lbs.)
E_T = Total energy per cycle (in-lbs./c), $E_K + E_W$
E_TC = Total energy to be absorbed per hour (in-lbs./hr)
E_W = Work or drive energy (in-lbs.)
F_D = Propelling force (lbs.)
F_P = Shock force (lbs.)
H = Height (in.)
Hp = Motor horsepower
I = Mass moment of inertia (in-lbs./sec^2)
K = Radius of gyration (in.)
L = Length (in.)
P = Operating pressure (psi)
R_S = Mounting distance from pivot point (in.)
S = Stroke of shock absorber (in.)
t = Time (sec.)
T = Torque (in-lbs.)
V = Impact velocity (in./sec.)
W = Weight (lbs.)
α = Angle of incline (degrees)
θ = Start point from true vertical 0° (degrees)
μ = Coefficient of friction
Ø = Angle of rotation (degrees)
ω = Angular velocity (radians/sec)

USEFUL FORMULAS

1. To Determine Shock Force

$$F_P = \frac{E_T}{S \times \mathbf{.85}}$$

For PRO and PM Series only, use

$$F_P = \frac{E_T}{S \times \mathbf{.50}}$$

2. To Determine Impact Velocity

A. If there is no acceleration (V is constant) (e.g., load being pushed by hydraulic cylinder or motor driven.)

$$V = \frac{D}{t}$$

B. If there is acceleration. (e.g., load being pushed by air cylinder)

$$V = \frac{\mathbf{2} \times D}{t}$$

3. To Determine Propelling Force Generated by Electric Motor

$$F_D = \frac{\mathbf{19{,}800} \times Hp}{V}$$

4. To Determine Propelling Force of Pneumatic or Hydraulic Cylinders

$$F_D = \mathbf{.7854} \times d^2 \times P$$

5. Free Fall Applications

A. Find Velocity for a Free Falling Weight:

$$V = \sqrt{\mathbf{772} \times H}$$

B. Kinetic Energy of Free Falling Weight:

$$E_K = W \times H$$

6. Deceleration and G Load

A. To Determine Approximate G Load with a Given Stroke

$$G = \frac{F_P - F_D}{W}$$

B. To Determine the Approximate Stroke with a Given G Load (Conventional Damping Only)

$$S = \frac{E_K}{GW\ .85 - .15\ F_D}$$

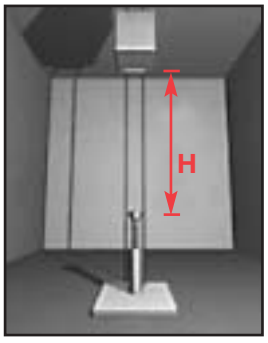
*For PRO/PM and TK Models:

$$S = \frac{E_K}{GW\ .5 - .5\ F_D}$$

NOTE: Constants are printed in **bold**.

SHOCK ABSORBERS

EXAMPLE 1:
Vertical Free Falling Weight



STEP 1: Application Data
(W) Weight = 3,400 lbs.
(H) Height = 20 in.
(C) Cycles/Hr = 2

STEP 2: Calculate kinetic energy
$E_K = W \times H$
$E_K = 3{,}400 \times 20 = 68{,}000$ in-lbs.

Assume Model OEM 4.0M x 6 is adequate (Page 21).

STEP 3: Calculate work energy
$E_W = W \times S$
$E_W = 3{,}400 \times 6$
$E_W = 20{,}400$ in-lbs.

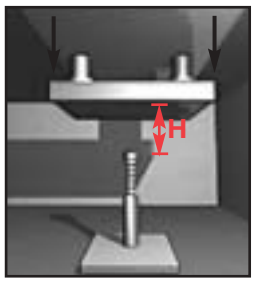
STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W$
$E_T = 68{,}000 + 20{,}400$
$E_T = 88{,}400$ in-lbs./c

STEP 5: Calculate total energy per hour
$E_TC = E_T \times C$
$E_TC = 88{,}400 \times 2$
$E_TC = 176{,}800$ in-lbs./hr

STEP 6: Calculate impact velocity and confirm selection
$V = \sqrt{\mathbf{772} \times H}$
$V = \sqrt{\mathbf{772} \times 20}$
V = 124 in./sec.

Model OEM 4.0M x 6 is adequate.

EXAMPLE 2:
Vertical Moving Load with Propelling Force Downward



STEP 1: Application Data
(W) Weight = 3,400 lbs.
(V) Velocity = 80 in./sec.
(d) Cylinder bore dia. = 4 in.
(P) Pressure = 70 psi
(C) Cycles/Hr = 200

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{\mathbf{772}} \times V^2 = \frac{3{,}400}{\mathbf{772}} \times 80^2$$

$E_K = 28{,}187$ in-lbs.

Assume Model OEM 4.0M x 4 is adequate (Page 21).

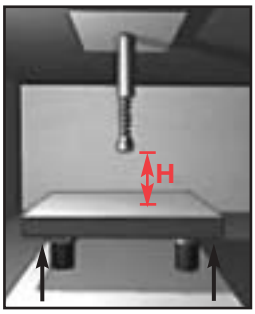
STEP 3: Calculate work energy
$F_D = [\mathbf{.7854} \times d^2 \times P] + W$
$F_D = [\mathbf{.7854} \times 4^2 \times 70] + 3{,}400$
$F_D = 4{,}280$ lbs.
$E_W = F_D \times S$
$E_W = 4{,}280 \times 4$
$E_W = 17{,}120$ in-lbs.

STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W$
$E_T = 28{,}187 + 17{,}120$
$E_T = 45{,}307$ in-lbs./c

STEP 5: Calculate total energy per hour
$E_TC = E_T \times C$
$E_TC = 45{,}307 \times 200$
$E_TC = 9{,}061{,}400$ in-lbs./hr

Model OEM 4.0M x 4 is adequate.

EXAMPLE 3:
Vertical Moving Load with Propelling Force Upward



STEP 1: Application Data
(W) Weight = 3,400 lbs.
(V) Velocity = 80 in./sec.
(d) 2 Cylinders bore dia. = 6 in.
(P) Operating pressure = 70 psi
(C) Cycles/Hr = 200

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{\mathbf{772}} \times V^2 = \frac{3{,}400}{\mathbf{772}} \times 80^2$$

$E_K = 28{,}187$ in-lbs.

Assume Model OEM 3.0M x 5 is adequate (Page 21).

STEP 3: Calculate work energy
$F_D = 2 \times [\mathbf{.7854} \times d^2 \times P] - W$
$F_D = 2 \times [\mathbf{.7854} \times 6^2 \times 70] - 3{,}400$
$F_D = 558$ lbs.
$E_W = F_D \times S$
$E_W = 558 \times 5$
$E_W = 2{,}790$ in-lbs.

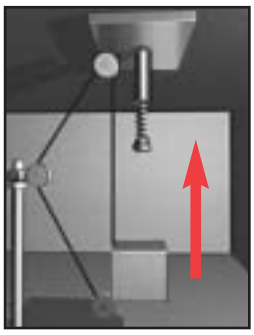
STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W$
$E_T = 28{,}187 + 2{,}790$
$E_T = 30{,}977$ in-lbs./c

STEP 5: Calculate total energy per hour
$E_TC = E_T \times C$
$E_TC = 30{,}977 \times 200$
$E_TC = 6{,}195{,}400$ in-lbs./hr

Model OEM 3.0M x 5 is adequate.

Sizing Examples

EXAMPLE 4:
Vertical Moving Load with Propelling Force from Motor



(e.g., Load Moving Force Up)

STEP 1: Application Data
(W) Weight = 200 lbs.
(V) Velocity = 60 in./sec.
(Hp) Motor horsepower = 1.5 Hp
(C) Cycles/Hr = 100

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{772} \times V^2 = \frac{200}{772} \times 60^2$$

$$E_K = 933 \text{ in-lbs.}$$

CASE A: UP

STEP 3: Calculate work energy

$$F_D = \frac{19{,}800 \times Hp}{V} - W$$

$$F_D = \frac{19{,}800 \times 1.5}{60} - 200$$

$$F_D = 295 \text{ lbs.}$$

Assume Model OEM 1.25 x 2 is adequate (Page 19).

$E_W = F_D \times S$
$E_W = 295 \times 2$
$E_W = 590$ in-lbs.

STEP 4: Calculate total energy per cycle

$E_T = E_K + E_W$
$E_T = 933 + 590$
$E_T = 1{,}523$ in-lbs./c

STEP 5: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 1{,}523 \times 100$
$E_TC = 152{,}300$ in-lbs./hr

Model OEM 1.25 x 2 is adequate.

CASE B: DOWN

STEP 3: Calculate work energy

$$F_D = \frac{19{,}800 \times Hp}{V} + W$$

$$F_D = \frac{19{,}800 \times 1.5}{60} + 200$$

$$F_D = 695 \text{ lbs.}$$

Assume Model OEM 2.0M x 2 is adequate (Page 21).

$E_W = F_D \times S$
$E_W = 695 \times 2$
$E_W = 1{,}390$ in-lbs.

STEP 4: Calculate total energy per cycle

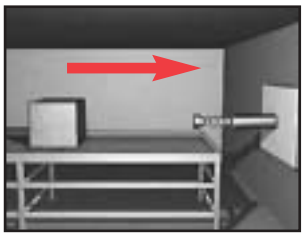
$E_T = E_K + E_W$
$E_T = 933 + 1{,}390$
$E_T = 2{,}323$ in-lbs./c

STEP 5: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 2{,}323 \times 100$
$E_TC = 232{,}300$ in-lbs./hr

Model OEM 2.0M x 2 is adequate.

EXAMPLE 5:
Horizontal Moving Load



STEP 1: Application Data
(W) Weight = 1,950 lbs.
(V) Velocity = 60 in./sec.
(C) Cycles/Hr = 200

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{772} \times V^2$$

$$E_K = \frac{1950}{772} \times 60^2$$

$$E_K = 9{,}093 \text{ in-lbs.}$$

Assume Model OEM 2.0M x 2 is adequate (Page 21).

STEP 3: Calculate work energy: N/A

STEP 4: Calculate total energy per cycle

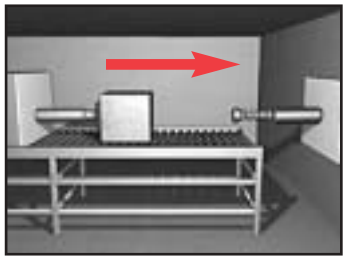
$E_T = E_K = 9{,}093$ in-lbs./c

STEP 5: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 9{,}093 \times 200$
$E_TC = 1{,}818{,}600$ in-lbs./hr

Model OEM 2.0M x 2 is adequate.

EXAMPLE 6:
Horizontal Moving Load with Propelling Force



STEP 1: Application Data
(W) Weight = 1,950 lbs.
(V) Velocity = 60 in./sec.
(d) Cylinder bore dia. = 3 in.
(P) Operating pressure = 70 psi
(C) Cycles/Hr = 200

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{772} \times V^2$$

$$E_K = \frac{1{,}950}{772} \times 60^2$$

$$E_K = 9{,}093 \text{ in-lbs.}$$

Assume Model OEM 2.0M x 2 is adequate (Page 21).

STEP 3: Calculate work energy

$$F_D = .7854 \times d^2 \times P$$

$$F_D = .7854 \times 3^2 \times 70$$

$F_D = 495$ lbs.
$E_W = F_D \times S$
$E_W = 495 \times 2$
$E_W = 990$ in-lbs.

STEP 4: Calculate total energy per cycle

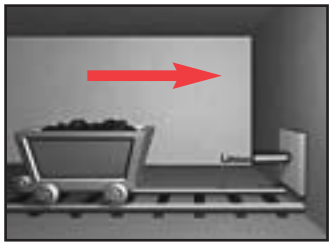
$E_T = E_K + E_W$
$E_T = 9{,}093 + 990$
$E_T = 10{,}083$ in-lbs./c

STEP 5: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 10{,}083 \times 200$
$E_TC = 2{,}016{,}600$ in-lbs./hr

Model OEM 2.0M x 2 is adequate.

EXAMPLE 7:
Horizontal Moving Load, Motor Driven



STEP 1: Application Data
(W) Weight = 2,200 lbs.
(V) Velocity = 60 in./sec.
(Hp) Motor horsepower = 1.5 Hp
(C) Cycles/Hr = 120

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{772} \times V^2$$

$$E_K = \frac{2{,}200}{772} \times 60^2$$

$$E_K = 10{,}259 \text{ in-lbs}$$

Assume Model OEM 2.0M x 2 is adequate (Page 21).

STEP 3: Calculate work energy

$$F_D = \frac{19{,}800 \times Hp}{V}$$

$$F_D = \frac{19{,}800 \times 1.5}{60}$$

$F_D = 495$ lbs.
$E_W = F_D \times S$
$E_W = 495 \times 2$
$E_W = 990$ in-lbs.

STEP 4: Calculate total energy per cycle

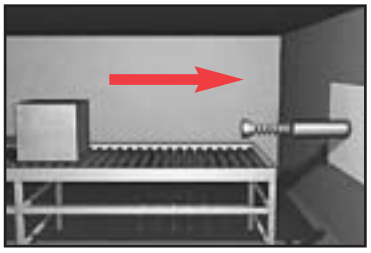
$E_T = E_K + E_W$
$E_T = 10{,}259 + 990$
$E_T = 11{,}249$ in-lbs./c

STEP 5: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 11{,}249 \times 120$
$E_TC = 1{,}349{,}880$ in-lbs./hr

Model OEM 2.0M x 2 is adequate.

EXAMPLE 8:
Horizontal Moving Load
Propelled by Drive Rollers
(Chain/Belt Drive or Conveyor Belt)



STEP 1: Application Data
(W) Weight = 1,765 lbs.
(V) Velocity = 47 in./sec.
(μ) Coefficient of Friction = .3
(C) Cycles/Hr = 120

STEP 2: Calculate kinetic energy

$$E_K = \frac{W}{772} \times V^2$$

$$E_K = \frac{1,765}{772} \times 47^2$$

E_K = 5,050 in-lbs.

Assume Model PM 2050 is adequate (Page 37).

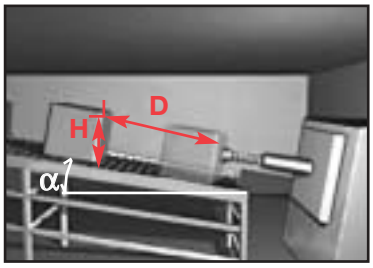
STEP 3: Calculate work energy
$F_D = W \times \mu$
F_D = 1,765 x .3
F_D = 530 lbs.
$E_W = F_D \times S$
E_W = 530 x 2
E_W = 1,060 in-lbs.

STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W$
E_T = 5,050 + 1,060
E_T = 6,110 in-lbs./c

STEP 5: Calculate total energy per hour
$E_TC = E_T \times C$
E_TC = 6,110 x 120
E_TC = 773,200 in-lbs./hr

From PM sizing graph, Model PM 2050-2 is adequate.

EXAMPLE 9:
Free Moving Load
Down an Inclined Plane



STEP 1: Application Data
(W) Weight = 550 lbs.
(H) Height = 8 in.
(α) Angle of incline = 30°
(C) Cycles/Hr = 250

STEP 2: Calculate kinetic energy
$E_K = W \times H$
E_K = 550 x 8
E_K = 4,400 in-lbs.

Assume Model OEM 1.5M x 3 is adequate (Page 21).

STEP 3: Calculate work energy
$F_D = W \times \sin \alpha$
F_D = 550 x .5
F_D = 275 lbs.
$E_W = F_D \times S$
E_W = 275 x 3
E_W = 825 in-lbs.

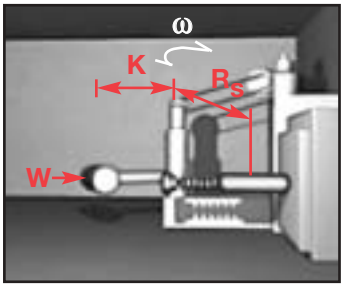
STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W$
E_T = 4,400 + 825
E_T = 5,225 in-lbs./c

STEP 5: Calculate total energy per hour
$E_TC = E_T \times C$
E_TC = 5,225 x 250
E_TC = 1,306,250 in-lbs./hr

STEP 6: Calculate impact velocity and confirm selection
$V = \sqrt{772 \times H}$
$V = \sqrt{772 \times 8} = 79$ in./sec.

Model OEM 1.5M x 3 is adequate.

EXAMPLE 10:
Horizontal Rotating Mass



STEP 1: Application Data
(W) Weight = 200 lbs.
(ω) Angular velocity = 1.5 rad./sec.
(T) Torque = 1,065 in-lbs.
(K) Radius of gyration = 15 in.
(R_S) Mounting radius = 20 in.
(C) Cycles/Hr = 120

STEP 2: Calculate kinetic energy

$$I = \frac{W}{386} \times K^2$$

$$I = \frac{200}{386} \times 15^2$$

I = 117 in-lbs./sec.^{2}

$$E_K = \frac{I \times \omega^2}{2}$$

$$E_K = \frac{117 \times 1.5^2}{2}$$

E_K = 132 in-lbs.
Assume Model STH .5M is adequate (Page 34).

STEP 3 Calculate work energy

$$F_D = \frac{T}{R_S}$$

$$F_D = \frac{1,065}{20}$$

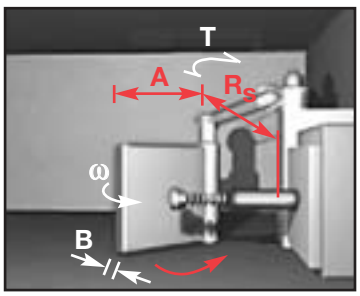
F_D = 53 lbs.
$E_W = F_D \times S$
E_W = 53 X .5
E_W = 27 in-lbs.

STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W$
E_T = 132 + 27
E_T = 159 in-lbs./c

STEP 5: Calculate total energy per hour
$E_TC = E_T \times C$
E_TC = 159 X 120
E_TC = 19,080 in-lbs./hr

Model STH .5M is adequate.

EXAMPLE 11:
Horizontal Rotating Door



STEP 1: Application Data
(W) Weight = 50 lbs.
(ω) Angular velocity = 2.5 rad./sec.
(T) Torque = 100 in-lbs.
(R_S) Mounting radius = 20 in.
(A) Width = 40 in.
(B) Thickness = .5 in.
(C) Cycles/Hr = 250

STEP 2: Calculate kinetic energy

$$K = .289 \times \sqrt{4 \times A^2 + B^2}$$

$$K = .289 \times \sqrt{4 \times 40^2 + .5^2}$$

K = 23.12

$$I = \frac{W}{386} \times K^2$$

$$I = \frac{50}{386} \times 23.12^2$$

I = 69 in-lbs./sec.^{2}

$$E_K = \frac{I \times \omega^2}{2}$$

$$E_K = \frac{69 \times 2.5^2}{2}$$

E_K = 216 in-lbs.
Assume Model OEM .5 is adequate (Page 19).

STEP 3: Calculate work energy

$$F_D = \frac{T}{R_S}$$

$$F_D = \frac{100}{20}$$

F_D = 5 lbs.
$E_W = F_D \times S = 5 \times .5 = 2.5$ in-lbs.

STEP 4: Calculate total energy per cycle
$E_T = E_K + E_W = 216 + 2.5 =$ 218.5 in-lbs./c

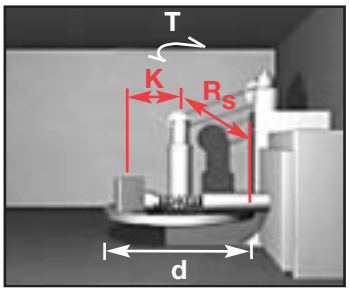
STEP 5: Calculate total energy per hour
$E_TC = E_T \times C = 218.5 \times 250 =$ 54,625 in-lbs./hr

STEP 6: Calculate impact velocity and confirm selection
$V = R_S \times \omega = 20 \times 2.5 = 50$ in./sec.

Model OEM .5 is adequate.

Sizing Examples

EXAMPLE 12:
Horizontal Moving Load, Rotary Table Motor Driven with Additional Load Installed



STEP 1: Application Data
(W) Weight = 440 lbs.
(W_1) Installed load = 110 lbs.
Rotational speed = 10 RPM
(T) Torque = 2,200 in-lbs.
Rotary table dia. = 20 in.
(K_{Load}) Radius of gyration = 8 in.
(R_S) Mounting radius = 8.86 in.
(C) Cycles/Hr = 1
(ω) Direction

Step 2: Calculate kinetic energy
To convert RPM to rad./sec., multiply by **.1047**

ω = RPM x **.1047** = 10 x **.1047** = **1.047** rad./sec.

$I = \frac{W}{\mathbf{386}} \times K^2$

In this case, the mass moment of inertia of the table and the mass moment of inertia of the load on the table must be calculated.

K_{Table} = Table Radius x **.707**

K_{Table} = 10 x **.707** = 7.07 in.

$I_{Table} = \frac{W}{\mathbf{386}} \times K^2_{Table}$

$I_{Table} = \frac{440}{\mathbf{386}} \times 7.07^2 = 57$ in-lbs./sec.^{2}

$I_{Load} = \frac{W_1}{\mathbf{386}} \times K^2_{Load}$

$I_{Load} = \frac{110}{\mathbf{386}} \times 8^2 = 18$ in-lbs./sec.^{2}

$E_K = \frac{(I_{Table} + I_{Load}) \times \omega^2}{\mathbf{2}}$

$E_K = \frac{(57 + 18) \times 1.047^2}{\mathbf{2}} = 41$ in-lbs.

Assume Model PM 50 is adequate (Page 35).

STEP 3: Calculate work energy

$F_D = \frac{T}{R_S} = \frac{2{,}200}{8.86} = 248$ lbs.

$E_W = F_D \times S = 248 \times .875 =$ 217 in-lbs.

STEP 4: Calculate total energy per cycle

$E_T = E_K + E_W = 41 + 217 =$ 258 in-lbs./c

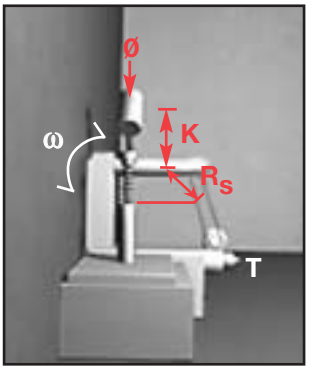
STEP 5: Calculate total energy per hour: not applicable, C=1

STEP 6: Calculate impact velocity and confirm selection

$V = R_S \times \omega = 8.86 \times 1.047 =$ 9 in./sec.

From PM Sizing Graph.
Model PM 50-3 is adequate.

EXAMPLE 13:
Vertical Motor Driven Rotating Arm with Attached Load – This example illustrates calculations for two conditions:
CASE A–Load Opposing Gravity
CASE B–Load Aided by Gravity



STEP 1: Application Data
(W) Weight = 110 lbs.
(ω) Angular velocity = 2 rad./sec.
(T) Torque = 3,100 in-lbs.
(θ) Starting point of load from true vertical = 20°
(Ø) Angle of rotation at impact = 30°
(K_{Load}) Radius of gyration = 24 in.
(R_S) Mounting radius = 16 in.
(C) Cycles/Hr = 1

STEP 2: Calculate kinetic energy

$I = \frac{W}{\mathbf{386}} \times K^2 = \frac{110}{\mathbf{386}} \times 24^2$

$I = 164$ in-lbs-sec^2

$E_K = \frac{I \times \omega^2}{\mathbf{2}}$

$E_K = \frac{164 \times 2^2}{\mathbf{2}}$

$E_K = 328$ in-lbs.

Assume Model OEM 1.0 is adequate (Page 19).

CASE A

STEP 3: Calculate work energy

$F_D = \frac{T - (W \times K \times \text{Sin } Ø)}{R_S}$

$F_D = \frac{3{,}100 - (110 \times 24 \times .5)}{16}$

$F_D = 111$ lbs.

$E_W = F_D \times S = 111 \times 1 = 111$ in-lbs.

STEP 4: Calculate total energy per cycle

$E_T = E_K + E_W = 328 + 111$

$E_T = 439$ in-lbs./c

STEP 5: Calculate total energy per hour: not applicable, C=1

STEP 6: Calculate impact velocity and confirm selection

$V = R_S \times \omega = 16 \times 2 = 32$ in./sec.

Model OEM 1.0 is adequate.

CASE B

STEP 3: Calculate work energy

$F_D = \frac{T + (W \times K \times \text{Sin } Ø)}{R_S}$

$F_D = \frac{3{,}100 + (110 \times 24 \times .5)}{16}$

$F_D = 276$ lbs.

$E_W = F_D \times S = 276 \times 1 = 276$ in-lbs.

STEP 4: Calculate total energy per cycle

$E_T = E_K + E_W = 328 + 276$

$E_T = 604$ in-lbs./c

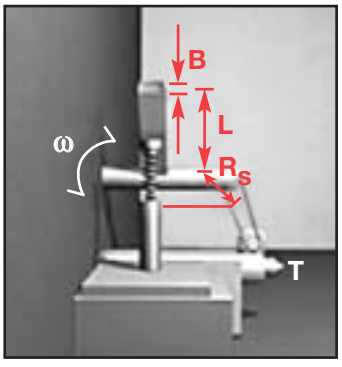
STEP 5: Calculate total energy per hour: not applicable, C=1

STEP 6: Calculate impact velocity and confirm selection.

$V = R_S \times \omega = 16 \times 2 = 32$ in./sec.

Model OEM 1.0 is adequate.

EXAMPLE 14:
Vertical Rotating Beam



STEP 1: Application Data
(W) Weight = 540 lbs.
(ω) Angular velocity = 3.5 rad./sec.
(T) Torque = 250 in-lbs.
(θ) Starting point of load from true vertical = 20°
(Ø) Angle of rotation at impact = 50°
(R_S) Mounting radius = 20 in.
(B) Thickness = 2.5 in.
(L) Length = 24 in.
(C) Cycles/Hr = 1

STEP 2: Calculate kinetic energy

$K = \mathbf{.289} \times \sqrt{\mathbf{4} \times L^2 + B^2}$

$K = \mathbf{.289} \times \sqrt{\mathbf{4} \times 24^2 + 2.5^2} = 13.89$

$I = \frac{W}{\mathbf{386}} \times K^2 = \frac{540}{\mathbf{386}} \times 13.89$

$I = 270$ in-lbs./sec.^{2}

$E_K = \frac{I \times \omega^2}{\mathbf{2}} = \frac{270 \times 3.5^2}{\mathbf{2}} = 1{,}653$ in-lbs.

Assume Model OEM 1.5M x 2 is adequate (Page 21).

STEP 3: Calculate work energy

$F_D = \frac{T + (W \times K \times \text{Sin } (\theta + Ø))}{R_S}$

$F_D = \frac{250 + (540 \times 13.89 \times \text{Sin } (20^\circ + 50^\circ))}{20}$

$F_D = 365$ lbs.

$E_W = F_D \times S = 365 \times 2 = 730$ in-lbs.

STEP 4: Calculate total energy per cycle

$E_T = E_K + E_W = 1{,}653 + 730 =$ 2,383 in-lbs./c

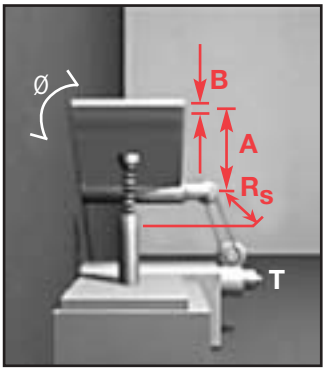
STEP 5: Calculate total energy per hour: not applicable, C=1

STEP 6: Calculate impact velocity and confirm selection

$V = R_S \times \omega = 20 \times 3.5 = 70$ in./sec.

Model OEM 1.5M x 2 is adequate.

EXAMPLE 15:
Vertical Rotating Lid



STEP 1: Application Data
(W) Weight = 2,000 lbs.
(ω) Angular velocity = 2 rad./sec.
(Hp) Motor horsepower = .25 Hp
(θ) Starting point of load from true vertical = 30°
(Ø) Angle of rotation at impact = 60°
(R_S) Mounting radius = 30 in.
(A) Width = 60 in.
(B) Thickness = 1 in.
(C) Cycle/Hr = 1

STEP 2: Calculate kinetic energy

$$K = \mathbf{.289} \times \sqrt{\mathbf{4} \times A^2 + B^2}$$

$$K = \mathbf{.289} \times \sqrt{\mathbf{4}} \times 60^2 + 1^2 = 34.68 \text{ in.}$$

$$I = \frac{W}{\mathbf{386}} \times K^2 = \frac{2{,}000}{\mathbf{386}} \times 34.68^2 \text{ in.}$$

$I = 6{,}232$ in-lbs./sec.^{2}

$$E_K = \frac{I \times \omega^2}{\mathbf{2}} = \frac{6{,}232 \times 2^2}{\mathbf{2}}$$

$E_K = 12{,}464$ in-lbs.
Assume Model OEM 3.0M x 2 is adequate (Page 21).

STEP 3: Calculate work energy

$$T = \frac{\mathbf{19{,}800} \times Hp}{\omega}$$

$$T = \frac{\mathbf{19{,}800} \times .25}{2} = 2{,}475 \text{ in-lbs.}$$

$$F_D = \frac{T + (W \times K \times \text{Sin}\,(\theta + Ø))}{R_S}$$

$$F_D = \frac{2{,}475 + (2{,}000 \times 34.68 \times \text{Sin}\,(30° + 60°))}{30}$$

$F_D = 2{,}395$ lbs.
$E_W = F_D \times S = 2{,}395 \times 2 = 4{,}790$ in-lbs.

STEP 4: Calculate total energy per cycle

$E_T = E_K + E_W = 12{,}464 + 4{,}790 = 17{,}254$ in-lbs./c

STEP 5: Calculate total energy per hour: not applicable, C=1

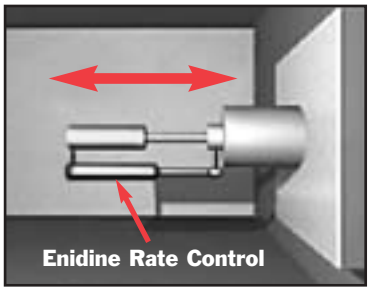
STEP 6: Calculate impact velocity and confirm selection

$V = R_S \times \omega = 30 \times 2 = 60$ in./sec.

Model OEM 3.0M x 2 is adequate.

RATE CONTROLS

EXAMPLE 16:
Horizontal Moving Load with Propelling Force



STEP 1: Application Data
(W) Weight = 50 lbs.
Damping direction (T, C or T and C) = T and C
(S) Stroke = 4 in.
(d) Cylinder bore dia = 2 in.
(d_1) Cylinder rod dia = .5 in.
(P) Pressure = 70 psi
(V) Velocity = 6 in./sec.
(C) Cycles/Hr = 200

STEP 2: Calculate propelling force (tension)

$F_D = \mathbf{.7854} \times d^2 \times P$
$F_D = \mathbf{.7854} \times 2^2 \times 70$
$F_D = 220$ lbs. (tension)
$F_D = \mathbf{.7854} \times (d^2 - d_1^2) \times P$ (compression)
$F_D = \mathbf{.7854} \times (2^2 - .5^2) \times 70$
$F_D = 206$ lbs. (compression)

STEP 3: Calculate total energy per cycle

$E_W = F_D \times S$ (tension)
$E_W = 220 \times 4$
$E_W = 880$ in-lbs./c (tension)
$E_W = F_D \times S$ (compression)
$E_W = 206 \times 4$
$E_W = 824$ in-lbs./c (compression)
$E_T = E_W$ (tension) + E_W (compression)
$E_T = 880 + 824$
$E_T = 1{,}704$ in-lbs./c

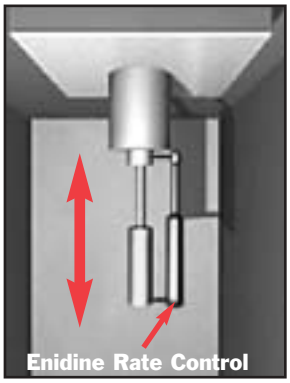
STEP 4: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 1{,}704 \times 200$
$E_TC = 340{,}800$ in-lbs./hr

STEP 5: Confirm selection.

Model ADA 510 TC is selected.

EXAMPLE 17:
Vertical Moving Load with Propelling Force Downward



STEP 1: Application Data
(W) Weight = 100 lbs.
Damping direction (T, C or T and C) = T
(d) Cylinder bore dia = 2 in.
(S) Stroke = 4 in.
(P) Pressure = 65 psi
(V) Velocity = 6 in./sec.
(C) Cycles/Hr = 10

STEP 2: Calculate propelling force

$F_D = [\mathbf{.7854} \times d^2 \times P]$
$F_D = [\mathbf{.7854} \times 2^2 \times 65] + 100$
$F_D = 304$ lbs.

STEP 3: Calculate total energy per cycle

$E_T = F_D \times S$
$E_T = 304 \times 4$
$E_T = 1{,}216$ in-lbs./c

STEP 4: Calculate total energy per hour

$E_TC = E_T \times C$
$E_TC = 1{,}216 \times 10 = 12{,}160$ in-lbs./hr

STEP 5: Confirm selection.

Model ADA 510 TP is selected.

Example #18

Crane A		Per Buffer
Propelling Force Crane	lbs.	
Propelling Force Trolley	lbs.	
Weight of Crane	lbs.	
Weight of Trolley	lbs.	
Distance X_{min}	in.	
Distance X_{max}	in.	
Distance Y_{min}	in.	
Distance Y_{max}	in.	
Crane Velocity	in./sec.	
Trolley Velocity	in./sec.	

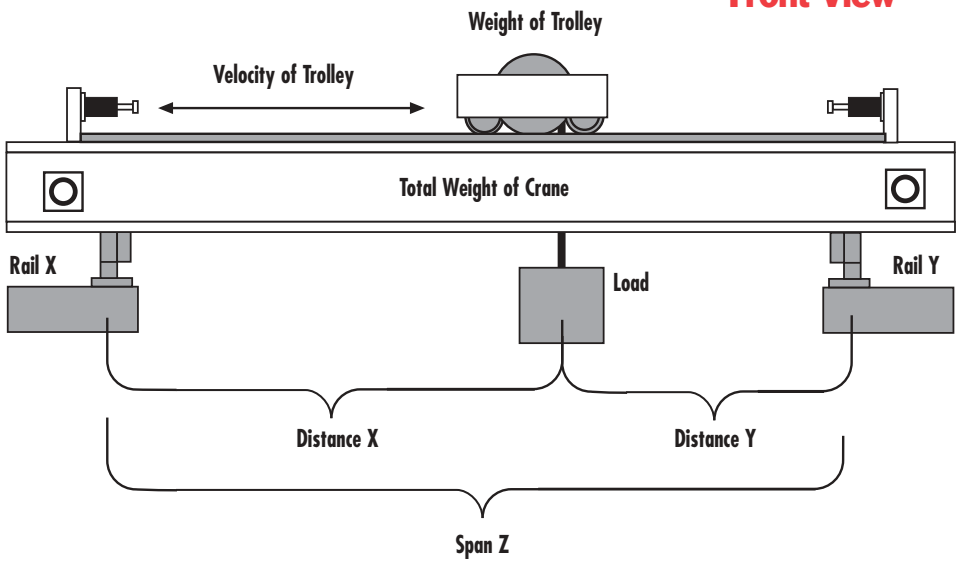
Crane B		Per Buffer
Propelling Force Crane	lbs.	
Propelling Force Trolley	lbs.	
Weight of Crane	lbs.	
Weight of Trolley	lbs.	
Distance X_{min}	in.	
Distance X_{max}	in.	
Distance Y_{min}	in.	
Distance Y_{max}	in.	
Crane Velocity	in./sec.	
Trolley Velocity	in./sec.	

Crane C		Per Buffer
Propelling Force Crane	lbs.	
Propelling Force Trolley	lbs.	
Weight of Crane	lbs.	
Weight of Trolley	lbs.	
Distance X_{min}	in.	
Distance X_{max}	in.	
Distance Y_{min}	in.	
Distance Y_{max}	in.	
Crane Velocity	in./sec.	
Trolley Velocity	in./sec.	

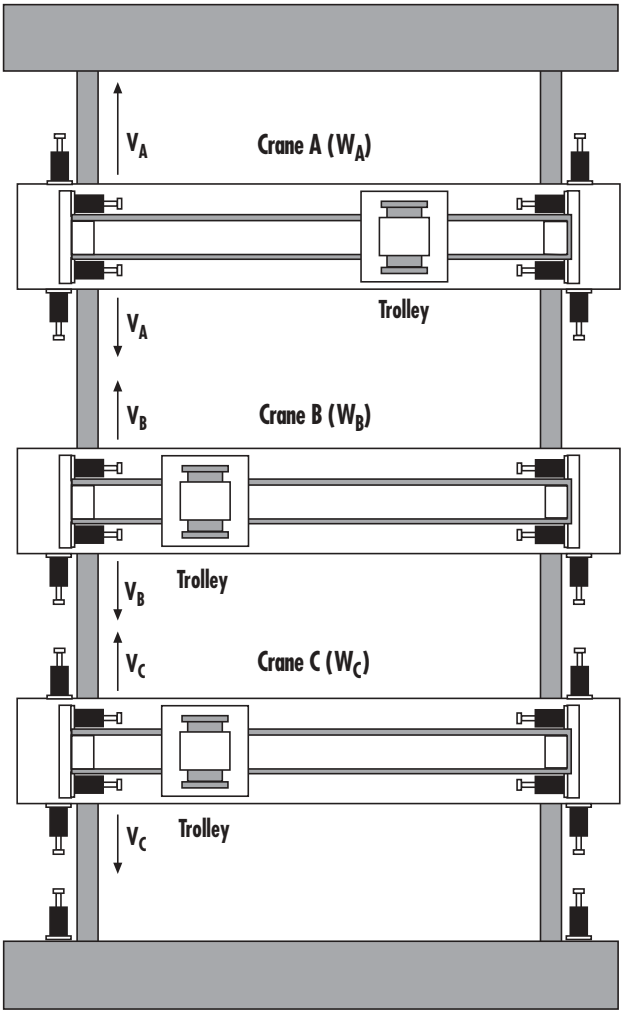
Please note:
Unless instructed otherwise, Enidine will always calculate with:

- 100% velocity v, and
- 100% propelling force F_D

Front View



Plan View



Application 1
Crane A against Solid Stop
Velocity:

$V_r = V_A$

Impact weight per buffer:

$$W_D = \frac{W}{2}$$

Application 2
Crane A against Crane B
Velocity:

$V_r = V_A + V_B$

Impact weight per buffer:

$$W_D = \frac{W_A \bullet W_B}{W_A + W_B} \div 2$$

Application 3
Crane B against Crane C
Velocity:

$$V_r = \frac{V_B + V_C}{2}$$

Impact weight per buffer:

$$W_D = \frac{W_B \bullet W_C}{W_B + W_C}$$

Application 4
Crane C against Solid Stop with Buffer
Velocity:

$$V_r = \frac{V_C}{2}$$

Impact weight per buffer:

$W_D = W_C$

Please note that this example is not based on any particular standard. The slung load can swing freely, and is therefore not taken into account in the calculation.

Calculation Example for Harbor Cranes as Application 1

Given Values

Total Weight of Crane:	**837,750 lbs.**
Weight of Trolley:	**99,200 lbs.**
Span:	**z = 3,940 in.**
Trolley Impact Distance:	**x = 3,540 in.**
Crane Velocity:	**V_{Crane} = 60 in./sec.**
Required Stroke:	**24 in.**
Trolley Velocity:	**$V_{Trolley}$ = 160 in./sec.**
Required Stroke:	**40 in.**

Determination of the Maximum Impact Weight W_{Dmax} per Buffer

$$\text{Bridge Weight per Rail} = \frac{\text{crane weight}_{total} - \text{trolley weight}}{2}$$

$$\text{Bridge Weight per Rail} = \frac{837{,}750 \text{ lbs.} - 99{,}200 \text{ lbs.}}{2} = 369{,}275 \text{ lbs.}$$

W_{Dmax} = Bridge Weight per Rail + Trolley Weight in Impact Position

$$W_{Dmax} = 369{,}275 \text{ lbs.} + \frac{(99{,}200 \text{ lbs.} \bullet 3{,}540 \text{ in.})}{3{,}940 \text{ in.}}$$

W_{Dmax} = 458,404 lbs.

Determine Size of Shock Absorber for Crane

$$E_K = \frac{W_{Dmax}}{772} \bullet V_r^2$$

$$E_K = \frac{458{,}404 \text{ lbs.}}{772} \bullet (60 \text{ in./sec.})^2$$

E_K = 2,137,635 in-lbs.

$V_r = V_A$ Application 1

E_K = Kinetic Energy

η = Efficiency

Selecting for required 24-inch stroke:

HD 5.0 x 24, maximum shock force ca. 104,786 lbs = $F_s = \frac{E_K}{s \bullet \eta}$

Determine Size of Shock Absorber for Trolley

W_D = Trolley Weight per Shock Absorber

$$W_D = \frac{99{,}200 \text{ lbs.}}{2}$$

W_D = 49,600 lbs.

$$E_K = \frac{W_D}{772} \bullet V_r^2$$

$$E_K = \frac{49{,}600 \text{ lbs.}}{772} \bullet (160 \text{ in./sec.})^2$$

E_K = 1,644,767 in-lbs.

$V_r = V_A$ Application 1

Selecting for required 40-inch stroke:

HD 4.0 x 40, maximum shock force ca. 48,376 lbs. = $F_s = \frac{E_K}{s \bullet \eta}$

To Ensure Correct Sizing:

If shock absorbers are used at less than 5% of their maximum rated energy per cycle (less than 10% for HDA and HP Series models), a smaller shock absorber should be used. If the shock absorber continually bottoms, verify sizing data.

Items to Keep in Mind:

- Do not clamp, paint or weld the shock absorber body.
- Do not paint or damage the surface finish of the piston rod.

Provide a Positive Stop

Stop collars provide a positive stop to prevent the shock absorber from bottoming* They also ensure that work being positioned is stopped at the same point every time. Proper stop collar mounting is as follows:

A. OEM Small, HP Series stop collars should be positioned to leave .06 inch of clearance before bottoming the shock absorber.

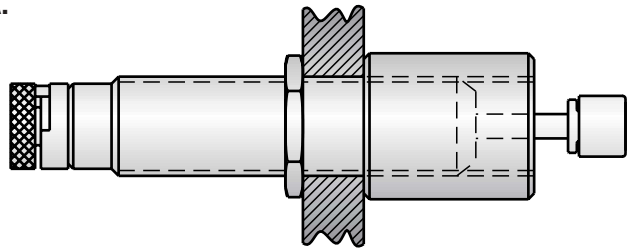
Platinum **PRO and PM Series** models have positive stop capabilities. However, the use of an external positive stop is recommended to extend the life of the product.

B. OEM Large Series – Stop collars for OEM 1.5M through OEM 2.0M and the low profile series thread onto the shock absorber and against the center shoulder or "boss."

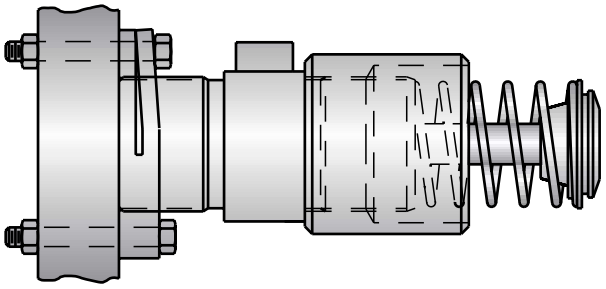
C. OEM Low Profile Series stop collar flange (SCF) serves both as a stop collar and mounting method. To install, mount SCF onto machine structure. Thread shock absorber into SCF through mounting structure until tight. Tighten set screw in flange of SCF. Check for accessibility of adjustment knob. Reorient assembly as required. Even if shock absorber is removed for maintenance, SCF maintains positive positioning and allows continued machinery operation at reduced speeds.

*Stop collars are not necessary if positive stop in mechanism already exists.

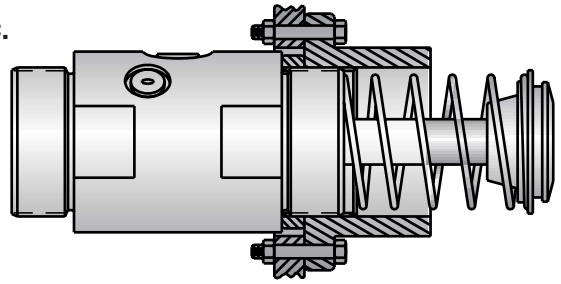
A.



B.

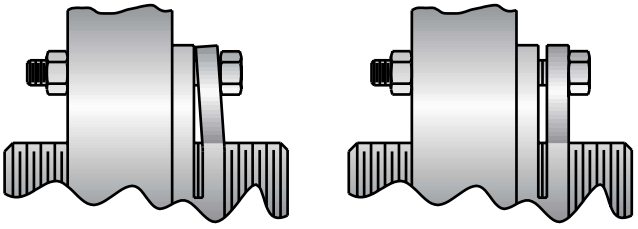


C.

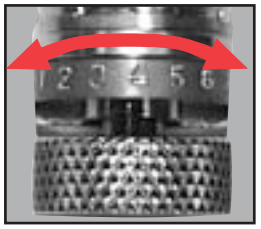


Flanges with Lock Slots

Flanges with lock slots, exclusively designed by Enidine, will hold the shock absorber body securely in place by applying pressure to cylinder body threads. To remove or reposition the unit, only the slotted flange bolt needs to be loosened. DO NOT REMOVE the shock absorber before this bolt is loosened. Verify that the bolt is tightened once the shock absorber is properly positioned.



To Correctly Adjust Shock Absorber:



To achieve the optimum adjustment setting:

1. Mount the shock absorber.
2. Set adjustment at zero (0)*: Cycle mechanism; if too soft, turn adjustment to next largest number. Repeat procedure until desired damping force is obtained.
3. Lock adjustment by tightening set screw with hex key wrench provided.

CAUTION:

A. Internal damage can occur if not adjusted in gradual increments.

B. If adjustment is set to the largest number and the mechanism is bottoming too hard at the end of the stroke, a larger unit is required.

C. If adjustment setting is set to the lowest number "0" and the mechanism is hitting too hard at the beginning of the stroke, a smaller unit is required.

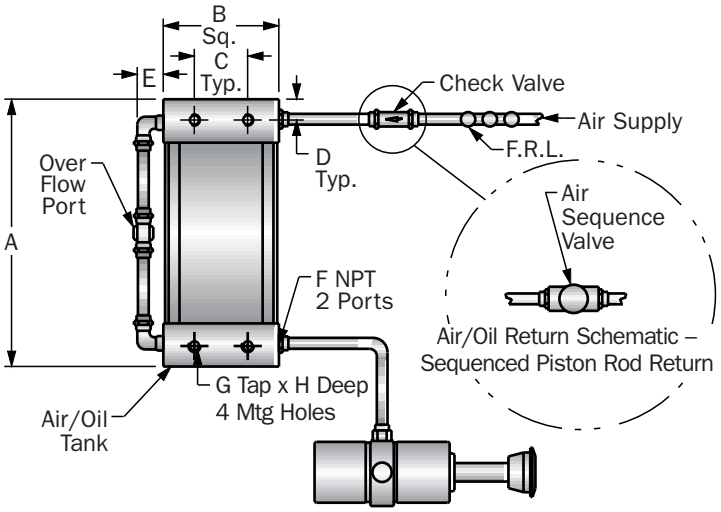
*For the approximate adjustment setting to be used, consult Useable Adjustment Settings in appropriate series sections.

Air/Oil Tanks should be considered when:

A. Energy per hour exceeds maximum rating for self-contained units.

B. Piston rod return sequence must be controlled.

Air/Oil Models, designated by the letter A before the model number (Example: AOEM), use air pressure over oil in a tank. An adapter (supplied with the shock absorber) is used in place of the fill plug to connect the shock absorber to the Air/Oil Tank, allowing fluid to flow between them. These methods replace the coil spring in a self-contained model to facilitate piston rod return. Consult factory for maximum air pressures. Air/Oil Tanks can be used with the Large AOEM Series (both standard adjustable as well as custom-orificed models), and AOEM Low Profile Series.



Air/Oil Return Schematic – Immediate Piston Rod Return

Important Mounting Considerations:

1. Always mount the shock absorber with the air/oil port facing up, regardless of mounting angle.
2. Always position the Air/Oil Tank above the shock absorber.
3. All port and line sizes must be as large as the shock absorber port size. Consult the factory for adapter port sizes.

Tank Dimensions

Model (Catalog No.)	A	B	C	D	E	F	G	H	Use With Shock Absorber Bore Size	Tank Vol. in^3
RT 1.5	7.38	2.88	1.25	.59	1.13	⅜-18 NPT	5/16-24	.50	.75, 1.13, 1.5	24
RT 2.0	10.25	4.13	1.84	.72	1.13	¾-14 NPT	⅜-24	.63	2.0	69

All dimensions in inches.

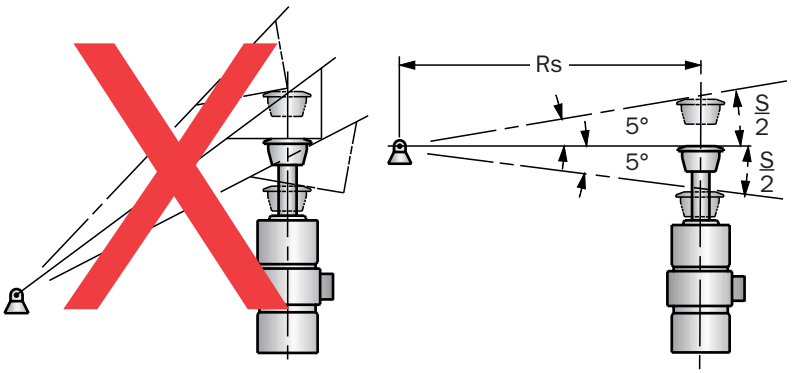
Mounting and Installation for Rotary Motion

To minimize sideload (without a sideload adapter), the shock absorber should be mounted at a radius which is equal to or greater than 6.5 times the stroke of the piston.

$R_S \geq 6.5 \times S$

To minimize sideload, the swing arm or impact pad should be perpendicular to the axis of the shock absorber when the piston is at midstroke, as shown.

Note: Recommended maximum sideload capability is 5° from centerline of shock absorber. Use of urethane or nylon striker cap is not recommended in rotary applications. Sideload adapters available for some models. See pages 26 and 44 for details.



Enidine Adjustable Hydraulic Series shock absorbers offer the most flexible solutions to energy absorption application requirements when input parameters vary or are not clearly defined.

By simply turning an adjustment knob, the damping force can be changed to accommodate a wide range of conditions. Enidine offers the broadest range of adjustable shock absorbers and mounting accessories in the marketplace today.

Features and Benefits

- *Adjustable design lets you "fine-tune" your desired damping and lock the numbered adjustment setting.*
- *Internal orifice design provides deceleration with the most efficient damping characteristics, resulting in the lowest reaction forces in the industry.*
- *Threaded cylinders provide mounting flexibility and increased surface area for improved heat dissipation.*
- *Incorporated optional fluids and seal packages can expand the standard operating temperature range from (15 to 180°F) to (–30 to 210°F).*
- *A select variety of surface finishes maintains original quality appearance and provides the longest corrosion resistance protection.*
- *Operational parameters can be expanded through the use of Enidine's Low Range and High Performance products.*
- *Fully field repairable units are available in bore sizes of .75 inches and larger.*
- *ISO quality standards result in reliable, long-life operation.*
- *Custom orificed non-adjustable units (CBOEM) are available to meet specific application requirements.*

*The Platinum **OEM Small Series** is designed to decelerate light-to-medium loads with the added benefit of corrosion resistant, nickel-plated components.*

*Enidine Platinum **Low Range (LROEM)** models are available to control velocities as low as 3 in./sec. and propelling forces as high as 450 lbs.*

Together, they comprise the widest range of adjustable shock absorbers in the industry.

All models feature a small envelope size to accommodate space constraints.

Page 19

*The **OEM Large Series** is available with metric threads and bore diameters from .75 to 2.00 inches. These models are designed to decelerate medium-to-large loads.*

*The Enidine **Low Range OEM (LROEM) Large Series** is available to control velocities as low as 3 in./sec. and propelling forces as high as 4,000 lbs.*

Both OEM and LROEM Large Series units are fully field reparable.

Page 21

*The Enidine **OEM Low Profile Series** provides a recessed adjustment knob along with imperial threads and bore diameters of .75 inches and 1.13 inches for drop-in competitive interchange.*

***Low Range (LROEM) Series** products are also available to control velocities as low as 3 in./sec. and propelling forces as high as 4,000 lbs.*

OEM Low Profile and LROEM Series shock absorbers are fully field repairable.

Page 20

***High Performance (HP) Series** design is capable of softly decelerating impact velocities as high as 240 in./sec.*

Wide range adjustability and multiple damping rates accommodate exact application needs.

Pages 24-25

Use this Enidine Product Selection Guide to quickly locate potential adjustable shock absorber models most suited for your requirements. Models are organized in order of smallest to largest energy capacity per cycle within their respective product families.

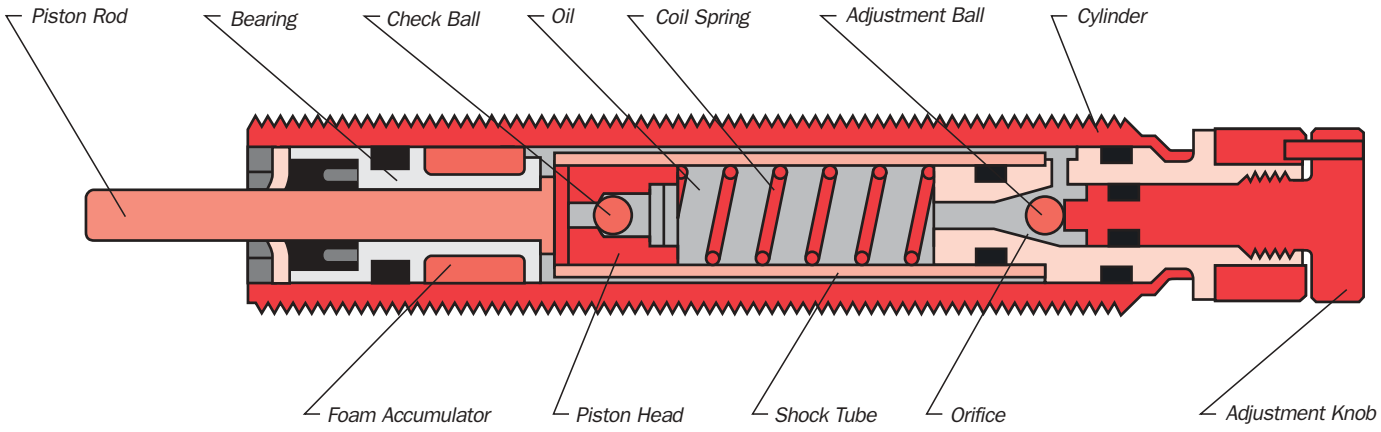
ENIDINE ADJUSTABLE SHOCK ABSORBERS

	Catalog No. (Model)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	Damping Type	Page No.
PLATINUM	OEM 0.1M (B)	0.28	50	110,000	D	19
PLATINUM	OEM .15M (B)	0.38	50	168,000	D	19
PLATINUM	OEM .25 (B)	0.38	50	178,000	D	19
PLATINUM	LROEM .25 (B)	0.38	50	178,000	D	19
PLATINUM	OEM .35 (B)	0.50	150	300,000	D	19
PLATINUM	LROEM .35 (B)	0.50	150	300,000	D	19
PLATINUM	OEM .5 (B)	0.50	250	284,000	D	19
PLATINUM	LROEM .5 (B)	0.50	250	284,000	D	19
PLATINUM	OEM 1.0 (B)	1.00	650	622,000	C	19
PLATINUM	LROEM 1.0 (B)	1.00	650	622,000	C	19
	HP 110	1.56	1,700	670,000	C	24-25
PLATINUM	OEM 1.15 X 1	1.00	1,700	670,000	C	19
PLATINUM	LROEM 1.15 X 1	1.00	1,700	670,000	C	19
PLATINUM	OEM 1.15 X 2	2.00	3,400	875,000	C	19
PLATINUM	LROEM 1.15 X 2	2.00	3,400	875,000	C	19
PLATINUM	OEM 1.25 x 1	1.00	1,700	808,000	C	19
PLATINUM	LROEM 1.25 x 1	1.00	1,700	808,000	C	19
PLATINUM	OEM 1.25 x 2	2.00	3,400	986,000	C	19
PLATINUM	LROEM 1.25 x 2	2.00	3,400	986,000	C	19
	LROEM ¾ x 1	1.00	2,300	1,120,000	C	20
	OEM ¾ x 1	1.00	2,300	1,120,000	C	20
	LROEM 1.5M x 1	1.00	2,300	1,120,000	C	21
	OEM 1.5M x 1	1.00	2,300	1,120,000	C	21
	LROEM ¾ x 2	2.00	4,600	1,475,000	C	20
	OEM ¾ x 2	2.00	4,600	1,475,000	C	20
	LROEM 1.5M x 2	2.00	4,600	1,475,000	C	21
	OEM 1.5M x 2	2.00	4,600	1,475,000	C	21
	OEM ¾ x 3	3.00	6,900	1,775,000	C	20
	OEM 1.5M x 3	3.00	6,900	1,775,000	C	21
	LROEM 1⅛ x 1	1.00	6,000	2,000,000	C	20
	LROEM 1⅛ x 2	2.00	12,000	2,400,000	C	20
	OEM 1⅛ x 2	2.00	12,000	2,400,000	C	20
	LROEM 2.0M x 2	2.00	12,000	2,400,000	C	21
	OEM 2.0M x 2	2.00	12,000	2,400,000	C	21
	OEM 3.0M x 2	2.00	20,000	3,290,000	C	21
	OEM 1⅛ x 4	4.00	24,000	3,200,000	C	20
	OEM 2.0M x 4	4.00	24,000	3,200,000	C	21
	OEM 4.0M x 2	2.00	34,000	13,300,000	C	21
	OEM 3.0M x 3.5	3.50	35,000	5,770,000	C	21
	OEM 1⅛ x 6	6.00	36,000	3,730,000	C	20
	OEM 2.0M x 6	6.00	36,000	3,730,000	C	21
	OEM 3.0M x 5	5.00	50,000	8,260,000	C	21
	OEM 3.0M x 6.5	6.50	65,000	10,750,000	C	21
	OEM 4.0M x 4	4.00	68,000	16,000,000	C	21
	OEM 4.0M x 6	6.00	102,000	18,600,000	C	21
	OEM 4.0M x 8	8.00	136,000	21,300,000	C	21
	OEM 4.0M x 10	10.00	170,000	24,000,000	C	21
	Custom Designs - Please consult factory for assistance.					

Key for Damping Type:
D – Dashpot
C – Conventional

Design Profiles

Enidine Adjustable Single Orifice Shock Absorber



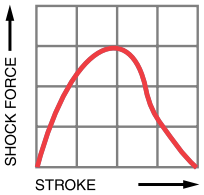
Adjustment Technique

The damping force of an Enidine single orifice shock absorber can be changed by turning the adjustment knob. Maximum damping force is achieved by turning the adjustment knob to eight (8), while minimum damping force is achieved by turning the adjustment knob to zero (0). Turning the adjustment knob causes the adjustment ball to increase or decrease the clearance (orifice area) between the ball and its seat, depending on rotation direction.

The internal structure of an adjustable single orifice shock absorber is shown above. When force is applied to the piston rod, the check ball is seated and the valve remains closed. Oil is forced through the orifice, creating pressure on the piston head that provides the resisting force. When the load is removed, the compressed coil spring moves to reposition the piston head and the check ball unseats, opening the valve that permits rapid fluid return. The closed cellular foam accumulator is compressed by the oil during the stroke, compensating for fluid displaced by the piston rod during compression. Without the fluid displacement volume provided by the foam accumulator, the system would be hydraulically locked. This type of orifice design produces constant orifice area damping.

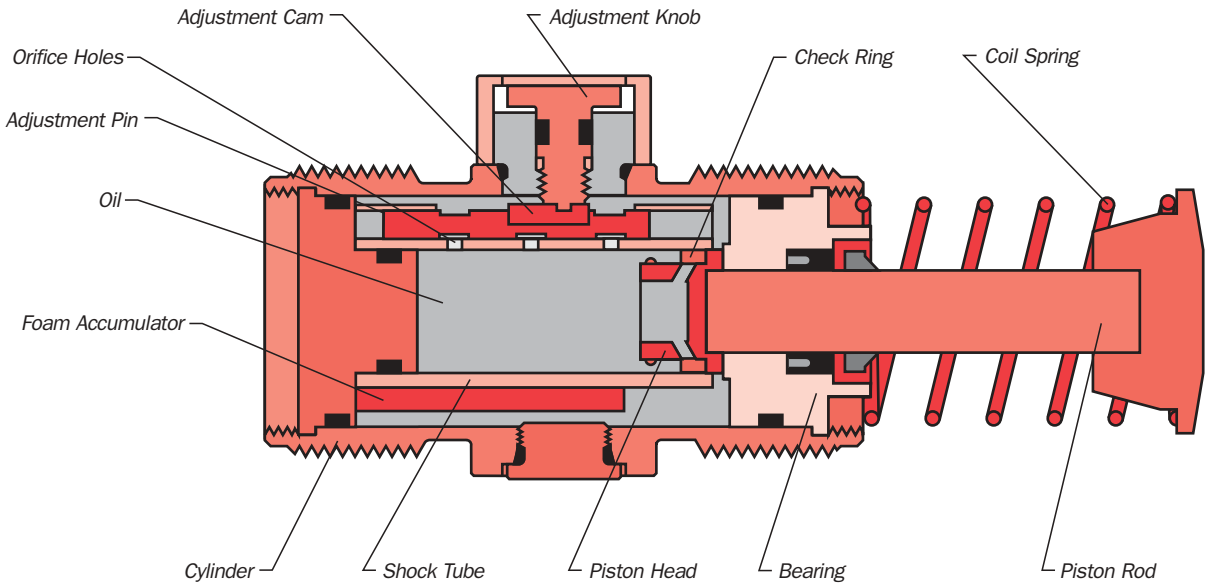
Damping Type

Constant orifice area damping **(Dashpot)** provides the largest shock force at the beginning of the stroke when impact velocity is highest. These shock absorbers provide high-energy absorption in a small, economical design. This type of damping technology is also available in non-adjustable shock absorber models.



Featuring a standard corrosion-resistant nickel-plated exterior, Enidine Platinum Series shock absorbers provide higher energy capacities than traditional shock absorbers within the same envelope size.

Enidine Adjustable Multiple Orifice Shock Absorber



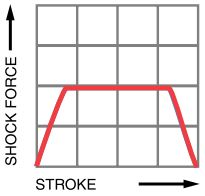
Adjustment Technique

The adjustable multiple orifice shock absorber is similar to the principles described earlier. The check ring replaces the check ball and the adjustment feature uses an adjustment pin instead of an adjustment ball. The damping force of the shock absorber can be changed by turning the adjustment knob. Maximum damping force is achieved by turning the adjustment knob to eight (8), while minimum damping force is achieved by turning the adjustment knob to zero (0).

Turning the adjustment knob rotates the adjustment cam within the shock absorber. The cam, in turn, moves the adjustment pin in the shock tube, closing or opening the orifice holes. By closing the orifice holes, the total orifice area of the shock absorber is reduced, thus increasing the damping force of the shock absorber. The adjustable shock absorber enables the user to change the damping force of the unit, should input conditions change, while still maintaining a conventional-type damping curve.

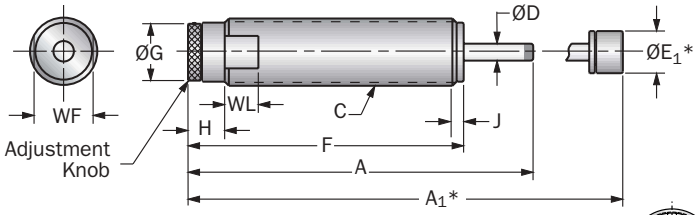
Damping Type

Conventional damping allows linear deceleration by providing a constant shock force over the entire stroke. This standard design is the most efficient, meaning it allows the most energy to be absorbed in a given stroke while providing the lowest shock force. This type of damping can be found in both adjustable and non-adjustable shock absorbers.

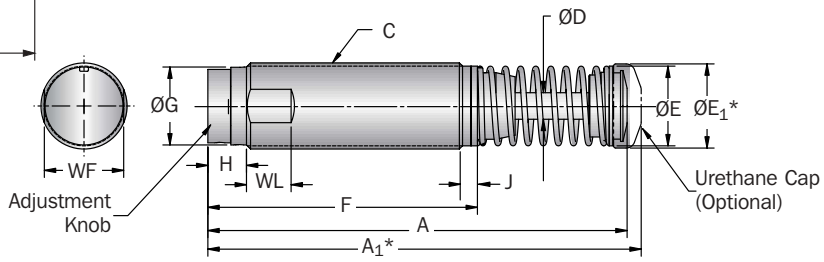


OEM Platinum Series

OEM 0.1M → OEM 1.0



OEM 1.15 → OEM 1.25



*Note: A_1 and E_1 apply to button models and urethane striker cap accessory.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	Optimal Velocity Range (in./sec.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force		(F_D) Max. Propelling Force (lbs.)	Model Weight (oz.)
							Extended (lbs.)	Compressed (lbs.)		
OEM .1M (B)	.24	0.28	12-130	50	110,000	275	0.5	1.0	80	1
OEM .15M (B)	.25	0.38	12-130	50	168,000	200	0.8	1.7	80	2
OEM .25 (B)	.25	0.38	12-130	50	178,000	200	0.8	1.7	80	2
LROEM .25 (B)	.25	0.38	3-50	50	178,000	200	0.8	1.7	100	2
OEM .35 (B)	.28	0.50	12-130	150	300,000	450	1.0	2.2	120	3
LROEM .35 (B)	.28	0.50	3-50	150	300,000	450	1.0	2.2	200	3
OEM .5 (B)	.44	0.50	12-180	250	284,000	775	1.3	2.8	150	5
LROEM .5 (B)	.44	0.50	3-50	250	284,000	775	2.0	3.8	250	5
OEM 1.0 (B)	.50	1.00	12-130	650	622,000	1,000	3.0	6.0	300	10
LROEM 1.0 (B)	.50	1.00	3-50	650	622,000	1,000	3.0	6.0	450	10
OEM 1.15 x 1	.63	1.00	12-130	1,700	670,000	2,500	12.5	20.0	500	17
LROEM 1.15 x 1	.63	1.00	3-80	1,700	670,000	2,500	12.5	20.0	750	17
OEM 1.15 x 2	.63	2.00	12-130	3,400	875,000	2,500	7.0	20.0	500	25
LROEM 1.15 x 2	.63	2.00	3-80	3,400	875,000	2,500	7.0	20.0	750	25
OEM 1.25 x 1	.63	1.00	12-130	1,700	808,000	2,500	12.5	20.0	500	20
LROEM 1.25 x 1	.63	1.00	3-80	1,700	808,000	2,500	12.5	20.0	750	20
OEM 1.25 x 2	.63	2.00	12-130	3,400	986,000	2,500	7.0	20.0	500	26
LROEM 1.25 x 2	.63	2.00	3-80	3,400	986,000	2,500	7.0	20.0	750	26

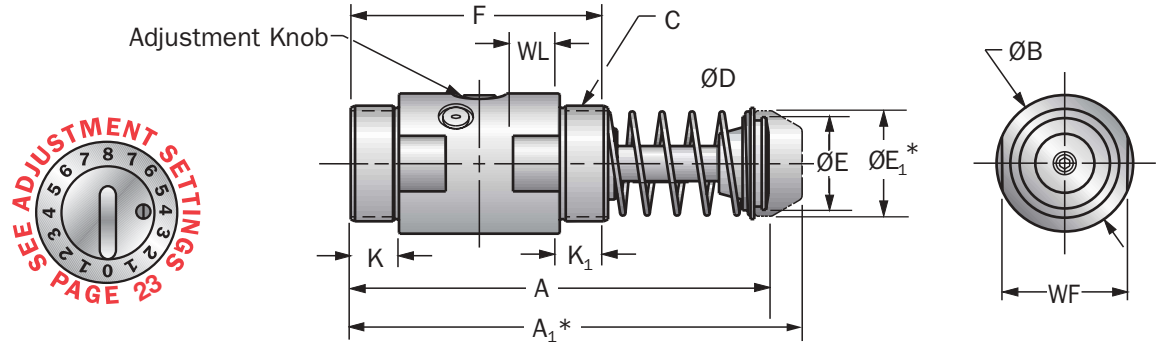
All dimensions in inches.

Catalog No. (Model)	A	A_1	C	D	E	E_1	F	G	H	J	WF	WL
OEM .1M (B)	2.25	2.63	M10 x 1,0	.12	N/A	0.34	1.95	.34	.40	N/A	N/A	N/A
OEM .15M (B)	3.22	3.61	M12 x 1,0	.13	N/A	0.34	2.81	.43	.56	N/A	.43	.38
(LR)OEM .25 (B)	3.22	3.59	1/2-20 UNF	.13	N/A	0.44	2.81	.43	.56	N/A	.44	.50
(LR)OEM .35 (B)	3.96	4.36	9/16-18 UNF	.16	N/A	0.44	3.44	.44	.57	.02	.50	.50
(LR)OEM .5 (B)	3.88	4.35	3/4-16 UNF	.19	N/A	0.50	3.31	.63	.67	N/A	.68	.50
(LR)OEM 1.0 (B)	5.12	5.62	1-12 UNF	.25	N/A	0.62	4.09	.87	.55	.18	.88	.50
(LR)OEM 1.15 x 1	5.92	6.12	1 1/4-12 UNF	.38	1.13	1.20	3.81	1.10	.55	.21	1.12	.63
(LR)OEM 1.15 x 2	8.54	8.74	1 1/4-12 UNF	.38	1.13	1.20	5.43	1.10	.55	.21	1.12	.63
(LR)OEM 1.25 x 1	5.92	6.12	1 3/8-12 UNF	.38	1.13	1.20	3.81	1.10	.55	.21	1.25	.63
(LR)OEM 1.25 x 2	8.54	8.74	1 3/8-12 UNF	.38	1.13	1.20	5.43	1.10	.55	.21	1.25	.63

All dimensions in inches.

Notes: 1. All shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. If less than 5%, a smaller model should be specified.
2. For mounting accessories, see pages 22-30.
3. (B) indicates button model of shock absorber. Buttons cannot be added to non-button models or removed from button models OEM .1M to OEM 1.0.
4. Urethane striker caps are available as accessories for models OEM 1.15 x 1 to OEM 1.25 x 2.

OEM 3/4 → OEM 1 1/8



*Note: A_1 and E_1 apply to urethane striker cap accessory.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	Optimal Velocity Range (in./sec.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force		(F_D) Max. Propelling Force (lbs.)	Model Weight (lbs.)
							Extended (lbs.)	Compressed (lbs.)		
OEM 3/4 x 1	0.75	1	12-140	2,300	1,120,000	3,000	11	15	650	2.6
LROEM 3/4 x 1	0.75	1	3-55	2,300	1,120,000	3,000	11	15	1,500	2.6
OEM 3/4 x 2	0.75	2	12-140	4,600	1,475,000	3,000	7	15	650	2.9
LROEM 3/4 x 2	0.75	2	3-55	4,600	1,475,000	3,000	11	18	1,500	2.9
OEM 3/4 x 3	0.75	3	12-140	6,900	1,775,000	3,000	7	18	650	3.4
LROEM 1 1/8 x 1	1.13	1	3-30	6,000	2,000,000	7,800	26	35	4,000	6.5
OEM 1 1/8 x 2	1.13	2	12-140	12,000	2,400,000	7,800	17	35	1,500	9.9
LROEM 1 1/8 x 2	1.13	2	3-30	12,000	2,400,000	7,800	17	35	4,000	9.9
OEM 1 1/8 x 4	1.13	4	12-140	24,000	3,200,000	7,800	16	36	1,500	11.6
OEM 1 1/8 x 6	1.13	6	12-140	36,000	3,730,000	7,800	20	64	1,500	14.5

All dimensions in inches.

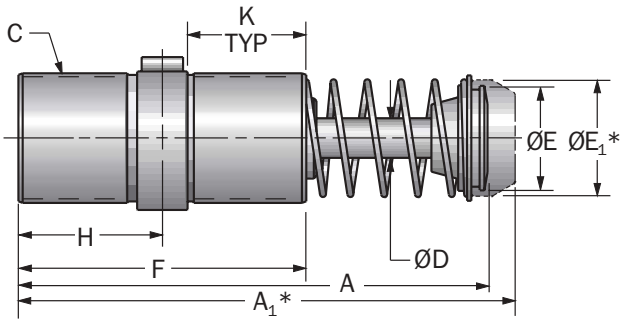
Catalog No. (Model)	A	A_1	B	C	D	E	E_1	F	K	K_1	WF	WL
(LR)OEM 3/4 x 1	5.68	6.38	2.25	1 3/4-12 UN	.50	1.50	1.75	3.63	0.91	0.82	2.00	0.42
(LR)OEM 3/4 x 2	7.68	8.38	2.25	1 3/4-12 UN	.50	1.50	1.75	4.63	0.91	0.82	2.00	0.50
OEM 3/4 x 3	9.68	10.38	2.25	1 3/4-12 UN	.50	1.50	1.75	5.63	0.91	0.82	2.00	0.50
LROEM 1 1/8 x 1	6.90	7.59	3.00	2 1/2-12 UN	.75	2.00	2.25	4.50	1.03	1.03	2.75	0.50
(LR)OEM 1 1/8 x 2	8.90	9.59	3.00	2 1/2-12 UN	.75	2.00	2.25	5.50	1.03	1.03	2.75	1.00
OEM 1 1/8 x 4	12.90	13.59	3.00	2 1/2-12 UN	.75	2.00	2.25	7.50	1.03	1.03	2.75	1.00
OEM 1 1/8 x 6	17.97	18.66	3.00	2 1/2-12 UN	.75	2.38	2.38	9.50	1.03	1.03	2.75	1.00

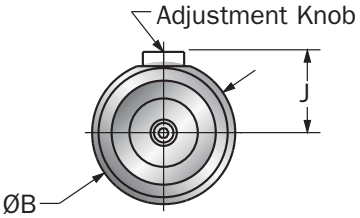
Notes: 1. All shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. If less than 5%, a smaller model should be specified.
2. Air/Oil (AOEM, LRAOEM) models – max. in-lbs per hour is 20% higher than the standard OEM/LROEM models.
3. For mounting accessories, see pages 22-30.
4. Rear flange mounting not recommended for OEM 1 1/8 x 6 when mounting horizontally.

All dimensions in inches.

OEM Large Series

OEM 1.5M → OEM 4.0M





*Note: A_1 and E_1 apply to urethane striker cap accessory.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	Optimal Velocity Range (in./sec.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force		(F_D) Max. Propelling Force (lbs.)	Model Weight (lbs.)
							Extended (lbs.)	Compressed (lbs.)		
OEM 1.5M x 1	0.75	1.0	12-140	2,300	1,120,000	3,000	11	15	650	2.0
LROEM 1.5M x 1	0.75	1.0	3-55	2,300	1,120,000	3,000	11	15	1,500	2.0
OEM 1.5M x 2	0.75	2.0	12-140	4,600	1,475,000	3,000	7	15	650	2.2
LROEM 1.5M x 2	0.75	2.0	3-55	4,600	1,475,000	3,000	11	18	1,500	2.2
OEM 1.5M x 3	0.75	3.0	12-140	6,900	1,775,000	3,000	7	18	650	2.6
OEM 2.0M x 2	1.13	2.0	12-140	12,000	2,400,000	7,800	17	35	1,500	7.5
LROEM 2.0M x 2	1.13	2.0	3-30	12,000	2,400,000	7,800	17	35	4,000	7.5
OEM 2.0M x 4	1.13	4.0	12-140	24,000	3,200,000	7,800	16	36	1,500	8.8
OEM 2.0M x 6	1.13	6.0	12-140	36,000	3,730,000	7,800	20	64	1,500	11.0
OEM 3.0M x 2	1.50	2.0	12-170	20,000	3,290,000	15,000	25	45	2,700	15.5
OEM 3.0M x 3.5	1.50	3.5	12-170	35,000	5,770,000	15,000	25	45	2,700	20.0
OEM 3.0M x 5	1.50	5.0	12-170	50,000	8,260,000	15,000	16	45	2,700	24.0
OEM 3.0M x 6.5	1.50	6.5	12-170	65,000	10,750,000	15,000	27	75	2,700	30.0
OEM 4.0M x 2	2.00	2.0	12-170	34,000	13,300,000	25,000	50	65	4,800	33.0
OEM 4.0M x 4	2.00	4.0	12-170	68,000	16,000,000	25,000	35	65	4,800	40.0
OEM 4.0M x 6	2.00	6.0	12-170	102,000	18,600,000	25,000	30	70	4,800	44.0
OEM 4.0M x 8	2.00	8.0	12-170	136,000	21,300,000	25,000	40	80	4,800	66.0
OEM 4.0M x 10	2.00	10.0	12-170	170,000	24,000,000	25,000	30	80	4,800	73.0

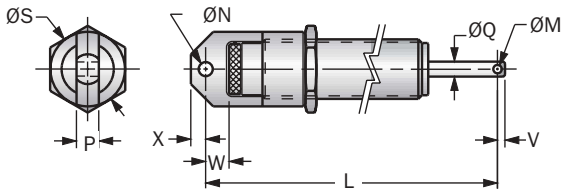
All dimensions in inches.

Catalog No. (Model)	A	A_1	B	C	D	E	E_1	F	H	J	K
(LR)OEM 1.5M x 1	5.68	6.38	2.00	M42 x 1.5	0.50	1.50	1.75	3.63	1.82	1.44	1.26
(LR)OEM 1.5M x 2	7.68	8.38	2.00	M42 x 1.5	0.50	1.50	1.75	4.63	2.32	1.44	1.76
OEM 1.5M x 3	9.68	10.38	2.00	M42 x 1.5	0.50	1.50	1.75	5.63	2.82	1.44	2.26
(LR)OEM 2.0M x 2	8.90	9.55	2.88	M64 x 2	0.75	2.00	2.25	5.50	2.75	1.89	2.00
OEM 2.0M x 4	12.90	13.55	2.88	M64 x 2	0.75	2.00	2.25	7.50	3.75	1.89	3.00
OEM 2.0M x 6	17.97	18.62	2.88	M64 x 2	0.75	2.38	2.38	9.50	4.75	1.89	3.00
OEM 3.0M x 2	9.66	10.43	3.88	M85 x 2	0.88	2.75	3.00	5.53	2.77	2.25	2.02
OEM 3.0M x 3.5	12.72	13.49	3.88	M85 x 2	0.88	2.75	3.00	7.06	3.53	2.25	2.78
OEM 3.0M x 5	15.72	16.49	3.88	M85 x 2	0.88	2.75	3.00	8.50	4.28	2.25	2.78
OEM 3.0M x 6.5	19.46	20.23	3.88	M85 x 2	0.88	3.19	3.19	10.06	5.03	2.25	2.78
OEM 4.0M x 2	12.32	13.20	5.00	M115 x 2	1.38	3.50	3.75	8.00	4.00	2.89	3.13
OEM 4.0M x 4	16.32	17.20	5.00	M115 x 2	1.38	3.50	3.75	10.00	5.00	2.89	4.13
OEM 4.0M x 6	20.32	21.20	5.00	M115 x 2	1.38	3.50	3.75	12.00	6.00	2.89	4.25
OEM 4.0M x 8	25.32	26.20	5.00	M115 x 2	1.38	3.50	3.75	14.00	7.00	2.89	4.25
OEM 4.0M x 10	29.32	30.20	5.00	M115 x 2	1.38	3.50	3.75	16.00	8.00	2.89	4.25

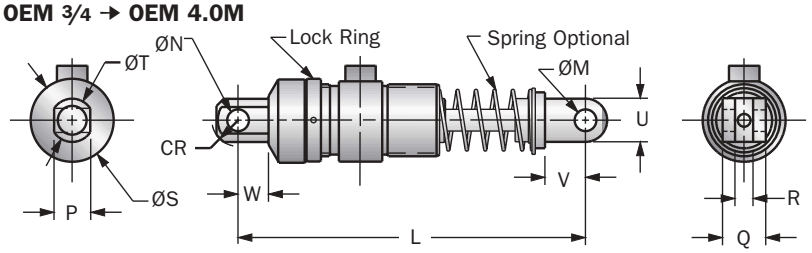
All dimensions in inches.

Notes: 1. All shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. If less than 5%, a smaller model should be specified.
2. Air/Oil (AOEM, LRAOEM) models – max. in-lbs per hour is 20% higher than the standard OEM/LROEM models (see page 14).
3. For mounting accessories, see pages 22-30.
4. Rear flange mounting of OEM 2.0M x 6, OEM 3.0M x 6.5, OEM 4.0M x 8 and OEM 4.0M x 10 models not recommended when mounting horizontally.

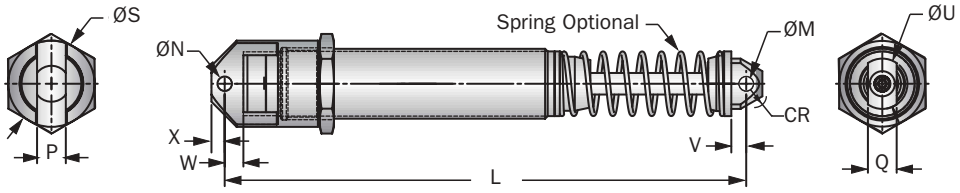
OEM 1.0



OEM ¾ → OEM 4.0M



OEM 1.15 → OEM 1.25



Catalog No. (Model)	(S) Stroke (in.)	L	M	N	P	Q	R	S	T	U	V	W	X	CR	Model Weight
OEM 1.0 CMS	1.0	6.38	.141 +.005/-.000	.251 +.005/-.000	.375 +.000/-.010	.252 +.000/-.003	N/A	1.25	N/A	N/A	.13	.35	.25	N/A	13.9 oz.
(LR)OEM 1.15 x 1 CM(S)	1.0	6.44	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.33	.23	.44	1.6 lbs.
(LR)OEM 1.15 x 2 CM(S)	2.0	9.07	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.33	.23	.44	1.6 lbs.
(LR)OEM 1.25 x 1 CM(S)	1.0	6.44	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.33	.23	.44	1.6 lbs.
(LR)OEM 1.25 x 2 CM(S)	2.0	9.07	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.33	.23	.44	1.9 lbs.
(LR)OEM ¾ x 1 CM(S)	1.0	7.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.5 lbs.
(LR)OEM ¾ x 2 CM(S)	2.0	9.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.8 lbs.
OEM ¾ x 3 CM(S)	3.0	11.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	4.3 lbs.
(LR)OEM 1 1⁄8 x 1CM(S)	1.0	10.07	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	11.7 lbs.
(LR)OEM 1 1⁄8 x 2 CM(S)	2.0	12.06	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	11.7 lbs.
OEM 1 1⁄8 x 4 CM(S)	4.0	16.06	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	13.4 lbs.
OEM 1 1⁄8 x 6 CM(S)	6.0	21.13	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	16.3 lbs.
(LR)OEM 1.5M x 1 CM(S)	1.0	7.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	2.9 lbs.
(LR)OEM 1.5M x 2 CM(S)	2.0	9.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.1 lbs.
OEM 1.5M x 3 CM (S)	3.0	11.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.5 lbs.
(LR)OEM 2.0M x 2 CM(S)	2.0	12.06	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	9.4 lbs.
OEM 2.0M x 4 CM(S)	4.0	16.06	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	10.7 lbs.
OEM 2.0M x 6 CM(S)	6.0	21.13	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	12.9 lbs.
OEM 3.0M x 2 CM(S)	2.0	12.81	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	3.88	1.50	1.50	1.40	1.06	N/A	.90	19.1 lbs.
OEM 3.0M x 3.5 CM(S)	3.5	15.84	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	3.88	1.50	1.50	1.40	1.06	N/A	.90	23.6 lbs.
OEM 3.0M x 5 CM(S)	5.0	18.84	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	3.88	1.50	1.50	1.40	1.06	N/A	.90	27.6 lbs.
OEM 3.0M x 6.5 CM(S)	6.5	22.59	.751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	.630 +.020/-.000	3.88	1.50	1.50	1.40	1.06	N/A	.90	33.6 lbs.
OEM 4.0M x 2 CM(S)	2.0	17.00	1.001 +.010/-.000	1.001 +.010/-.000	1.500 +.000/-.010	3.56	1.505 +.020/-.000	5.00	2.25	2.00	2.00	1.75	N/A	1.35	42.4 lbs.
OEM 4.0M x 4 CM(S)	4.0	21.00	1.001 +.010/-.000	1.001 +.010/-.000	1.500 +.000/-.010	3.56	1.505 +.020/-.000	5.00	2.25	2.00	2.00	1.75	N/A	1.35	49.4 lbs.
OEM 4.0M x 6 CM(S)	6.0	25.00	1.001 .010/-.000	1.001 +.010/-.000	1.500 +.000/-.010	3.56	1.505 +.020/-.000	5.00	2.25	2.00	2.00	1.75	N/A	1.35	53.4 lbs.
OEM 4.0M x 8 CM(S)	8.0	30.00	1.001 +.010/-.000	1.001 +.010/-.000	1.500 +.000/-.010	3.56	1.505 +.020/-.000	5.00	2.25	2.00	2.00	1.75	N/A	1.35	75.4 lbs.
OEM 4.0M x 10 CM(S)	10.0	34.00	1.001 +.010/-.000	1.001 +.010/-.000	1.500 +.000/-.010	3.56	1.505 +.020/-.000	5.00	2.25	2.00	2.00	1.75	N/A	1.35	82.4 lbs.

Notes: 1. Clevis mount not recommended for OEM 2.0M x 6, OEM 3.0M x 6.5, OEM 4.0M x 8 and OEM 4.0M x 10 models when mounted horizontally.
2. "S" designates model is supplied with spring.

All dimensions in inches.

Useable Adjustment Settings

After properly sizing the shock absorber, the useable range of adjustment settings for the application can be determined:

1. Locate the intersection point of the application's impact velocity and the selected model graph line.
2. The intersection is the **maximum** adjustment setting to be used. Adjustments exceeding this maximum suggested setting could overload the shock absorber.
3. The useable adjustment setting range is from the 0 setting to the **maximum** adjustment setting as determined in step 2.

Example: OEM 1.25 x 1

1. Impact Velocity: 40 in./sec.
2. Intersection Point: Adjustment Setting 5
3. Useable Adjustment Setting Range: 0 to 5

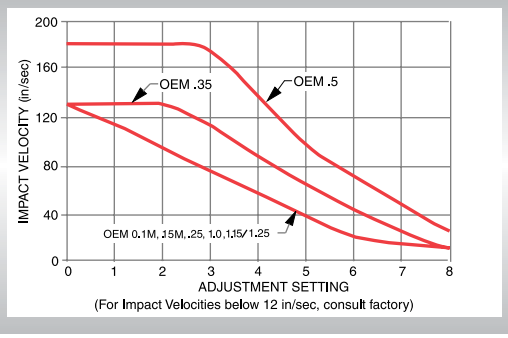
Example: LROEM 1⅛ x 2

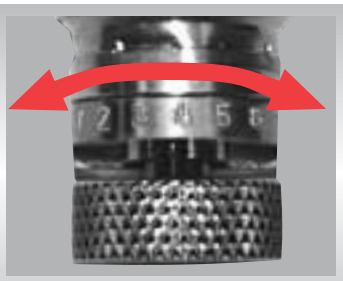
1. Impact Velocity: 20 in./sec.
2. Intersection Point: Adjustment Setting 3
3. Useable Adjustment Setting Range: 0 to 3

Position 0 provides minimum damping force, position 8 provides maximum damping force.

Useable Adjustment Setting Range

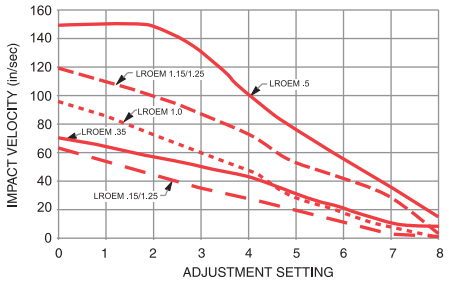
Platinum OEM Small Series

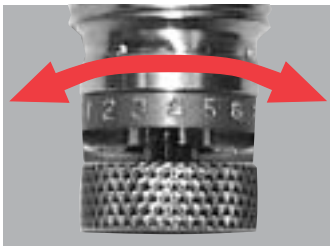



180° adjustment with setscrew locking. (OEM 0.1M – OEM .5)


360° adjustment with setscrew locking. (OEM 1.0)

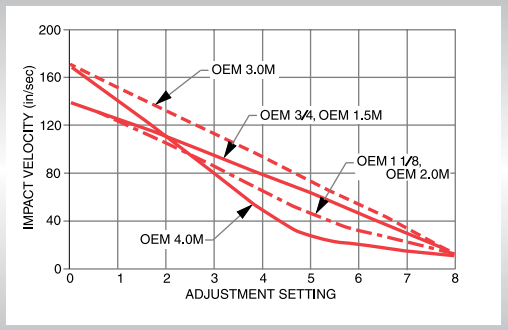
Platinum Low Range OEM Small Series

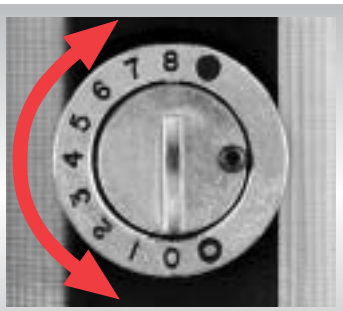


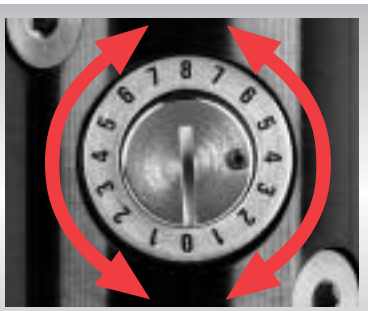

180° adjustment with setscrew locking. (LROEM .15M – LROEM .5)

360° adjustment with setscrew locking. (LROEM 1.0)

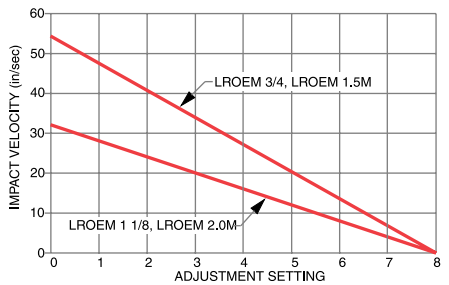
OEM Large

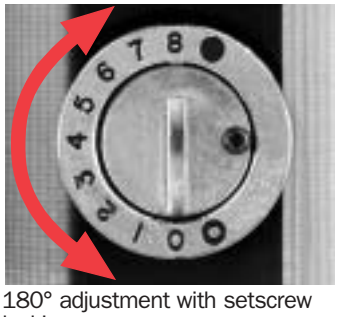



180° adjustment with setscrew locking. (OEM 1.5M – OEM 4.0M)

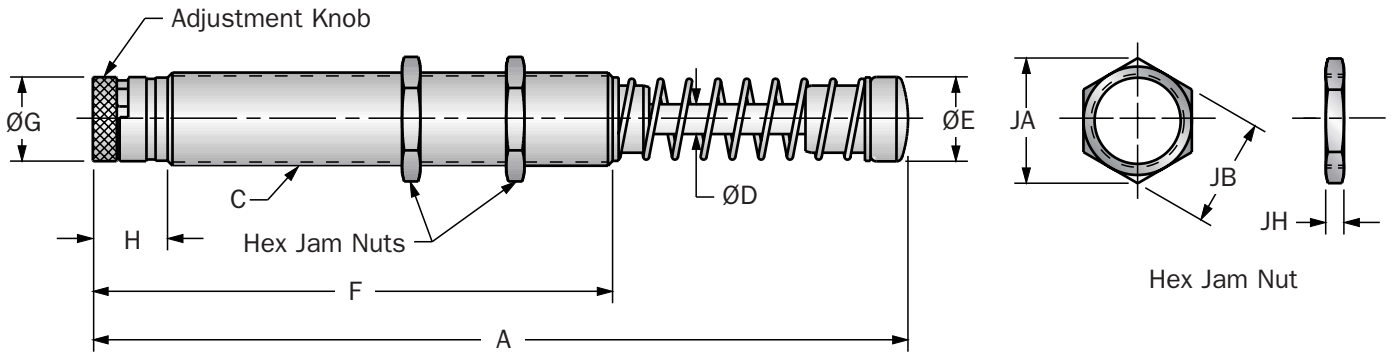

360° adjustment with setscrew locking. (OEM ¾ and OEM 1⅛)

Low Range OEM Large




180° adjustment with setscrew locking (LROEM 1.5M and LROEM 2.0M)


360° adjustment with setscrew locking (LROEM ¾ and LROEM 1⅛)

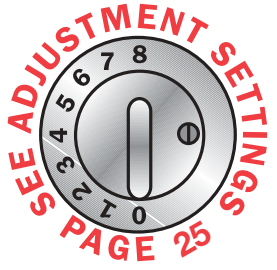


Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	Optimal Velocity Range (in./sec.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force		(F_D) Max. Propelling Force (lbs.)	Model Weight (oz.)
							Extended (lbs.)	Compressed (lbs.)		
HP 110 IF-1	.56	1.56	57-240	1,700	670,000	1,700	4	11	500	16
HP 110 IF-2	.56	1.56	32-180	1,700	670,000	1,700	4	11	500	16
HP 110 IF-3	.56	1.56	10-120	1,700	670,000	1,700	4	11	500	16

All dimensions in inches.

Catalog No. (Model)	A	C	D	E	F	G	H	JA	JB	JH
HP 110 1F-1	8.5	1-12 UNF	.31	.88	5.45	.88	.81	1.30	1.13	.19
HP 110 1F-2	8.5	1-12 UNF	.31	.88	5.45	.88	.81	1.30	1.13	.19
HP 110 1F-3	8.5	1-12 UNF	.31	.88	5.45	.88	.81	1.30	1.13	.19

All dimensions in inches.

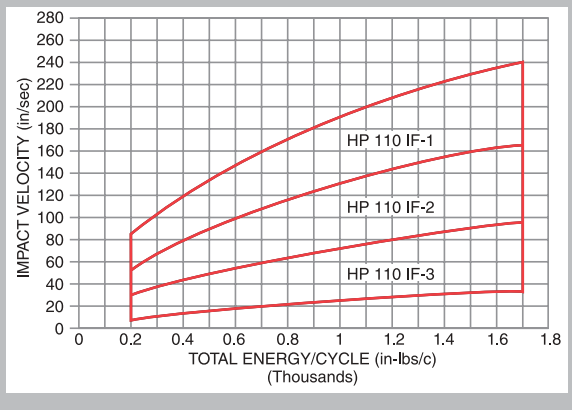


HP Series Shock Absorber Sizing

1. Determine load weight (lbs.), impact velocity (in./sec.), propelling force (lbs.) if any, and cycles per hour.
2. Calculate total energy per cycle (in.-lbs./c) and total energy per hour (in.-lbs./hr). Consult this catalog's sizing examples (pages 5-12) for assistance if required.
3. Compare the calculated total energy per cycle (in.-lbs./c), total energy per hour (in.-lbs./hr) and propelling force (lbs.) to the values listed above.
4. Locate the intersection point of the determined impact velocity (in./sec.) and total energy per cycle (in.-lbs./c) on the sizing graph to select the appropriate model.
5. Refer to the usable adjustment settings graph (below) to determine the maximum adjustment setting.
6. Contact Enidine for applications with requirements that fall outside the sizing graph.

Sizing Graph

HP 110



Example: Horizontal Application

1. Weight (W): 35 lbs.
   Impact Velocity (V): 180 in./sec.
   Propelling Force (F_D): None
   Cycles/Hour (C): 80
2. Total Energy/Cycle (E_T): 1469 in.-lbs./c
   Total Energy/Hour (E_TC): 117,520 in.-lbs./hr
3. Compare total energy/cycle (1469 in.-lbs./c) and total energy/hour (117,520 in.-lbs./hr) to the HP Engineering Data chart.
4. Intersection Point: HP 110 IF-1

Useable Adjustment Settings

After properly sizing the shock absorber, the useable range of adjustment settings for the application can be determined.

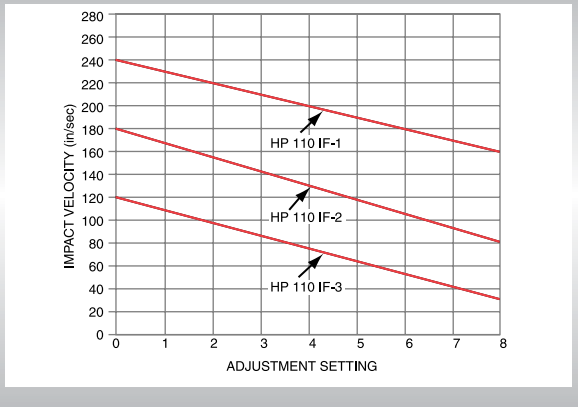
1. Locate the intersection point of the application's impact velocity and the selected HP model graph line.
2. The intersection is the **maximum** adjustment setting to be used. Adjustments exceeding this setting could overload the shock absorber.
3. The useable adjustment range is from the 0 setting to the **maximum** adjustment setting as determined in step 2.

Example: HP 110 IF-1

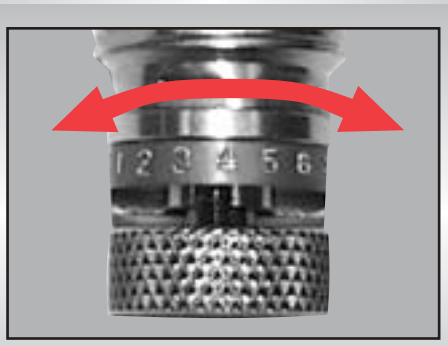
1. Impact Velocity: 180 in./sec.
2. Intersection Point: Adjustment Setting 6
3. Useable Adjustment Setting Range: 0 to 6

Useable Adjustment Settings

HP 110



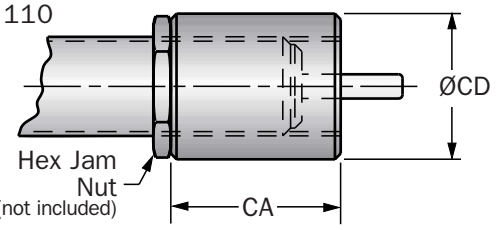
Position 0 provides minimum damping force, position 8 provides maximum damping force.



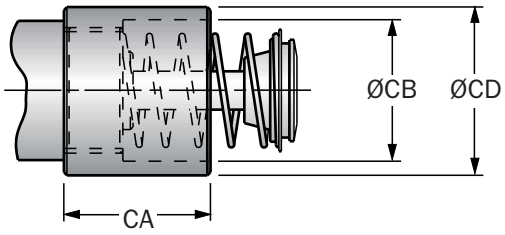
180° adjustment with setscrew locking.

STOP COLLAR (SC)

OEM 0.1M → OEM 1.25
HP 110



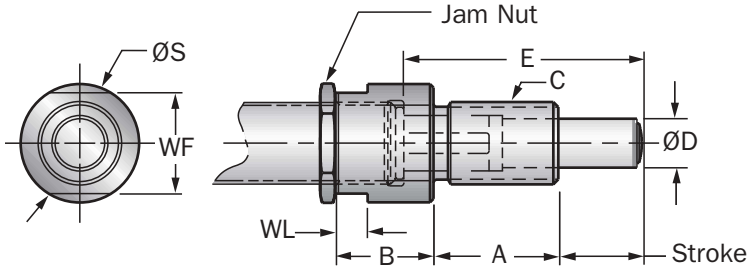
OEM 3/4 → OEM 2.0M



Catalog No.	Part Number	Model (Ref)	CA	CB	CD	Weight(oz.)
SC M10 x 1	M98921058	OEM 0.1M (B)	0.75	N/A	0.63	0.5
SC M12 x 1	M95588058	OEM 0.15M (B)	0.75	N/A	0.63	0.5
SC ½-20	M93935057	(LR)OEM .25 (B)	1.00	N/A	0.75	1.0
SC 9/16-18	M94950199	(LR)OEM .35 (B)	1.00	N/A	0.69	1.0
SC ¾-16	M92646057	(LR)OEM .5 (B)	1.50	N/A	1.00	2.0
SC 1-12 x 1	M92587057	(LR)OEM 1.0 (B)	1.75	N/A	1.50	8.0
SC 1¼-12	M921049057	OEM 1.15	2.50	N/A	1.50	7.0
SC 1⅜-12	M921293057	OEM 1.25	2.50	N/A	1.69	7.0
SC 1¾-12	8KE2940	(LR)OEM ¾	1.94	1.94	2.22	12.0
SC 2½-12 x 2	8KE3010	(LR)OEM 1⅛ x 2 & 4	2.47	2.54	3.00	23.0
SC 2½-12 x 6	8KE3012	OEM 1⅛ x 6	3.66	2.54	3.00	33.0
SC M42 x 1.5 x 1	8K2940	(LR)OEM 1.5M x 1	2.44	1.94	2.22	14.0
SC M42 x 1.5 x 2	8K2941	(LR)OEM 1.5M x 2	2.94	1.94	2.22	19.0
SC M42 x 1.5 x 3	8K2942	OEM 1.5M x 3	3.44	1.94	2.22	23.0
SC M64 x 2 x 2	8K3010	(LR)OEM 2.0M x 2	3.50	2.54	3.00	33.0
SC M64 x 2 x 4	8K3011	OEM 2.0M x 4	4.50	2.54	3.00	42.0
SC M64 x 2 x 6	8K3012	OEM 2.0M x 6	5.63	2.54	3.00	52.0
SC 1-12HP x 1.56	M95568181	HP 110	2.00	N/A	1.50	8.0

All dimensions in inches.

SIDE LOAD ADAPTERS (SLA)

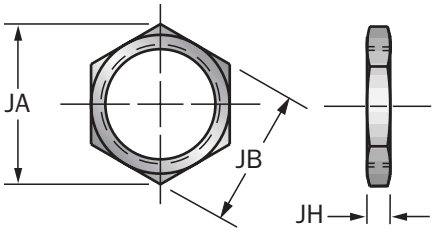


Catalog No.	Part Number	Model (Ref)	Stroke (in.)	A	B	C	D	E	S	WF	WL
SLA 10MF	SLA_33457	OEM 0.1M	.25	.47	.43	M10 x 1	.20	.85	.51	11mm	.28
SLA 12MF	SLA_33299	OEM .15M	.38	.71	.55	M12 x 1	.24	1.28	.63	13mm	.28
SLA ½-20 x .38	SLA_71133	(LR)OEM .25	.38	.71	.65	½ - 20 UNF	.31	1.37	.71	.63	.28
SLA 9/16/18 x .50	SLA_71134	(LR)OEM .35	.5	.79	.63	9/16 - 18 UNF	.31	1.55	.71	.63	.28
SLA ¾-16 x .50	SLA_33847	(LR)OEM .5	.5	.94	.55	¾ - 16 UNF	.43	1.64	.98	.88	.28
SLA 1-12 x 1	SLA_33848	(LR)OEM 1.0	1.0	1.50	1.80	1-12 UNF	.59	2.88	1.42	1.25	.39

Note: Maximum sideload angle is 30°.

All dimensions in inches unless otherwise noted.

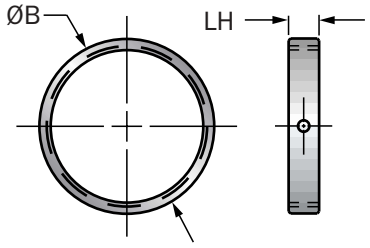
JAM NUT (JN)



Catalog No.	Part Number	Model (Ref)	JA	JB	JH	Weight (oz.)
JN M10 x 1	J24421035	OEM 0.1M	0.59	0.51	.13	0.1
JN M12 x 1	J25588035	OEM .15M	0.68	0.59	.16	0.1
JN 1/2-20	J13935034	(LR)OEM .25	0.72	0.63	.12	0.1
JN 9/16-18	J14950034	(LR)OEM .35	1.01	0.88	.31	0.6
JN 3/4-16	J12646034	(LR)OEM .5	1.08	0.94	.18	0.3
JN 1-12	J11976034	(LR)OEM 1.0	1.30	1.13	.18	0.5
JN 1 1/4-12	J18609034	OEM 1.15	1.73	1.50	.25	0.9
JN 1 3/8-12	J13164034	OEM 1.25	1.88	1.63	.25	0.9

All dimensions in inches.

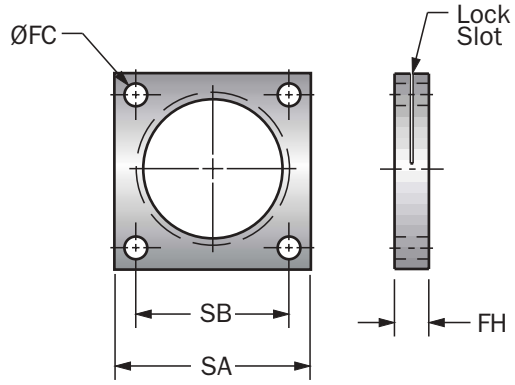
LOCK RING (LR)



Catalog No.	Part Number	Model (Ref)	B	LH	Weight (oz.)
LR 1 3/4-12	F8E2940049	(LR)OEM 3/4	2.00	.38	2.0
LR 2 1/2-12	F8E3010049	(LR)OEM 1 1/8	2.88	.38	3.0
LR M42 x 1.5	F82940049	(LR)OEM 1.5M	2.00	.38	3.0
LR M64 x 2	F83010049	(LR)OEM 2.0M	2.88	.50	4.0
LR M85 x 2	F83330049	(LR)OEM 3.0M	3.88	.63	8.0
LR M115 x 2	F83720049	(LR)OEM 4.0M	5.00	.88	14.0

All dimensions in inches.

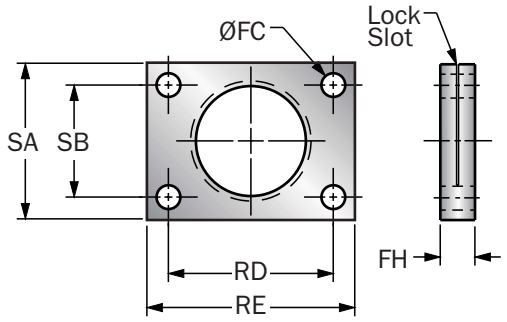
SQUARE FLANGE (SF)



Catalog No.	Part Number	Model (Ref)	FC	FH	SA	SB	Bolt Size	Wt. (oz.)
SF 1 3/4-12	M4E2940056	(LR)OEM 3/4	.34	.50	2.25	1.63	5/16	5.0
SF 2 1/2-12	M4E3010056	(LR)OEM 1 1/8	.41	.62	3.50	2.75	3/8	20.0
SF M42 x 1.5	M42940056	(LR)OEM 1.5M	.34	.50	2.25	1.63	5/16	5.0
SF M64 x 2	M43010056	(LR)OEM 2.0M	.41	.62	3.50	2.75	3/8	20.0
SF M85 x 2	M43330056	OEM 3.0M	.53	.75	4.00	3.00	1/2	24.0
SF M115 x 2	M43720056	OEM 4.0M	.65	1.00	5.50	4.38	5/8	56.0

All dimensions in inches.

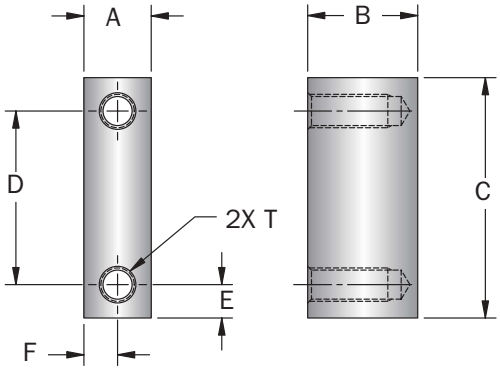
RECTANGULAR FLANGE (RF)



Catalog No.	Part Number	Model (Ref)	FC	FH	RD	RE	SA	SB	Bolt Size	Wt. (oz.)
RF 1¼-12	N121049129	(LR)OEM 1.15	.22	.38	1.63	2.00	1.75	1.13	#10	1.0
RF 1⅜-12	N121293129	(LR)OEM 1.25	.22	.38	1.63	2.00	1.75	1.13	#10	1.0
RF 1¾-12	M5E2940053	(LR)OEM ¾	.34	.50	2.38	3.00	2.25	1.63	5/16	9.0
RF M42 x 1.5	M52940053	(LR)OEM 1.5M	.34	.50	2.38	3.00	2.25	1.63	5/16	9.0
RF M85 x 2	M53330053	OEM 3.0M	.53	.75	4.00	5.00	4.00	3.00	½	37.0

All dimensions in inches.

STOP BAR KIT (SB) NEW

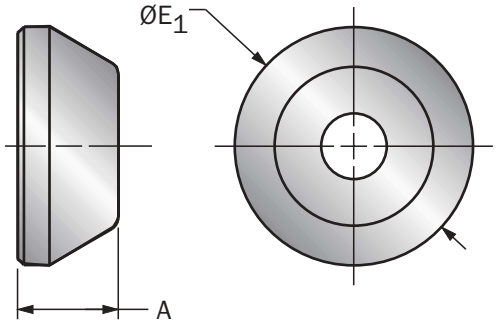


Kit Part Number	Model (Ref)	A	B	C	D	E	F	T	Bolt Size	Wt. (oz.)
T58706300	OEM ¾	.63	1.03	2.25	1.63	.31	.32	5/16 - 24 UNF X ¾ DEEP	5/16	6.1
T58650300	OEM 1⅛	.63	1.42	3.50	2.75	.38	.32	⅜ - 24 UNF X ¾ DEEP	⅜	10.5

Note: Kit includes 2 Stop Bars, Rectangular Flange, and Lock Ring.

All dimensions in inches.

URETHANE STRIKER CAP (UC)



Catalog No.	Part Number	Model (Ref)	A	E_1	Wt. (oz.)
UC 8609	C98609079	(LR)OEM 1.15/1.25	.39	1.20	0.2
UC 2940	C92940079	(LR)OEM ¾	.97	1.75	0.5
UC 3010	C93010079	(LR)OEM 1⅛	.95	2.25	0.8
UC 2940	C92940079	(LR)OEM 1.5M	.97	1.75	0.5
UC 3010	C93010079	(LR)OEM 2.0M	.95	2.25	0.8
UC 3330	C93330079	OEM 3.0M	1.22	3.00	3.0
UC 3720	C93720079	OEM 4.0M	1.47	3.75	6.0

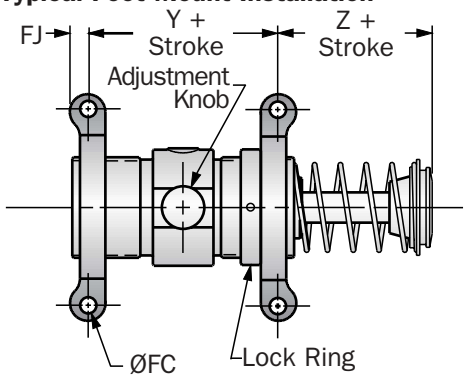
Note: For complete shock absorber dimension with urethane striker cap, refer to engineering data, pages 19-21.

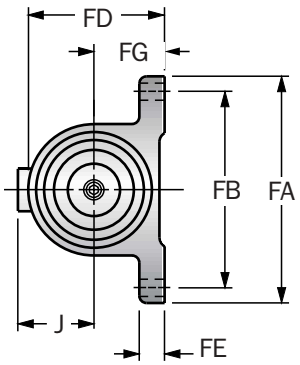
All dimensions in inches.

Accessories

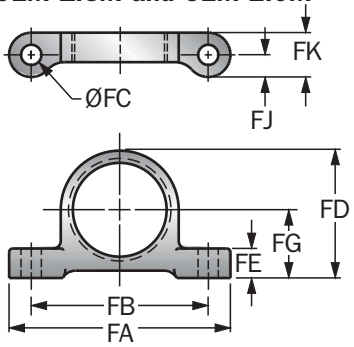
FOOT MOUNT (FM)

Typical Foot Mount Installation

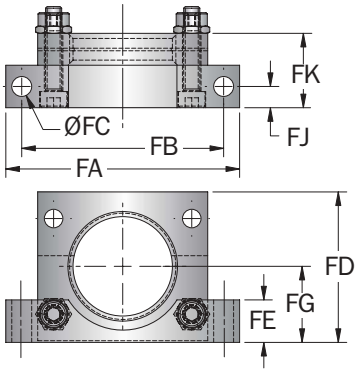




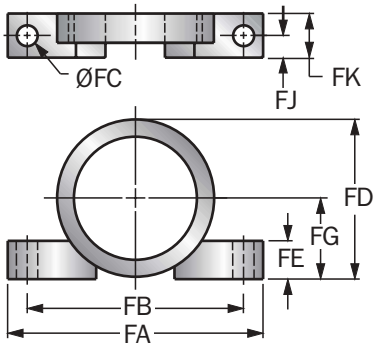
OEM 3/4, OEM 1 1/8, OEM 1.5M and OEM 2.0M



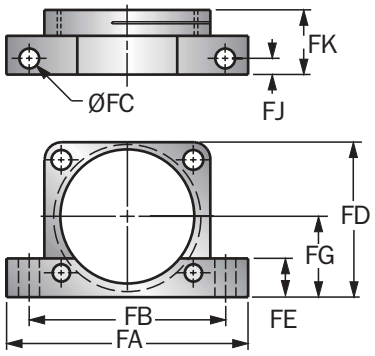
OEM 1.15 → OEM 1.25



OEM 3.0M



OEM 4.0M

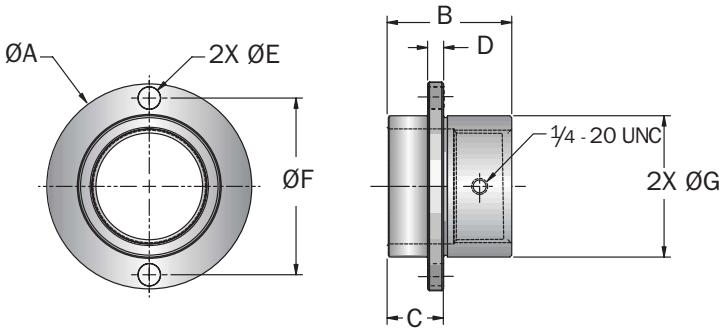


Catalog No.	Part Number	Model (Ref)	J	Y	Z	FA	FB	FC	FD	FE	FG	FJ	FK	Bolt Size	Weight	Notes
FM 1¼-12	2F21049305	(LR)OEM 1.15	N/A	2.23	1.25	2.75	2.38	.23	1.75	0.50	0.90	0.25	0.88	#10	4.0 oz.	N/A
FM 1⅜-12	2F21293305	(LR)OEM 1.25	N/A	2.23	1.25	2.75	2.38	.23	1.75	0.50	0.90	0.25	0.88	#10	4.0 oz.	N/A
FM 1¾-12	2FE2940	(LR)OEM ¾	N/A	2.38	1.06	3.75	3.00	.34	2.16	0.50	1.16	0.38	0.75	5/16	12.0 oz.	N/A
FM 2½-12	2FE3010	(LR)OEM 1⅛	N/A	3.00	1.56	5.63	4.88	.41	3.38	0.63	1.75	0.44	0.88	⅜	2.3 lbs.	1
FM M42 x 1.5	2F2940	(LR)OEM 1.5M	1.44	2.38	1.06	3.75	3.00	.34	2.16	0.50	1.16	0.38	0.75	5/16	12.0 oz.	N/A
FM M64 x 2	2F3010	(LR)OEM 2.0M	1.89	3.00	1.56	5.63	4.88	.41	3.38	0.63	1.75	0.44	0.88	⅜	2.3 lbs.	2
FM M85 x 2	2F3330	OEM 3.0M	2.25	3.19	2.32	6.50	5.50	.53	4.06	1.00	2.06	0.57	1.13	½	6.9 lbs.	3
FM M115 x 2	2F3720	OEM 4.0M	2.89	7.50	1.44	8.00	6.50	.65	5.88	1.50	3.13	0.63	2.50	⅝	8.6 lbs.	4,7

Notes: 1. OEM 1⅛ x 6, Z dimension is 2.69 in.
2. OEM 2.0M x 6, Z dimension is 2.69 in.
3. OEM 3.0M x 6.5, Z dimension is 3.06 in.
4. OEM 4.0M x 8 and 4.0M x 10, Z dimension is 2.44 in.
5. Shock absorber must be ordered separately from the foot mount kit.
6. All foot mount kits include two foot mounts. A lock ring is also supplied with all kits except the OEM 1.25 foot mount kit.
7. For rear foot mount, dimension on OEM 4.0M, dimension FJ is .63.

All dimensions in inches.

STOP COLLAR WITH FLANGE (SCF)



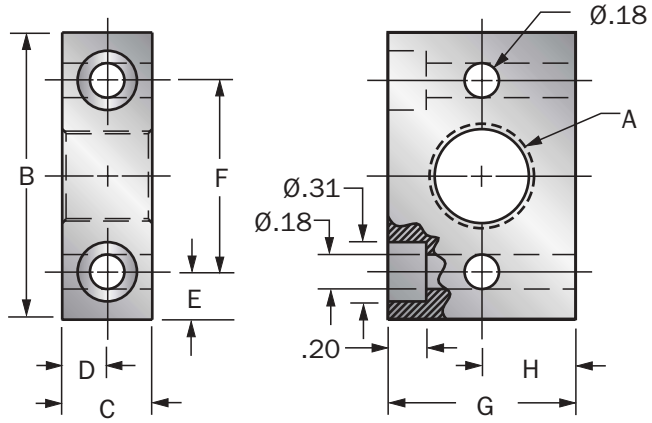
Catalog No.	Part Number	Model (Ref)	A	B	C ±.002	D	E	F	G	Bolt Size	Weight (oz.)
SCF 1¾-12	M98640300	OEM ¾	3.25	1.94	.88	.25	.34	2.75	2.20	5/16	20.5
SCF 2½-12	M98650300	OEM 1⅛	4.25	2.47	1.00	.38	.34	3.50	2.95	5/16	39.8

Note: Locking set screw feature provided as standard.

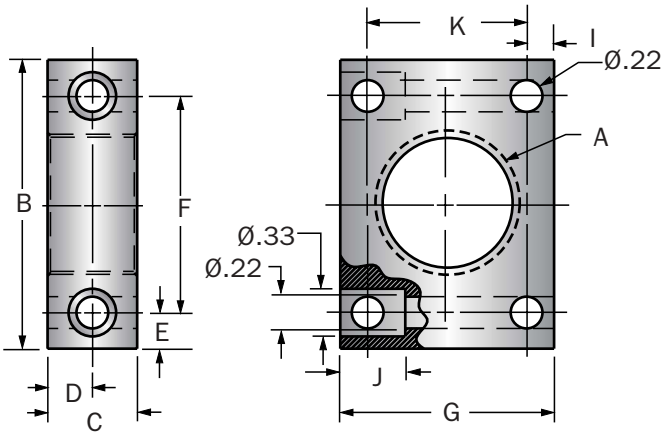
All dimensions in inches.

UNIVERSAL RETAINING FLANGE (SMALL BORE) (UF)

UF M10 x 1 → UF 1/2 - 20



UF 9/16 - 18 → UF 1-12



Catalog No.	Part Number	Model (Ref)	A	B	C	D	E	F	G	H	I	J	K
UF M10 x 1	U16363189	OEM 0.1M(B)	M10 x 1	1.50	.47	.24	.25	1.00	0.98	0.49	N/A	.20	N/A
UF M12 x 1	U15588189	OEM .15M(B)	M12 x 1	1.50	.47	.24	.25	1.00	0.98	0.49	N/A	.20	N/A
UF 1/2-20	U13935095	(LR)OEM .25(B)	1/2-20 UNF	1.50	.56	.28	.25	1.00	1.00	0.50	N/A	.20	N/A
UF 9/16-18	U19018095	(LR)OEM .35(B)	9/16-18 UNF	1.81	.62	.31	.22	1.38	1.38	N/A	.19	.32	1.00
UF 3/4-16	U120275095	(LR)OEM .5(B)	3/4-16 UNF	2.00	.62	.31	.25	1.50	1.50	N/A	.19	.45	1.12
UF 1-12	U19599095	(LR)OEM 1.0(B)	1-12 UNF	2.00	.62	.31	.25	1.50	1.50	N/A	.19	.45	1.12
UF 1-12	U19599095	HP 110	1-12 UNF	2.00	.62	.31	.25	1.50	1.50	N/A	.19	.45	1.12

All dimensions in inches.

Ordering Information

SHOCK ABSORBERS

10 - **OEM 1.0** **B**

10 — Select quantity

OEM 1.0 — Select catalog number:
- OEM, HP (Adjustable)
- LROEM (Low range adjustable)
- CBOEM (Non-adjustable)
- AOEM/LRAOEM (Adjustable and low range adjustable air/oil return)
- CBAOEM (Non-adjustable air/oil return)

B — Select piston rod type:
- "___" (No button)
- "B" (Button model, OEM 0.1M, .25, .35, .5 and 1.0 only)
- "CM" (Clevis mount)

Application Data — Required for CBOEM and CBAOEM models only:
- Vertical or Horizontal motion
- Weight
- Impact velocity
- Propelling force (if any)
- Other (temperature or other environmental conditions)
- Cycles per hour

ACCESSORIES

Example 1

10 **LR 1 3/4-12** Lock Ring
(P/N F8E2940049)

10 — Select quantity

LR 1 3/4-12 (P/N F8E2940049) — Select catalog/part number

Example 2

5 **UC 2940** Urethane Striker Cap
(P/N C92940079)

5 — Select quantity

UC 2940 (P/N C92940079) — Select catalog/part number

Enidine non-adjustable hydraulic shock absorbers can accommodate varying energy conditions. This family of tamperproof shock absorbers provides consistent performance, cycle after cycle. Non-adjustable models are designed to absorb maximum energy within a compact envelope size.

Features and Benefits

- *Extensive non-adjustable product line offers flexibility in both size and energy absorption capacity to fulfill a wide range of application requirements.*
- *Tamperproof design ensures repeatable performance.*
- *Special materials and finishes can be designed to meet specific customer requirements.*
- *Incorporating optional fluids and seal packages can expand the standard operating temperature range from (15 to 180°F) to (–30 to 210°F).*
- *Threaded cylinders provide mounting flexibility and increase surface area for improved heat dissipation.*
- *A select variety of surface finishes maintains original quality appearance and provides the longest corrosion resistance protection.*
- *ISO quality standards result in reliable, long-life operation.*

PLATINUM

*The Platinum **PRO Series** has unique progressive damping and a multi-orifice design that provides softer stops for medium-to-high impact velocities and fragile loads. **The Platinum PRO Series also includes the added benefit of corrosion-resistant, nickel-plated components and positive stop capabilities.***

Models can accommodate a wide range of operating conditions.

Pages 39-40

*The **PM Series** uses a self-compensating design to provide energy absorption in low velocity and high drive force applications. **The Platinum PM Series also includes the added benefit of corrosion-resistant, nickel-plated components and positive stop capabilities.***

Models can accommodate a wide range of operating conditions with varying masses or propelling forces.

Pages 35-38

*The Enidine **STH Series** offers the highest energy absorption capacity relative to its size.*

These custom-orificed shock absorbers are designed to meet exact application requirements.

STH Series shock absorbers are available in fully threaded cylinder bodies, providing flexibility in mounting configurations.

Page 34

*The **TK Series** is a versatile, miniature design which provides effective, reliable deceleration and vibration control for light loads.*

Models can accommodate a wide range of operating conditions.

Page 34

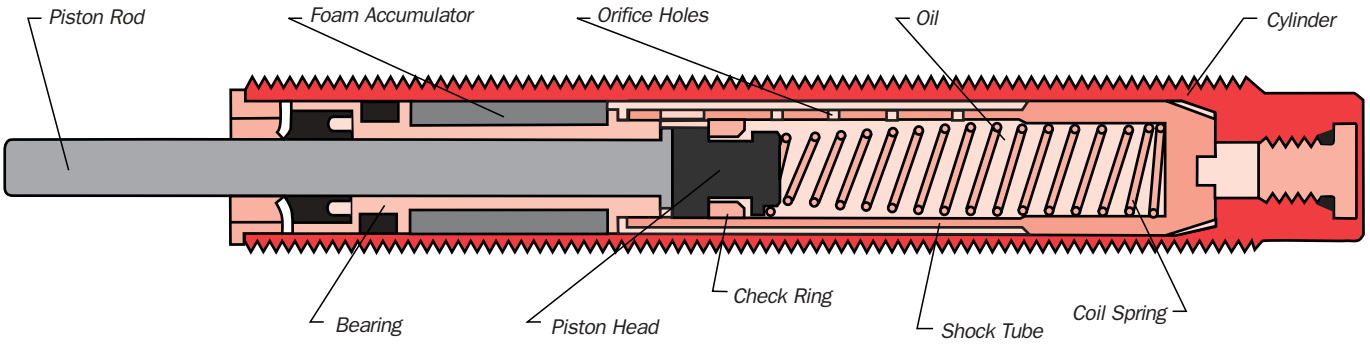
Use this Enidine Product Selection Guide to quickly locate potential non-adjustable shock absorber models most suited for your requirements. Models are organized in order of smallest to largest energy capacity per cycle.

ENIDINE NON-ADJUSTABLE SHOCK ABSORBERS

	Catalog No. (Model)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	Damping Type	Page No.
PLATINUM	TK 21	0.25	20	36,000	D	34
PLATINUM	PMX 8	0.25	25	50,000	SC	35
	TK 10M	0.25	50	115,000	D	34
	PMX 10	0.28	50	110,000	SC	35
PLATINUM	PM 15	0.41	90	250,000	SC	35
PLATINUM	PRO 15	0.41	90	250,000	P	39
	STH .25M	0.25	100	39,000	D	34
PLATINUM	SPM 25	0.50	180	260,000	SC	35
PLATINUM	PM 25	0.63	235	300,000	SC	35
PLATINUM	PRO 25	0.63	235	300,000	P	39
PLATINUM	SPM 50	0.50	250	400,000	SC	35
PLATINUM	PM 50	0.88	485	475,000	SC	35
PLATINUM	PRO 50	0.88	485	475,000	P	39
	STH .5M	0.50	585	390,000	D	34
PLATINUM	PM 100	1.00	800	622,000	SC	35
PLATINUM	PRO 100	1.00	800	622,000	P	39
	PRO 110	1.56	1,700	670,000	P	39
PLATINUM	PM 120	1.00	1,400	670,000	SC	35
PLATINUM	PM 125	1.00	1,400	774,000	SC	35
PLATINUM	PRO 120	1.00	1,400	670,000	P	39
PLATINUM	PRO 125	1.00	1,400	774,000	P	39
	PM 1525	1.00	2,000	1,120,000	SC	37
	STH .75M	0.75	2,150	780,000	D	34
PLATINUM	PM 220	2.00	2,750	800,000	SC	35
PLATINUM	PM 225	2.00	2,750	900,000	SC	35
PLATINUM	PRO 220	2.00	2,750	800,000	P	39
PLATINUM	PRO 225	2.00	2,750	900,000	P	39
	PM 1550	2.00	4,000	1,475,000	SC	37
	STH 1.0M	1.00	4,400	1,300,000	D	34
	PM 1575	3.00	6,000	1,775,000	SC	37
	STH 1.0M x 2	2.00	8,800	2,100,000	D	34
	PM 2050	2.00	10,000	2,400,000	SC	37
	STH 1.5M x 1	1.00	10,200	2,200,000	D	34
	PM 2100	4.00	20,000	3,200,000	SC	37
	STH 1.5M x 2	2.00	20,400	3,200,000	D	34
	PM 2150	6.00	30,000	3,730,000	SC	37

Key for Damping Type:
D – Dashpot
C – Conventional
P – Progressive
SC – Self-compensating

Enidine Non-Adjustable Multiple Orifice Shock Absorber



Non-Adjustable Multiple Orifice Shock Absorber

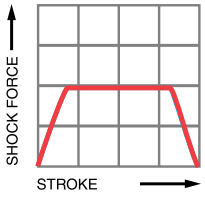
The design of a multi-orifice shock absorber features a double cylinder arrangement with space between the concentric shock tube and cylinder, and a series of orifice holes drilled down the length of the shock tube wall.

During piston movement, the check ring is seated and oil is forced through the orifices in the shock tube wall, into the closed cellular foam accumulator and behind the piston head. The orifice area decreases as the piston head moves and closes the orifice holes. During repositioning, the coil spring pushes the piston rod outward. This unseats the check ring and permits the oil to flow from the accumulator and across the piston head, back into the shock tube.

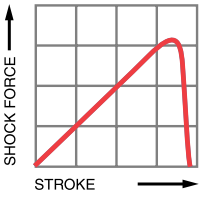
Multiple orifice shock absorbers can provide conventional, progressive, self-compensating or constant orifice area (dashpot) damping.

Damping Types

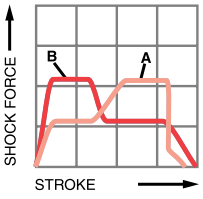
Conventional damping allows linear deceleration by providing a constant shock force over the entire stroke. This standard design is the most efficient, meaning it allows the most energy to be absorbed in a given stroke, while providing the lowest shock force. This type of damping is also available in adjustable shock absorbers.



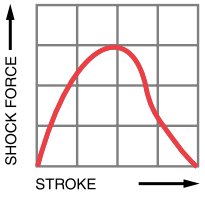
Progressive damping provides deceleration with a gradually increasing shock force. The initial minimal resistance at impact protects delicate loads and machinery from damage. Progressive damping shock absorbers also have built-in self-compensation, so they can operate over a wide range of weights and velocities. This type of damping provides smooth deceleration in applications where energy conditions may change.



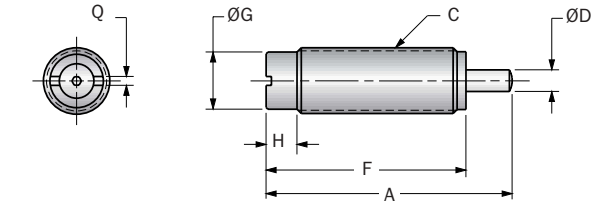
Self-compensating damping maintains acceptable deceleration with conventional type damping characteristics. Self-compensating shock absorbers operate over a wide range of weights and velocities. These shock absorbers are well suited for high drive force, low velocity applications, and where energy conditions may change. Curve A shows the *shock force vs. stroke* curve of a self-compensating shock absorber impacted with a low velocity and high drive force. Curve B shows the *shock force vs. stroke* curve of a self-compensating shock absorber impacted with a high velocity and low drive force.



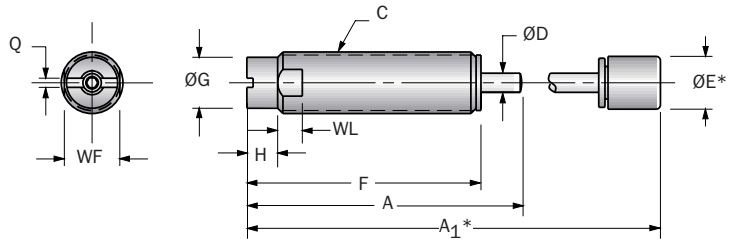
Constant orifice area damping **(Dashpot)** provides the largest shock force at the beginning of the stroke when impact velocity is highest. These shock absorbers provide high-energy absorption in a small, economical design. This type of damping is also available in adjustable shock absorbers.



TK 21



TK 10M



*Note: A_1 and E apply to button models and urethane striker cap accessory.

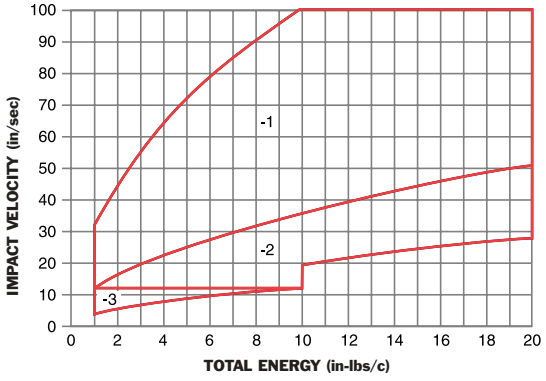
Catalog No. (Model)	Catalog No. Damping Constant	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force Extended (lbs.)	Nominal Coil Spring Force Compressed (lbs.)	(F_D) Max. Propelling Force (lbs.)	Model Weight (oz.)
TK 21	-1, -2, -3	.28	.25	20	36,000	160	.65	1.13	20	.4
TK 10M (B)	-1 to -9	.28	.25	50	115,000	315	0.3	2.2	N/A	.5

Catalog No. (Model)	A	A_1	C	D	ØE	F	G	H	Q	WF	WL	Stroke (S) (in.)	Stroke Constant
TK 21	1.39	N/A	3/8-32 UNEF	.12	N/A	1.13	.32	.17	.05	N/A	N/A	0.25	-1, -2, -3
TK 10M (B)	1.75	2.14	M10 x 1.0	.12	.35	1.50	.33	.20	.06	.35	.16	0.25	-1 to -9

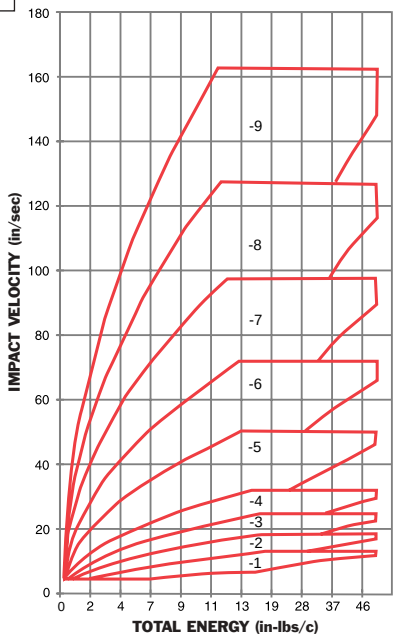
Note: 1. A positive stop is required to prevent the bottoming of the TK 21 shock absorber.

All dimensions in inches.

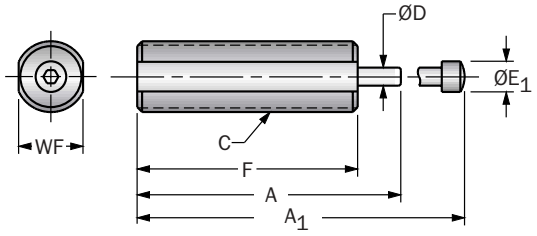
TK 21



TK 10M



STH .25M → STH 1.5M x 2



Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force Extended (lbs.)	Nominal Coil Spring Force Compressed (lbs.)	Model Weight	A	A_1	C	D	E	F	WF
STH .25M	0.44	0.25	100	39,000	615	2.5	4.0	2.8 oz.	N/A	2.81	M14 X 1.0	.19	.50	2.00	.50
STH .5M	0.57	0.50	585	390,000	1,800	4.0	7.0	7.7 oz.	N/A	3.50	M22 X 1.5	.22	.38	2.70	.88
STH .75M	0.77	0.75	2,180	780,000	4,400	8.0	20.0	1.1 lbs.	N/A	5.13	M30 X 2.0	.31	.56	4.06	1.13
STH 1.0M	1.00	1.00	4,400	1,300,000	6,700	22.0	53.0	1.6 lbs.	N/A	6.70	M36 X 1.5	.38	.69	5.38	1.25
STH 1.0M x 2	1.00	2.00	8,800	2,100,000	6,700	15.0	30.0	1.9 lbs.	N/A	9.38	M36 X 1.5	.38	.69	7.02	1.25
STH 1.5M x 1	1.38	1.00	10,200	2,200,000	14,600	20.0	51.0	3.1 lbs.	7.09	N/A	M45 X 1.5	.63	N/A	6.06	1.63
STH 1.5M x 2	1.38	2.00	20,400	3,200,000	14,600	12.5	51.0	4.0 lbs.	10.63	N/A	M45 X 1.5	.63	N/A	8.62	1.63

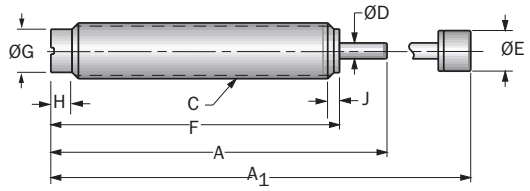
Notes: 1. Custom orificed application data needed.
2. All shock absorbers will function at 5% of their rated energy per cycle. If less than 5%, a smaller model should be specified.
3. Enidine recommends a positive stop to prevent bottoming of the shock absorber.

All dimensions in inches.

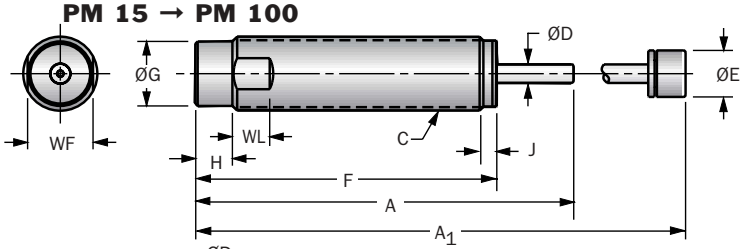
PM Series

The Platinum PM Series uses a self-compensating design to provide energy absorption in low velocity and high drive force applications. Models can accommodate a wide range of operating conditions with varying masses or propelling forces.

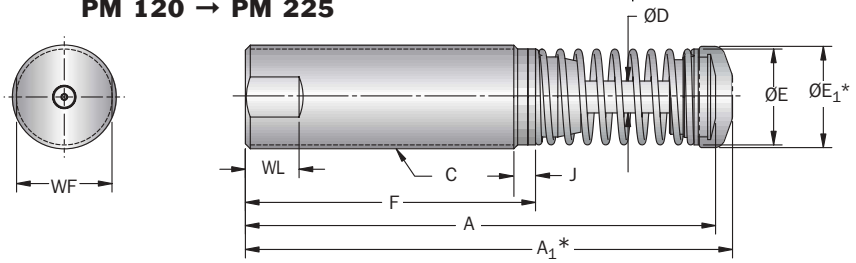
PMX 8 → PMX 10



PM 15 → PM 100



PM 120 → PM 225



*Note: A_1 and E_1 apply to button models and urethane striker cap accessory.

Catalog No. (Model)	Damping Constant	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force		(F_D) Max. Propelling Force (lbs.)	Model Weight (oz.)
							Extended (lbs.)	Compressed (lbs.)		
PMX 8 IF (B)	-1,-2,-3	0.18	0.25	25	50,000	200	0.6	1.2	45	.5
PMX 10 IF (B)	-1,-2,-3	0.24	0.28	50	110,000	360	0.5	1.0	80	1.0
PM 15 IF (B)	-1,-2,-3	0.25	0.41	90	250,000	450	0.7	1.6	50	2.0
PM 15 IC (B)	-1,-2,-3	0.25	0.41	90	250,000	450	0.7	1.6	50	2.0
SPM 25 IF (B)	-1,-2,-3	0.28	0.50	180	300,000	625	1.0	2.5	200	2.4
SPM 25 IC (B)	-1,-2,-3	0.28	0.50	180	300,000	625	1.0	2.5	200	2.4
PM 25 IF (B)	-1,-2,-3	0.28	0.63	235	350,000	625	1.0	2.5	200	2.4
PM 25 IC (B)	-1,-2,-3	0.28	0.63	235	350,000	625	1.0	2.5	200	2.4
SPM 50 IF (B)	-1,-2,-3	0.44	0.50	250	400,000	850	1.5	3.5	360	4.0
PM 50 IF (B)	-1,-2,-3	0.44	0.88	485	475,000	850	2.0	6.8	360	4.8
PM 100 IF (B)	-1,-2,-3	0.50	1.00	800	622,000	1,250	3.0	6.0	500	10.5
PM 120 IF	-1,-2,-3	0.63	1.00	1,400	670,000	2,500	12.5	20.0	700	17.0
PM 125 IF	-1,-2,-3	0.63	1.00	1,400	774,000	2,500	12.5	20.0	700	21.0
PM 220 IF	-1,-2,-3	0.63	2.00	2,750	800,000	2,500	7.0	20.0	700	23.0
PM 225 IF	-1,-2,-3	0.63	2.00	2,750	900,000	2,500	7.0	20.0	700	27.0

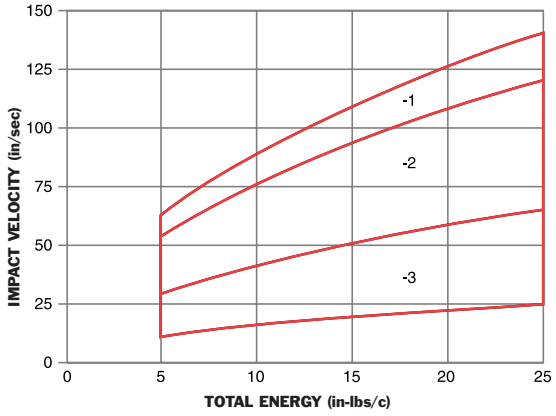
All dimensions in inches.

Catalog No. (Model)	A	A_1	C	D	E	E_1	F	G	H	J	WF	WL
PMX 8 IF (B)	1.86	2.25	(IF) 3/8-32 UNEF	.10	0.27	N/A	1.61	.26	.18	.10	N/A	N/A
PMX 10 IF (B)	2.12	2.51	(IF) 7/16-28 UNEF	.12	0.34	N/A	1.83	.34	.18	.13	N/A	N/A
PM 15 IF (B)	2.45	2.85	(IF) 7/16-28 UNEF	.12	N/A	.40	2.10	.39	.27	.10	.39	.38
PM 15 IC (B)	2.45	2.85	(IC) 1/2-20 UNEF	.12	N/A	.40	2.10	.39	.27	.10	.39	.38
SPM 25 IF (B)	3.25	3.63	(IF) 1/2-20 UNF	.16	0.44	N/A	2.74	.43	.20	.04	.44	.50
SPM 25 IC (B)	3.25	3.63	(IC) 9/16-18 UNF	.16	0.44	N/A	2.74	.43	.20	.04	.50	.50
PM 25 IF (B)	3.84	4.22	(IF) 1/2-20 UNF	.16	N/A	.44	3.20	.43	.30	.04	.44	.50
PM 25 IC (B)	3.84	4.22	(IC) 9/16-18 UNF	.16	N/A	.44	3.20	.43	.30	.04	.50	.50
SPM 50 (B)	3.46	3.93	(IF) 3/4-16 UNF	.19	0.50	N/A	2.93	.64	.30	.04	.68	.50
PM 50 IF (B)	4.66	5.13	(IF) 3/4-16 UNF	.19	0.50	N/A	3.76	.64	.30	.04	.68	.50
PM 100 IF (B)	5.07	5.57	(IF) 1-12 UNF	.25	0.62	N/A	4.04	.87	.50	.18	.88	.50
PM 120 IF	5.52	5.72	(IF) 1 1/4-12 UNF	.38	1.13	1.20	3.41	N/A	N/A	.21	1.12	.63
PM 125 IF	5.52	5.72	(IF) 1 3/8-12 UNF	.38	1.13	1.20	3.41	N/A	N/A	.21	1.25	.63
PM 220 IF	8.14	8.34	(IF) 1 1/4-12 UNF	.38	1.13	1.20	5.03	N/A	N/A	.21	1.12	.63
PM 225 IF	8.14	8.34	(IF) 1 3/8-12 UNF	.38	1.13	1.20	5.03	N/A	N/A	.21	1.25	.63

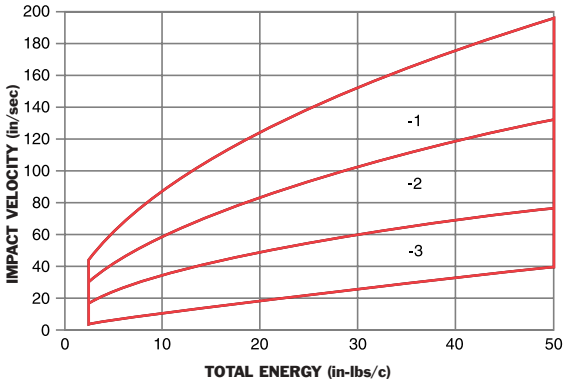
All dimensions in inches.

Notes: 1. (B) indicates button model of shock absorber. Buttons cannot be added to non-button models or removed from button models.
2. Urethane striker caps are available as accessories for models PM 120 to PM 225.

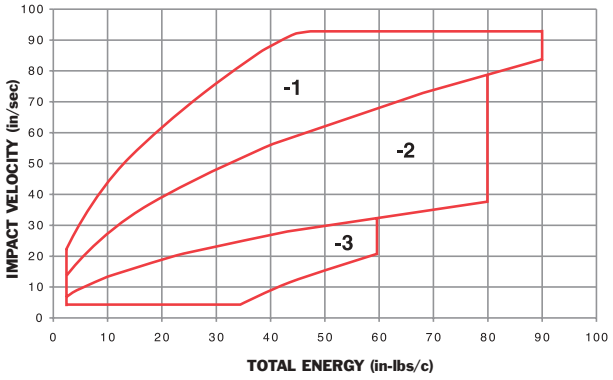
PMX 8



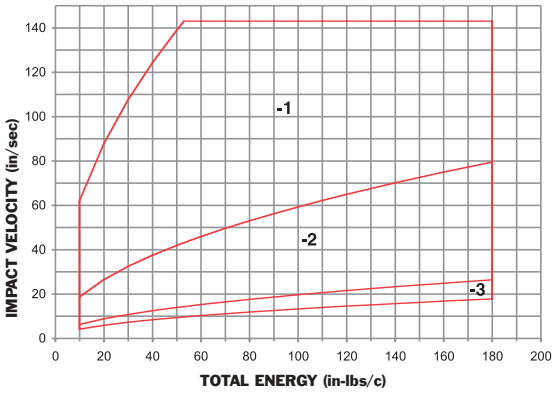
PMX 10



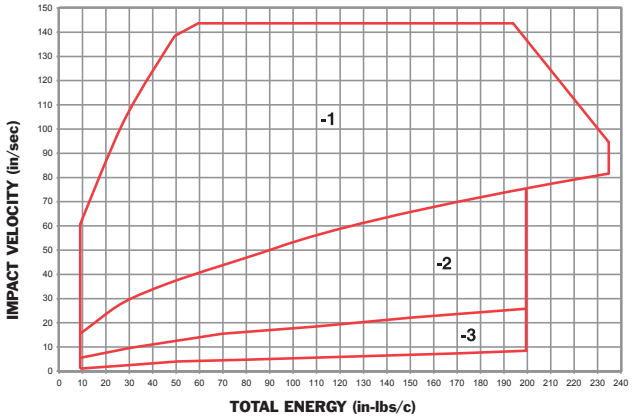
PM 15



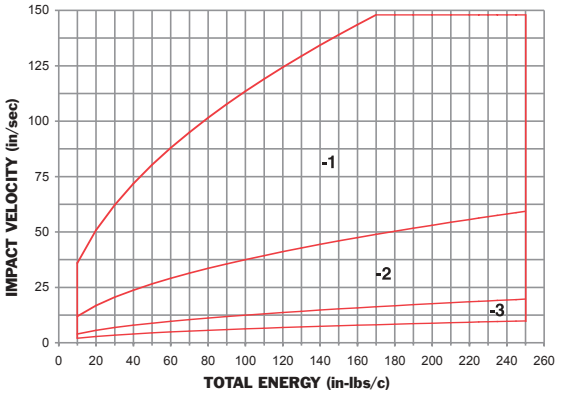
SPM 25



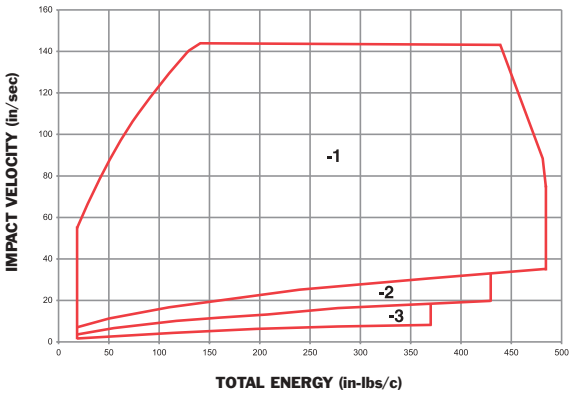
PM 25



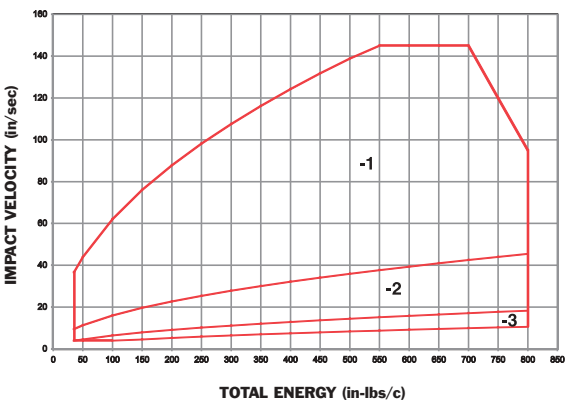
SPM 50



PM 50



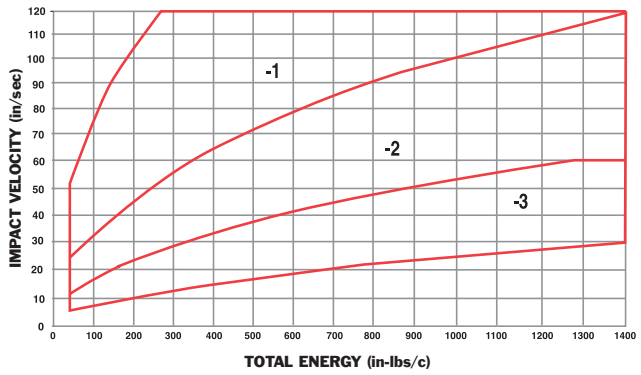
PM 100



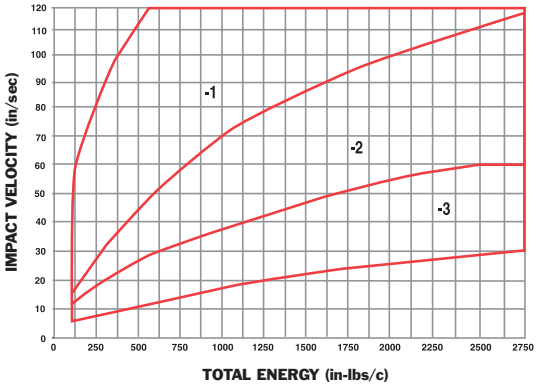
NON-ADJUSTABLES

PM Series Sizing Graphs

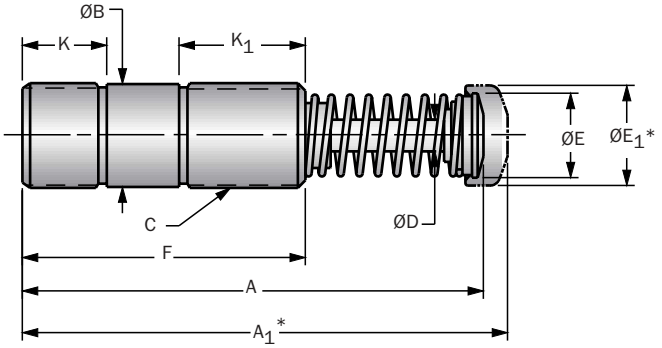
PM 120/125



PM 220/225



PM 1525 → PM 2150



*Note: A_1 and E_1 apply to urethane striker cap accessory.

Catalog No. (Model)	Damping Constant	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force		(F_D) Max. Propelling Force (lbs.)	Model Weight (lbs.)
							Extended (lbs.)	Compressed (lbs.)		
PM 1525	-1,-2,-3	0.75	1.00	2,000	1,120,000	4,000	11.0	15.0	1,500	2.1
PM 1550	-1,-2,-3	0.75	2.00	4,000	1,475,000	4,000	11.0	18.0	1,500	2.3
PM 1575	-1,-2,-3	0.75	3.00	6,000	1,775,000	4,000	7.0	18.0	1,500	2.7
PM 2050	-1,-2,-3	1.13	2.00	10,000	2,400,000	10,000	17.0	35.0	4,000	6.4
PM 2100	-1,-2,-3	1.13	4.00	20,000	3,200,000	10,000	15.5	36.0	4,000	7.5
PM 2150	-1,-2,-3	1.13	6.00	30,000	3,730,000	10,000	20.0	64.0	4,000	9.4

All dimensions in inches.

Catalog No. (Model)	A	A_1	B	C	D	E	E_1	F	K	K_1
PM 1525 IF	5.68	6.37	1.73	(IF) 1¾-12 UN	.50	1.48	1.75	3.63	1.37	1.49
PM 1550 IF	7.68	8.37	1.73	(IF) 1¾-12 UN	.50	1.48	1.75	4.63	1.37	2.37
PM 1575 IF	9.68	10.37	1.73	(IF) 1¾-12 UN	.50	1.48	1.75	5.63	1.37	2.87
PM 2050 IF	8.90	9.55	2.48	(IF) 2½-12 UN	.75	1.98	2.25	5.50	1.50	2.75
PM 2100 IF	12.90	13.55	2.48	(IF) 2½-12 UN	.75	1.98	2.25	7.50	1.50	3.75
PM 2150 IF	17.97	18.62	2.48	(IF) 2½-12 UN	.75	2.38	2.38	9.50	1.50	4.75

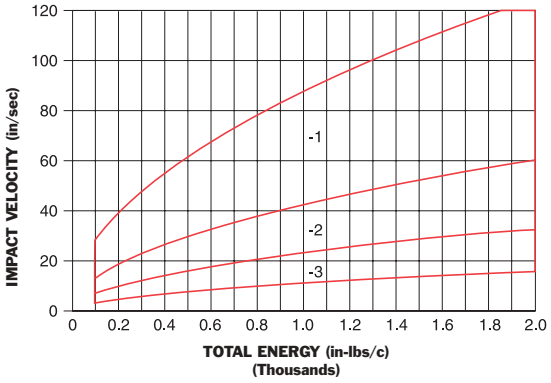
Notes: 1. (B) indicates button model of shock absorber. Buttons cannot be added to non-button models or removed from button models.
2. Urethane striker caps are available as accessories for models PM 1525 to PM 2150.

All dimensions in inches.

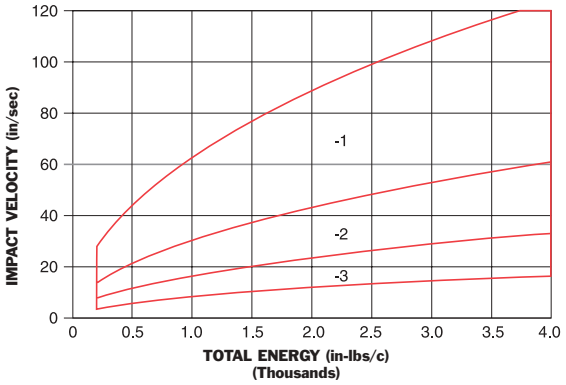
Note: Minimum impact velocity for PM models is 4 in./sec.

PM Series Sizing Graphs

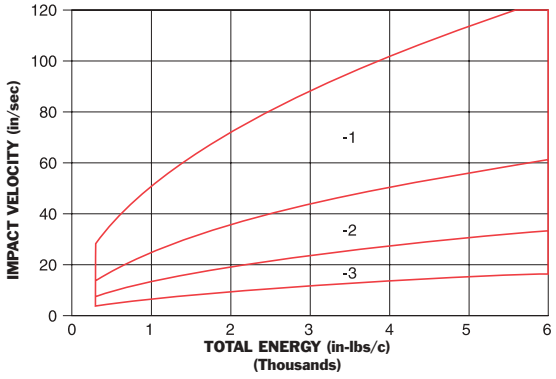
PM 1525



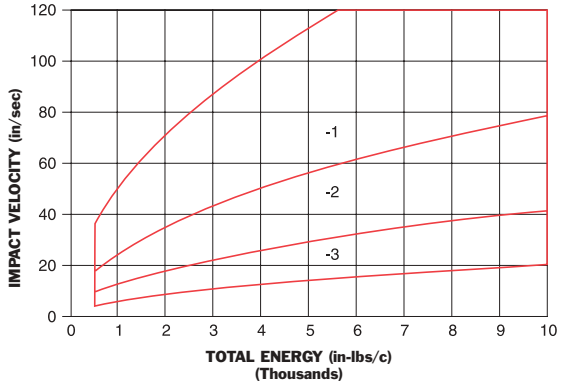
PM 1550



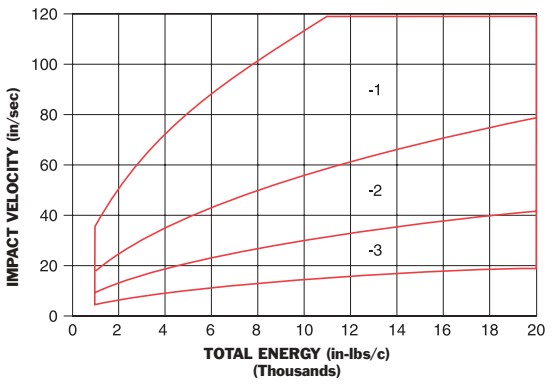
PM 1575



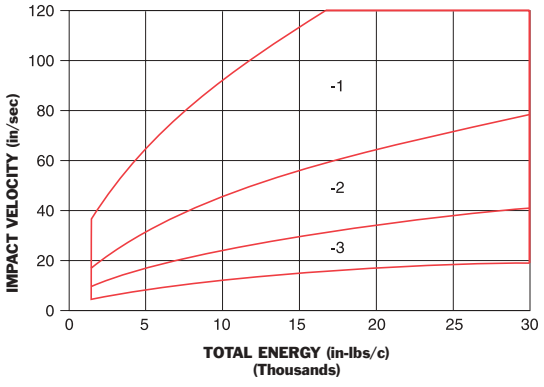
PM 2050



PM 2100



PM 2150

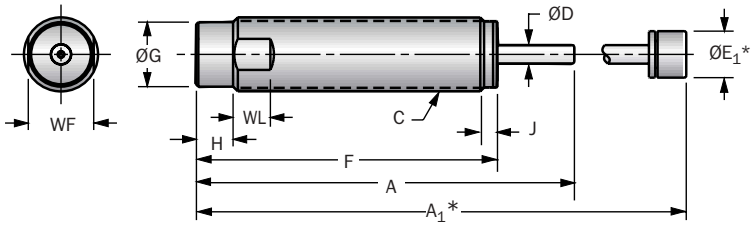


Note: Minimum impact velocity for PM models is 4 in./sec.

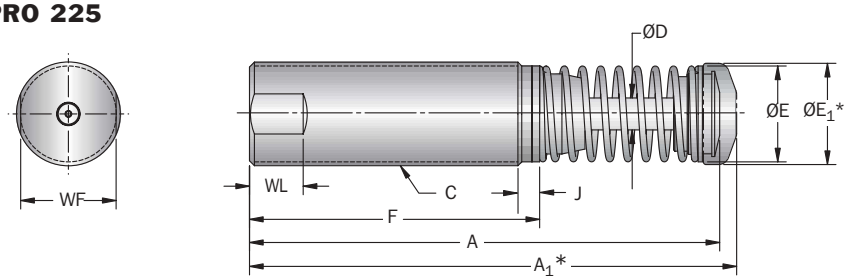
PRO Series

The Platinum PRO Series has unique progressive damping and a multi-orifice design providing softer stops for medium to high impact velocities and fragile loads. Models can accommodate a wide range of operating conditions.

PRO 15 → PRO 100



PRO 110 → PRO 225



*Note: A_1 and E_1 apply to button models and urethane striker cap accessory.

	Catalog No. (Model)	Catalog No. Damping Constant	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Coil Spring Force Extended (lbs.)	Nominal Coil Spring Force Compressed (lbs.)	(F_D) Max. Propelling Force (lbs.)	Model Weight (oz.)
PLATINUM	PRO 15 IF (B)	-1, -2, -3	.25	0.41	90	250,000	450	0.7	1.6	50	2.0
PLATINUM	PRO 15 IC (B)	-1, -2, -3	.25	0.41	90	250,000	450	0.7	1.6	50	2.0
PLATINUM	PRO 25 IF (B)	-1, -2, -3	.28	0.63	235	300,000	625	1.0	2.5	120	2.4
PLATINUM	PRO 25 IC (B)	-1, -2, -3	.28	0.63	235	300,000	625	1.0	2.5	120	2.4
PLATINUM	PRO 50 IF (B)	-1, -2, -3	.44	0.88	485	475,000	850	2.0	6.8	200	4.8
PLATINUM	PRO 100 IF (B)	-1, -2, -3	.50	1.00	800	622,000	1,250	3.0	6.0	350	10.5
	PRO 110 IF (B)	-1, -2, -3	.56	1.56	1,700	670,000	1,700	4.0	11.0	500	16.0
PLATINUM	PRO 120 IF	-1, -2, -3	.63	1.00	1,400	670,000	2,500	12.5	20.0	500	17.0
PLATINUM	PRO 125 IF	-1, -2, -3	.63	1.00	1,400	774,000	2,500	12.5	20.0	500	17.0
PLATINUM	PRO 220 IF	-1, -2, -3	.63	2.00	2,750	800,000	2,500	7.0	20.0	500	26.0
PLATINUM	PRO 225 IF	-1, -2, -3	.63	2.00	2,750	900,000	2,500	7.0	20.0	500	26.0

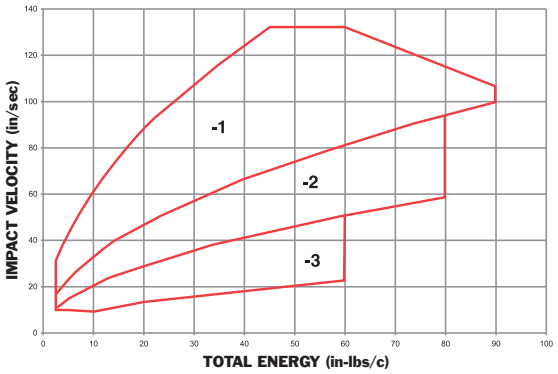
All dimensions in inches.

Catalog No. (Model)	A	A_1	C	D	E	E_1	F	G	H	J	WF	WL
PRO 15 IF (B)	2.45	2.85	(IF) 7/16-28 UNEF	.12	N/A	.40	2.10	.39	.27	.10	.39	.38
PRO 15 IC (B)	2.45	2.85	(IC) 1/2-20 UNEF	.12	N/A	.40	2.10	.39	.27	.10	.39	.38
PRO 25 IF (B)	3.84	4.22	(IF) 1/2-20 UNF	.16	N/A	.44	3.20	.43	.30	.04	.44	.50
PRO 25 IC (B)	3.84	4.22	(IC) 9/16-18 UNF	.16	N/A	.44	3.20	.43	.30	.04	.50	.50
PRO 50 IF (B)	4.66	5.13	(IF) 3/4-16 UNF	.19	N/A	.50	3.76	.64	.30	.04	.68	.50
PRO 100 IF (B)	5.07	5.57	(IF) 1-12 UNF	.25	N/A	.62	4.04	.87	.50	.18	.88	.50
PRO 110 IF (B)	7.93	8.06	(IF) 1-12 UNF	.31	0.88	0.88	5.00	0.84	N/A	.06	N/A	N/A
PRO 120 IF	5.52	5.72	(IF) 1 1/4-12 UNF	.38	1.13	1.20	3.41	N/A	N/A	.21	1.12	.63
PRO 125 IF	5.52	5.72	(IF) 1 3/8-12 UNF	.38	1.13	1.20	3.41	N/A	N/A	.21	1.25	.63
PRO 220 IF	8.14	8.34	(IF) 1 1/4-12 UNF	.38	1.13	1.20	5.03	N/A	N/A	.21	1.12	.63
PRO 225 IF	8.14	8.34	(IF) 1 3/8-12 UNF	.38	1.13	1.20	5.03	N/A	N/A	.21	1.25	.63

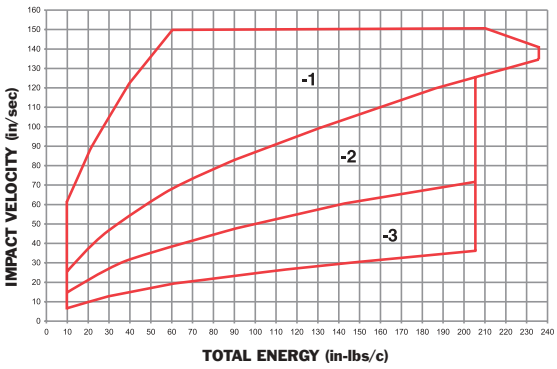
Notes: 1. (B) indicates button model of shock absorber. Buttons cannot be added to non-button models or removed from button models. All dimensions in inches.
2. Urethane striker caps are available as accessories for models PRO 120 to PRO 225.

PRO Series Sizing Graphs

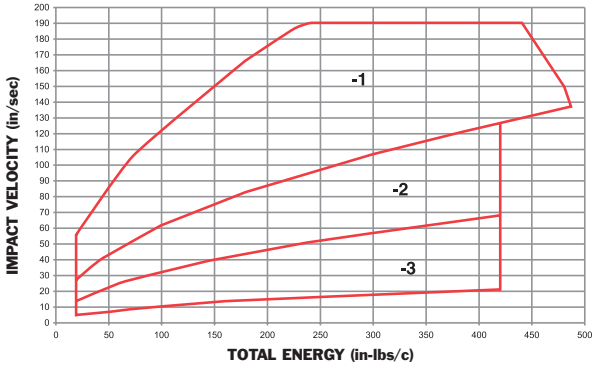
PRO 15



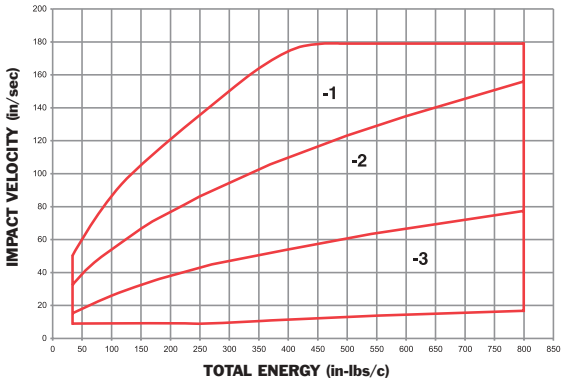
PRO 25



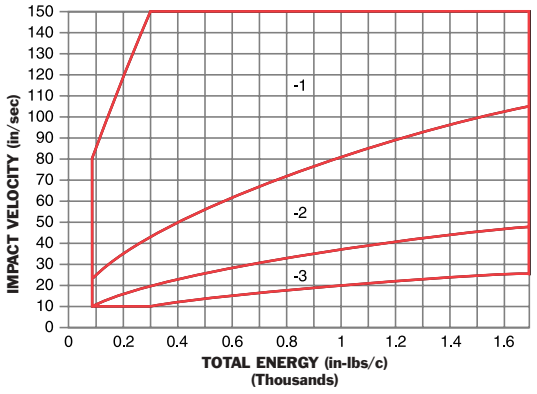
PRO 50



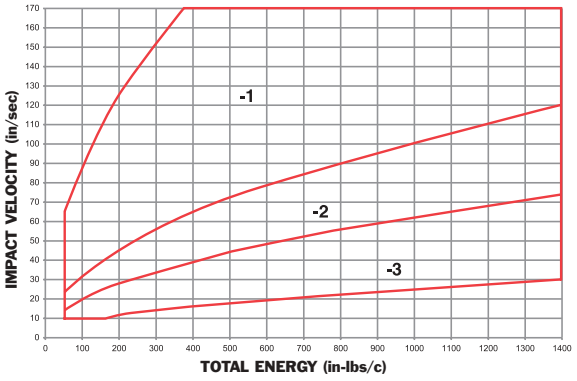
PRO 100



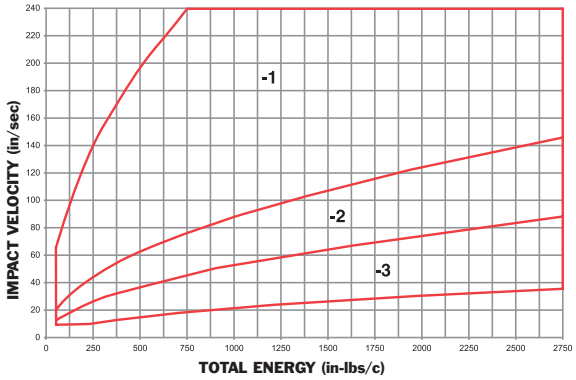
PRO 110

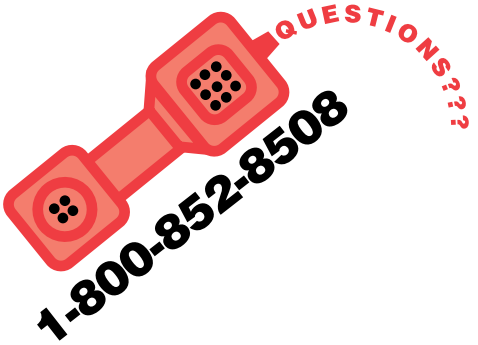


PRO 125



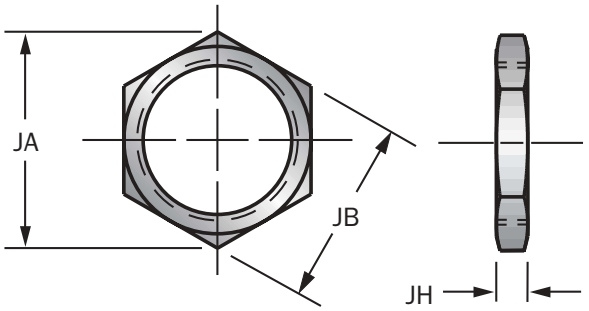
PRO 225





Note: Minimum impact velocity for PRO models is 10 in./sec.

JAM NUT (JN)



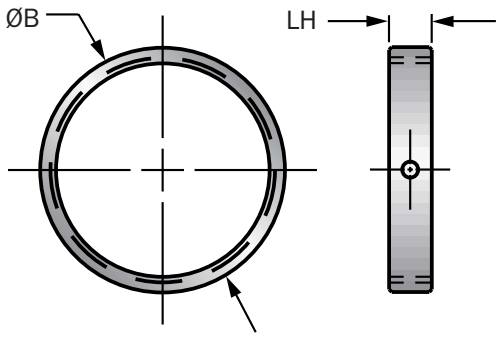
Catalog No.	Part Number	Model (Ref)	JA	JB	JH	Wt. (oz.)
JN 3/8-32	J14421034	PMX 8	0.58	0.50	.09	0.1
JN 7/16-28	J15588034	PMX 10	0.65	0.56	.16	0.1
JN 7/16-28	J15588034	PM/PRO 15	0.65	0.56	.16	0.1
JN 9/16-18	J14950034	SPM/PM/PRO 25 IC	1.01	0.88	.31	0.6
JN 1/2-20	J13935034	SPM/PM/PRO 25 IF	0.72	0.63	.12	0.1
JN 3/4-16	J12646034	SPM/PM/PRO 50	1.08	0.94	.18	0.3
JN 1-12	J11976034	PM/PRO 100	1.30	1.13	.18	0.5
JN 1 1/4-12	J18609034	PM 120/220	1.73	1.50	.25	0.9

All dimensions in inches.

Catalog No.	Part Number	Model (Ref)	JA	JB	JH	Wt. (oz.)
JN 1-12	J11976034	PRO 110	1.30	1.13	.18	0.5
JN 1 3/8-12	J13164034	PRO 125/225	1.88	1.63	.25	0.9
JN 3/8-32	J14421034	TK 21	.58	.50	.09	0.1
JN M14 X 1	J2495035	STH .25M	.77	.67	.16	0.6
JN M22 X 1.5	J26402035	STH .5M	1.24	1.06	.22	0.5
JN M30 X 2	J30583035	STH .75M	1.63	1.42	.27	0.9
JN M36 X 1.5	J23164035	STH 1.0M	1.86	1.61	.25	0.9
JN M36 X 1.5	J23164035	STH 1.0 X 2M	1.86	1.61	.25	0.9
JN M10 x 1	J24421035	TK10	0.59	0.51	.13	0.1

All dimensions in inches.

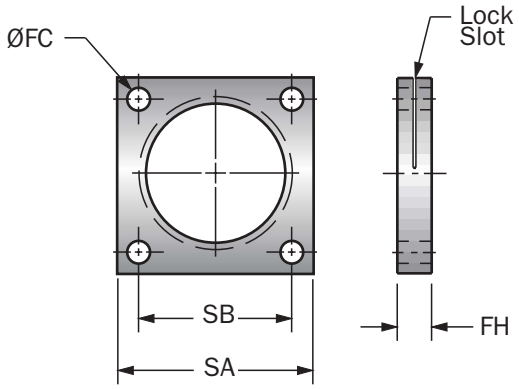
LOCK RING (LR)



Catalog No.	Part Number	Model (Ref)	B	LH	Wt. (oz.)
LR 1 3/4-12	F8E2940049	PM 1500 Series	2.00	.38	2.0
LR 2 1/2-12	F8E3010049	PM 2000 Series	2.88	.38	3.0
LR M45 x 1.5	F88637049	STH 1.5 Series	2.25	.38	2.0

All dimensions in inches.

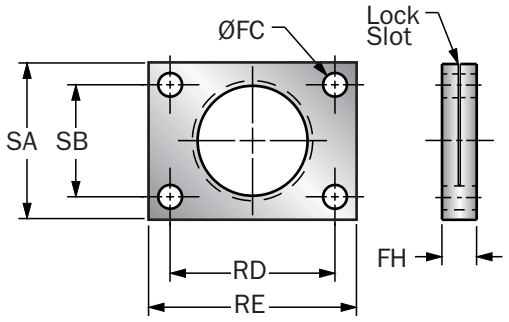
SQUARE FLANGE (SF)



Catalog No.	Part Number	Model (Ref)	FC	FH	SA	SB	Bolt Size	Wt. (oz.)
SF 1¾-12	M4E2940056	PM 1500 Series	.34	.50	2.25	1.63	5⁄16	5
SF 2½-12	M4E3010056	PM 2000 Series	.41	.62	3.50	2.75	⅜	20
SF M45 X 1.5	M48637056	STH 1.5 Series	.34	.50	2.25	1.63	5⁄16	5

All dimensions in inches.

RECTANGULAR FLANGE (RF)

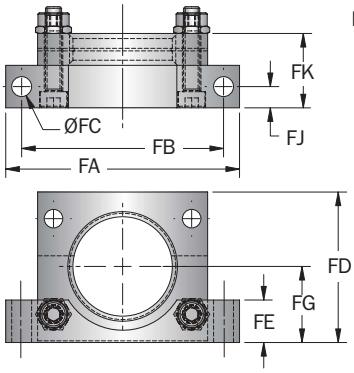


Catalog No.	Part Number	Model (Ref)	FC	FH	RD	RE	SA	SB	Bolt Size	Wt. (oz.)
RF 1¼-12	N121049129	PM 120 / 220	.22	.38	1.63	2.00	1.75	1.13	#10	1
RF 1⅜-12	N121293129	PRO 125 / 225	.22	.38	1.63	2.00	1.75	1.13	#10	1
RF 1¾-12	M5E2940053	PM 1500 Series	.34	.50	2.38	3.00	2.25	1.63	5⁄16	9
RF M45 x 1.5	M58637053	STH 1.5 Series	.34	.50	2.38	3.00	2.25	1.63	5⁄16	9

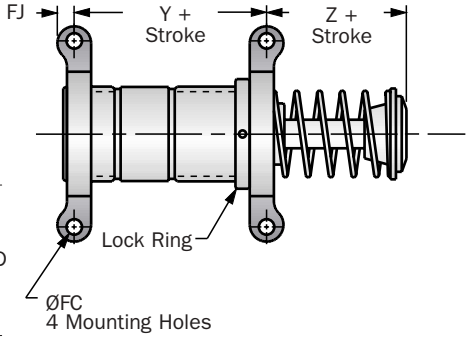
All dimensions in inches.

FOOT MOUNT KIT (FM)

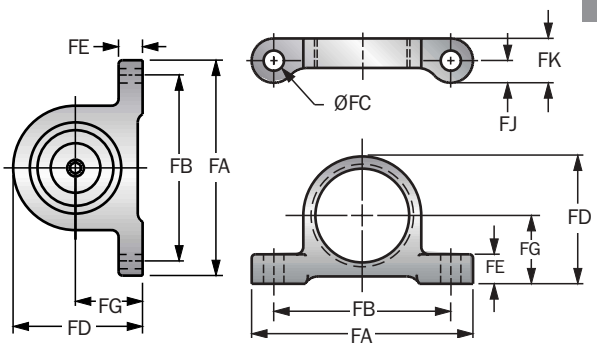
PM 120, PM 220, PRO 125, PRO 225



Typical Foot Mount Installation



PM 1500, PM 2000



Catalog No.	Part Number	Model (Ref)	Y	Z	FA	FB	FC	FD	FE	FG	FJ	FK	Size	Bolt Weight	Kit Notes
FM 1¼-12	2F21049305	PM 120/220	2.25	1.25	2.75	2.38	.23	1.77	.50	.90	.25	.88	#10	4.0 oz	N/A
FM 1⅜-12	2F21293305	PRO 125/225	2.25	1.25	2.75	2.38	.23	1.77	.50	.90	.25	.88	#10	4.0 oz	N/A
FM 1¾-12	2FE2740	PM 1500 Series	2.38	1.06	3.75	3.00	.34	2.16	.50	1.16	.38	N/A	5⁄16	12.0 oz	3
FM 2½-12	2FE3010	PM 2000 Series	3.00	1.56	5.63	4.88	.41	3.38	.63	1.75	.44	N/A	⅜	2.3 lbs	1,3

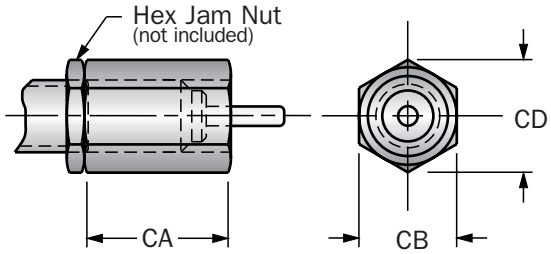
Notes: 1. PM 2150 Z dimension is 2.69 in.
2. Shock absorber must be ordered separately from foot mount kit.
3. All foot mount kits include two foot mounts. A lock ring is also supplied for the PM 1500 and PM 2000 Series.

All dimensions in inches.

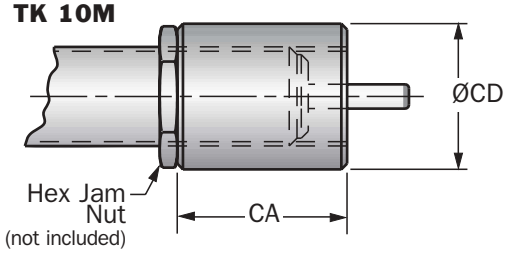
NON-ADJUSTABLES

STOP COLLAR (SC)

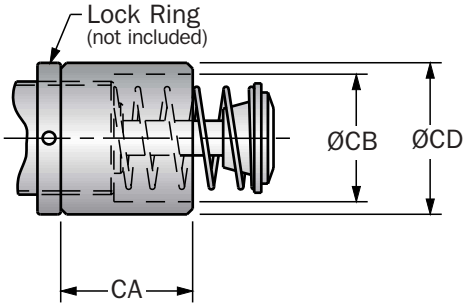
PMX 8



PMX 10 → PM 220
PRO 15 → PRO 225
TK 10M



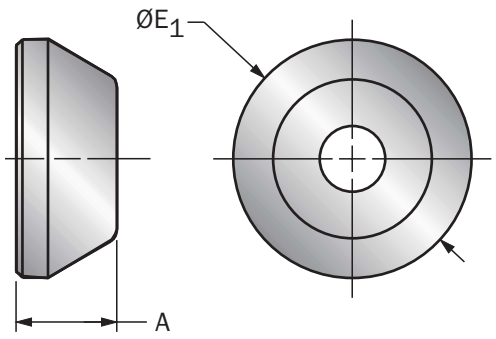
PM 1525 → PM 2150



Catalog No.	Part Number	Model (Ref)	CA	CB	CD	Wt. (oz.)
SC 3/8-32	M99137057	PMX 8 (B)	0.75	.50	0.58	.5
SC M10 X 1	M98921058	TK 10M	0.75	N/A	0.56	.4
SC 7/16-28	M95588057	PMX 10 (B)	0.75	N/A	0.63	.5
SC 7/16-28	M95588057	PM 15 (B)/PRO 15	0.75	N/A	0.63	.5
SC 1/2-20	M93935057	SPM/PM/PRO 25 IF (B)	1.00	N/A	0.75	1.0
SC 9/16-18	M9495199	SPM/PM/PRO 25 IC (B)	1.00	N/A	0.69	1.0
SC 3/4-16	M92646057	SPM/PM/PRO 50 (B)	1.50	N/A	1.00	2.0
SC 1-12 x 1	M92587057	PM 100 (B)/PRO 100	1.75	N/A	1.50	8.0
SC 1-12 x 1.56	M95568181	PRO 110	2.00	N/A	1.50	8.0
SC 1 1/4-12	M921049057	PM 120/220, PRO 120/220	2.50	N/A	1.50	7.0
SC 1 3/8-12	M921293057	PM/PRO 125/225	2.50	N/A	1.69	7.0
SC 1 3/4-12	8KE2940	PM 1525, 1550 & 1575	1.94	1.94	2.22	11.0
SC 2 1/2-12 x 2	8KE3010	PM 2050 & 2100	2.47	2.54	3.00	23.0
SC 2 1/2-12 x 6	8KE3012	PM 2150	3.66	2.54	3.00	35.0

All dimensions in inches.

URETHANE STRIKER CAP (UC)

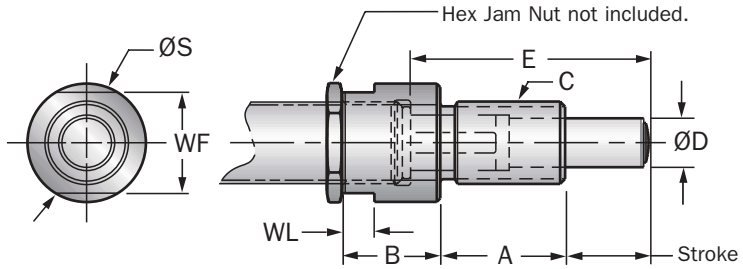


Catalog No.	Part Number	Model (Ref)	A	E_1	Wt. (oz.)
UC 8609	C98609079	PRO/PM 120,125, 220 & 225	.39	1.20	0.1
UC 2940	C92940079	PM 1500	.97	1.75	0.5
UC 3010	C93010079	PM 2000	.95	2.25	0.8
UC 5568	C95568079	PRO 110	.39	0.88	0.1

Note: For complete shock absorber dimension with urethane striker cap, refer to engineering data pages 35-39.

All dimensions in inches.

SIDELOAD ADAPTERS (SLA)



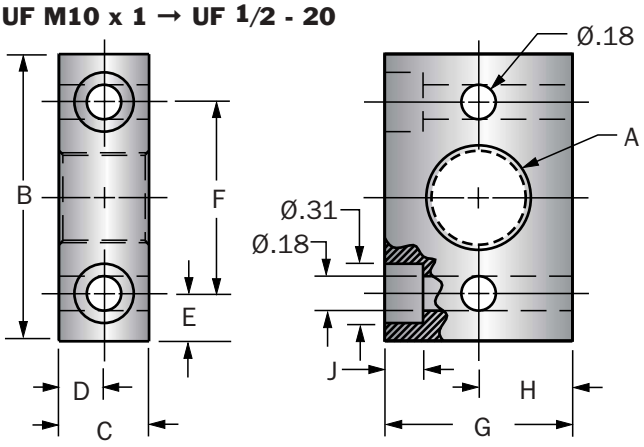
Catalog No.	Part Number	Model (Ref)	A	B	C	D	E	S	WF	WL	Stroke (in.)
SLA 3/8-32 x .25	SLA_33843	TK 21	.47	.43	3/8 - 32 UNEF	.20	.85	.51	.44	.16	.25
SLA 10 MF	SLA_33457	TK 10M	.47	.43	M10 X 1	.20	.85	.51	11mm	.28	.25
SLA 7/16-28 x .28	SLA_33974	PMX 10	.47	.43	7/16-28 UNEF	.20	.87	.63	.56	.16	.28
SLA 7/16-28 x .41	SLA_33844	PRO/PM 15 IF	.71	.55	7/16-28 UNEF	.24	1.28	.63	.56	.28	.41
SLA 1/2-20 x .41	SLA_71146	PRO/PM 15 IC	.71	.55	1/2-20 UNF	.24	1.28	.63	.56	.28	.41
SLA 1/2-20 x .63	SLA_33849	PRO/PM 25 IF	1.02	.51	1/2-20 UNF	.31	1.62	.71	.63	.28	.63
SLA 9/16-18 x .63	SLA_33850	PRO/PM 25 IC	1.02	.51	9/16-18 UNF	.31	1.62	.71	.63	.28	.63
SLA 1/2-20 x .50	SLA_33845	SPM 25 IF	.79	.63	1/2-20 UNF	.31	1.55	.71	.63	.28	.5
SLA 9/16/18 x .50	SLA_33846	SPM 25 IC	.79	.63	9/16-18 UNF	.31	1.55	.71	.63	.28	.5
SLA 3/4-16 x .88	SLA_33851	PRO/PM 50	1.26	.67	3/4-16 UNF	.43	2.44	.98	.88	.28	.88
SLA 3/4-16 x .50	SLA_33847	SPM 50	.94	.55	3/4-16 UNF	.43	1.64	.98	.88	.28	.5
SLA 1-12 x 1	SLA_33848	PRO/PM 100	1.50	1.18	1-12 UNF	.59	2.88	1.42	1.25	.39	1.00

Notes: 1. To be used with non-button models only.
2. Maximum sideload angle is 30 degrees.

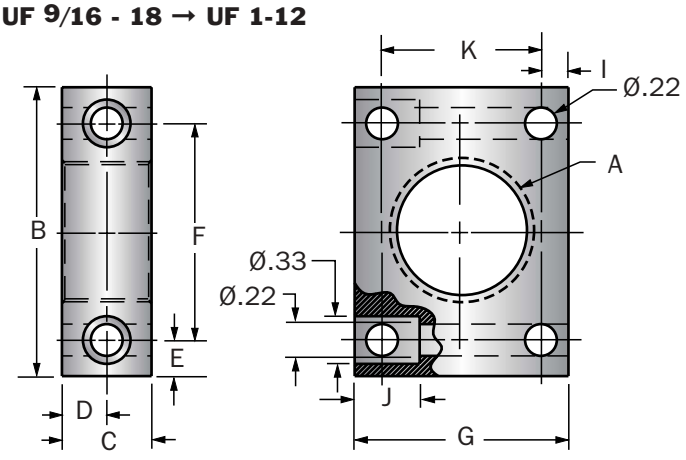
All dimensions in inches.

UNIVERSAL RETAINING FLANGE (SMALL BORE) (UF)

UF M10 x 1 → UF 1/2 - 20



UF 9/16 - 18 → UF 1-12

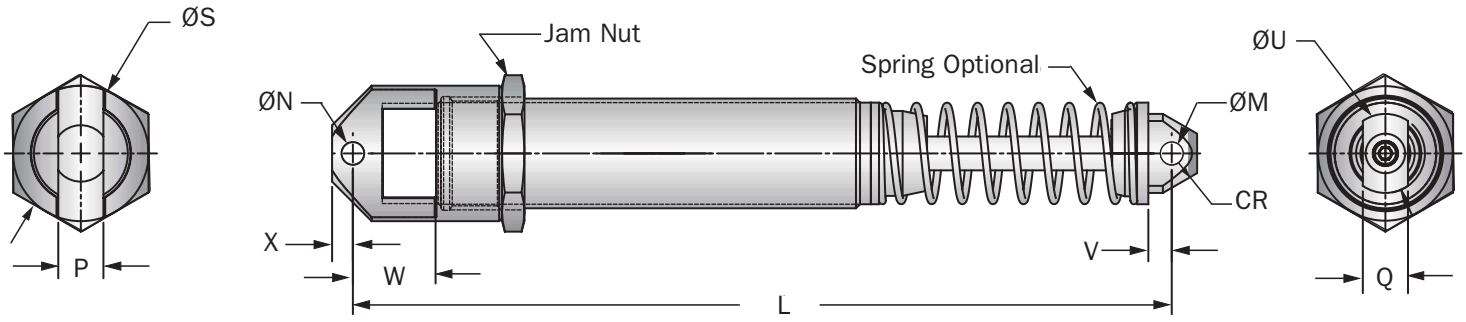


Catalog No.	Part Number	Model (Ref)	A	B	C	D	E	F	G	H	I	J	K
UF M10 x 1	U16363189	TK 10M(B)	M10 x 1	1.50	.47	.24	.25	1.00	0.98	.49	N/A	.20	N/A
UF 3/8-32	U19070095	TK21/PMX 8	3/8-32 UNF	1.50	.56	.28	.25	1.00	1.00	.50	N/A	.20	N/A
UF 7/16-28	U15588095	PRO/PM 15(B)/PMX 10	7/16-28 UNF	1.50	.56	.28	.25	1.00	1.00	.50	N/A	.20	N/A
UF 1/2-20	U13935095	PRO/PM/SPM 25 IF(B)	1/2-20 UNF	1.50	.56	.28	.25	1.00	1.00	.50	N/A	.20	N/A
UF 9/16-18	U19018095	PRO/PM/SPM 25 IC(B)	9/16-18 UNF	1.81	.62	.31	.22	1.38	1.38	N/A	.19	.32	1.00
UF 3/4-16	U120275095	PRO/PM/SPM 50(B)	3/4-16 UNF	2.00	.62	.31	.25	1.50	1.50	N/A	.19	.45	1.12
UF 1-12	U19599095	PRO 100(B)	1-12 UNF	2.00	.62	.31	.25	1.50	1.50	N/A	.19	.45	1.12
UF 1-12	U19599095	PRO 110	1-12 UNF	2.00	.62	.31	.25	1.50	1.50	N/A	.19	.45	1.12

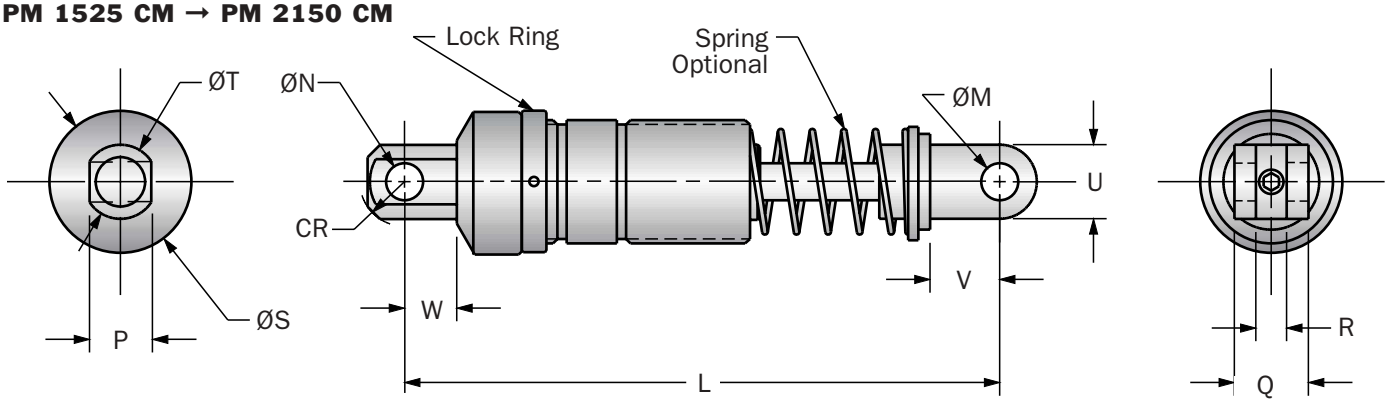
All dimensions in inches.

Clevis Mounting

PM 120 CM → PM 225 CM
PRO 110 CM → PRO 225 CM



PM 1525 CM → PM 2150 CM



Catalog No. (Model)	L	M	N	P	Q	R	S	T	U	V	W	X	CR	Model Weight (lbs.)
PM/PRO 120 CM (S)	6.59	251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.48	.31	.44	1.3
PM/PRO 220 CM (S)	9.22	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.48	.31	.44	1.7
PM 1525 CM (S)	7.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.0
PM 1550 CM (S)	9.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	.505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.2
PM 1575 CM (S)	11.84	.376 +.010/-.000	.501 +.010/-.000	.750 +.000/-.010	1.00	505 +.020/-.000	2.00	1.00	1.00	1.01	.87	N/A	.56	3.6
PM 2050 CM (S)	12.06	751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	8.2
PM 2100 CM (S)	16.06	751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	9.3
PM 2150 CM (S)	21.13	751 +.010/-.000	.751 +.010/-.000	1.250 +.000/-.010	1.50	630 +.020/-.000	2.88	1.50	1.50	1.40	1.06	N/A	.90	11.2
PRO 110 CM (S)	8.32	197 +.005/-.000	.251 +.005/-.000	.375 +.000/-.010	.315 +.000/-.010	N/A	1.25	N/A	.88	.42	.51	.25	.25	1.2
PM/PRO 125 CM (S)	6.59	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.93	.23	.44	1.6
PM/PRO 225 CM (S)	9.22	.251 +.005/-.000	.251 +.005/-.000	.500 +.000/-.010	.500 +.000/-.010	N/A	1.50	N/A	.88	.23	.93	.23	.44	1.9

Note: (S) indicates model comes with spring.

All dimensions in inches.

SHOCK ABSORBER ORDERING INFORMATION

Example 1:
Standard Products

10 PRO 50 IF -2 B

- **10** — Select quantity
- **PRO** — Select catalog number
- **50** — Select damping constant from appropriate sizing graph
- **IF** — Select thread designation from engineering data chart (If applicable)
- **-2** — Select piston rod type
  - "–" (without button)
  - "B" (with button)
  - "CM" (Clevis mount)

Example 2:
Custom Orifice Products*

10 STH .25 APPLICATION DATA

- **10** — Select quantity
- **STH** — Select catalog number
- **APPLICATION DATA** — Specify:
  - Vertical, rotary or horizontal motion
  - Weight
  - Impact velocity
  - Propelling force (if any)
  - Other (temperature or other environmental conditions)
  - Cycles per hour

*Enidine will specify individual part number for each application.

ACCESSORIES

Example 1

10 UF ¾ -16 Universal Mounting Flange
(P/N U120275095)

- **10** — Select quantity
- **UF ¾ -16 (P/N U120275095)** — Select catalog/part number

Example 2

5 UC 8609 Urethane Striker Cap
(P/N C98609079)

- **5** — Select quantity
- **UC 8609 (P/N C98609079)** — Select catalog /part number

Enidine Heavy Duty Series (HD/HDA) large-bore hydraulic shock absorbers protect equipment from large impacts in applications such as automated storage and retrieval systems, as well as overhead bridge and trolley cranes.

They are available in a wide variety of stroke lengths and damping characteristics to increase equipment life and meet stringent deceleration requirements.

Features and Benefits

- *Compact design smoothly and safely decelerates large energy capacity loads up to 8 million in-lbs. per cycle.*
- *Engineered to meet OSHA, AISE, CMMA and other safety specifications such as DIN and FEM.*
- *Internal air charged bladder accumulator replaces mechanical return springs, providing shorter overall length and reduced weight.*
- *Wide variety of optional configurations including bellows, clevis mounts and safety cables.*
- *Available in standard adjustable or custom-orificed non-adjustable models.*
- *Incorporating optional fluids and seal packages can expand standard operating temperature range from (15° to 140°F) to (-30° to 210°F).*
- *All sizes are fully field repairable.*
- *Piston rod extension sensor systems available for reuse safety requirements.*
- *Zinc plated external components provide enhanced corrosion protection. Epoxy painting and special rod materials are available for use in highly corrosive environments.*

HD Series

Custom-orificed design accommodates specified damping requirements. Computer generated output performance simulation is used to optimize the orifice configuration. Available in standard bore dimensions of up to 6 in. (150mm) and strokes over 60 in. (1525mm).

HDA Series

Adjustable units enable user to modify shock absorber resistance to accommodate load velocity variations, with strokes up to 12 in. (305mm). Standard adjustable configurations available. Special bore sizes and strokes for both HD and HDA Series models are available upon request.

Pages 48-62

HD/HDA SERIES SHOCK ABSORBERS

Catalog No. (Model)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	Damping Type	Page No.
HD 1.5 x (Stroke)	2-24	185,000	C, P, SC	49
HD 2.0 x (Stroke)	10-56	680,000	C, P, SC	50
HD 3.0 x (Stroke)	2-56	1,200,000	C, P, SC	51-52
HDA 3.0 x (Stroke)	2-12	240,000	C	51
HD 3.5 x (Stroke)	2-48	1,400,000	C, P, SC	53-54
HD 4.0 x (Stroke)	2-48	2,400,000	C, P, SC	55-56
HDA 4.0 x (Stroke)	2-10	600,000	C	55-56
HD 5.0 x (Stroke)	4-40	4,150,000	C, P, SC	57-58
HDA 5.0 x (Stroke)	4-12	1,000,000	C	57
HD 6.0 x (Stroke)	4-48	7,125,000	C, P, SC	59
HDA 6.0 x (Stroke)	4-12	1,625,000	C	59

All dimensions in inches.

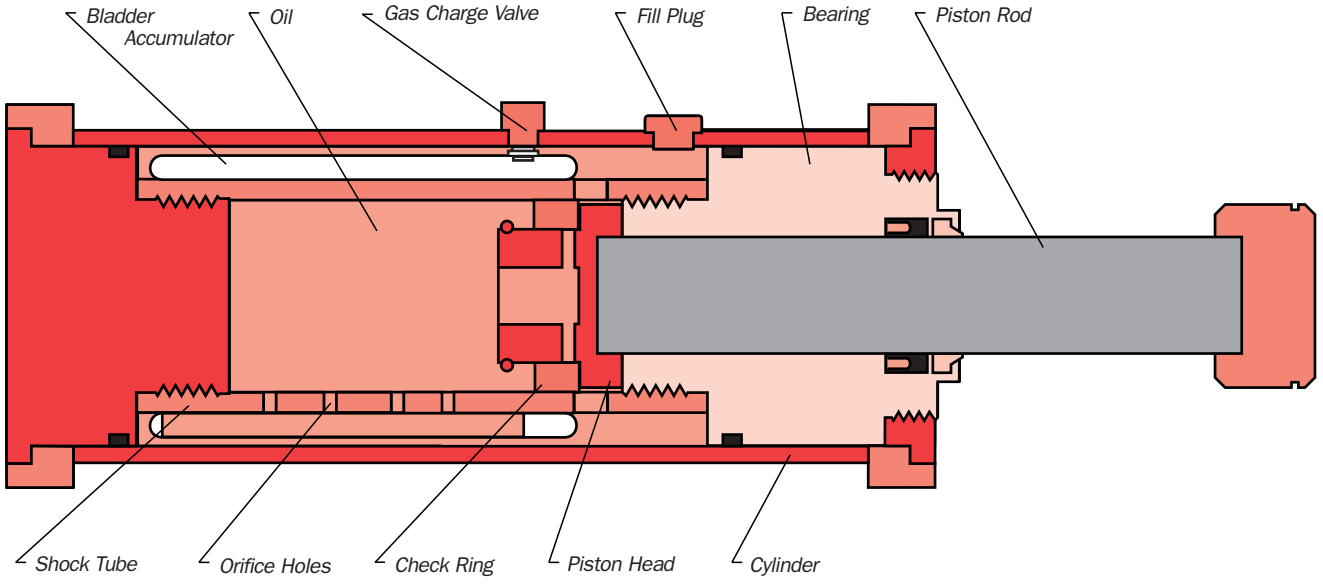
Heavy Duty Large Bore (HD/HDA) Series Shock Absorbers

The Enidine HD/HDA Series is a large bore, multi-orifice family of shock absorbers which incorporates a double cylinder arrangement with space between the concentric shock tube and cylinder, and a series of orifice holes drilled down the length of the shock tube wall.

During piston movement, the check ring is seated and oil is forced through the orifices in the shock tube wall, into the gas charged bladder/accumulator area, and behind the piston head. The orifice area decreases as the piston moves and closes the orifice holes. The bladder/accumulator is also compressed by the oil during the compression stroke, which compensates for the fluid displaced by the piston rod during compression.

During repositioning, the pressure from the bladder/accumulator pushes the piston rod outward. This unseats the check ring and permits oil to flow rapidly through the piston head into the front of the shock tube. The unique gas-charged bladder accumulator replaces mechanical return springs, decreasing overall product size and weight.

The HD/HDA Series can provide conventional, progressive or self-compensating damping. Their compact, heavy-duty design (non-adjustable shown below) safely and effectively decelerates large moving loads, with energy capacities of up to eight million in-lbs per cycle.



HD/HDA Series Shock Absorber Sizing

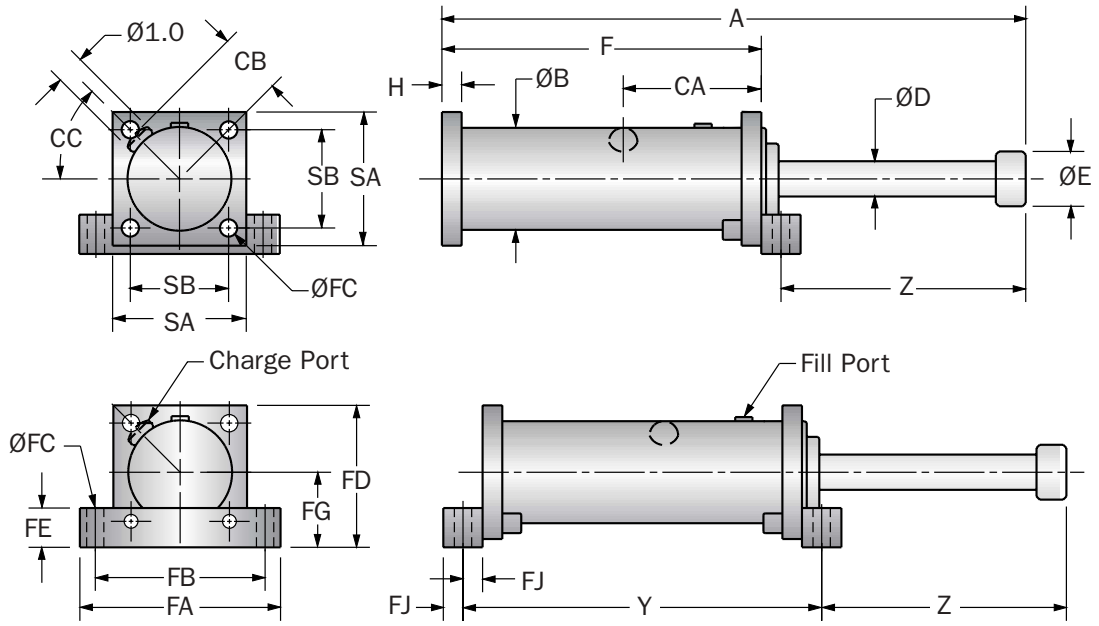
1. Determine load weight (lbs.), impact velocity (in./sec), propelling force (lbs.) if any, cycles per hour and stroke (in.) required.
2. Calculate total energy per cycle (in.-lbs./c) and total energy per hour (in.-lbs./hr). Consult this catalog's sizing examples (pages 5-12) for assistance, if required.
3. Compare the calculated total energy per cycle (in-lbs./c) and total energy per hour (in.-lbs./hr), to the values listed in the HD/HDA Series Engineering Data charts. For HDA selection, the impact velocity must be below 130 in./sec.
4. Select the appropriate HD/HDA Series model.

Example: Horizontal Application

1. Weight (W): 55,000 lbs.
   Velocity (V): 43 in./sec.
   Propelling Force (F_D): 6,700 lbs.
   Cycles/Hour (C): 10 cycles/hr
   Stroke (S): 5 in.
2. Total Energy/Cycle (E_T): 165,229 in.-lbs./c
   Total Energy/Hour (E_TC): 1,652,290 in.-lbs./hr
3. Compare total energy per cycle (165,229 in.-lbs./c) and total energy per hour (1,652,290 in.-lbs./hr) to the HD/HDA Series Engineering Data charts (pages 49-60).
4. Selection: HD 3.0 x 5 (HDA is not appropriate because maximum in.-lbs. per cycle are exceeded).

HD Series

HD 1.5 x 2 → HD 1.5 x 24



Note: For TF, FF and FR mounting, delete front foot and dimensions.

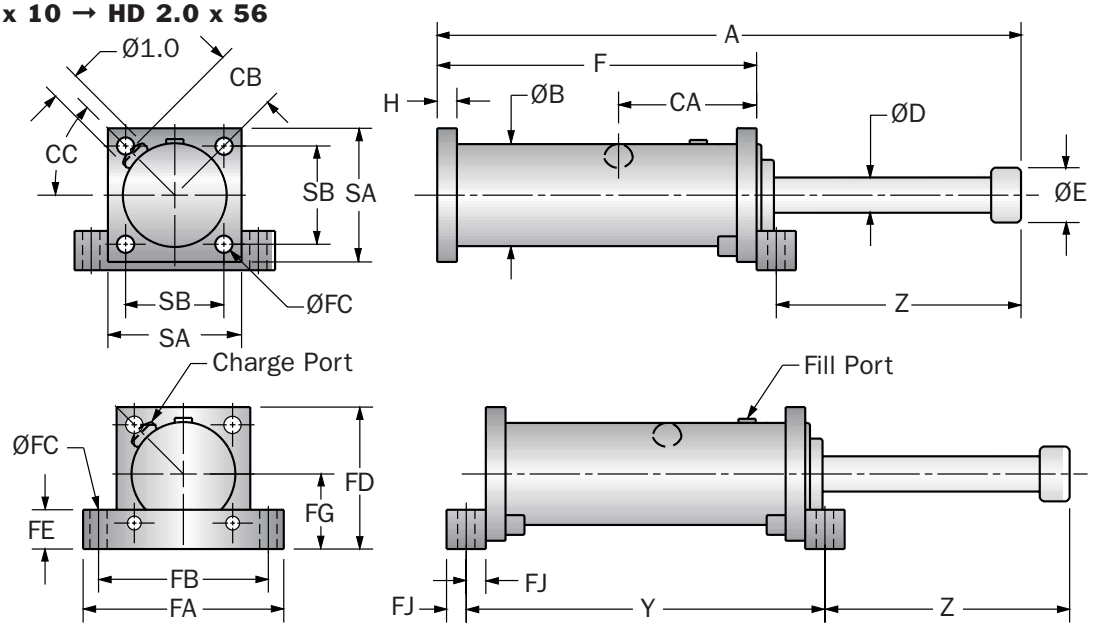
Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 1.5 x 2	1.57	2	27,000	1,590,000	15,750	63	4.7	3.5	1/2	22
HD 1.5 x 4	1.57	4	53,000	3,160,000	15,750	63	4.7	3.5	1/2	24
HD 1.5 x 6	1.57	6	79,000	4,742,000	15,750	63	4.7	3.5	1/2	26
HD 1.5 x 8	1.57	8	106,000	6,319,000	15,750	63	4.7	3.5	1/2	29
HD 1.5 x 10	1.57	10	132,000	7,426,000	15,750	63	4.7	3.5	1/2	31
HD 1.5 x 12	1.57	12	158,000	8,315,000	15,750	63	4.7	3.5	1/2	35
HD 1.5 x 14	1.57	14	184,000	9,187,000	15,750	63	4.7	3.5	1/2	37
HD 1.5 x 16	1.57	16	180,000	10,076,000	13,500	63	4.7	3.5	1/2	40
HD 1.5 x 18	1.57	18	162,000	9,717,000	10,750	63	4.7	3.5	1/2	42
HD 1.5 x 20	1.57	20	146,000	8,761,000	8,750	63	4.7	3.5	1/2	44
HD 1.5 x 24	1.57	24	126,000	7,540,000	6,250	63	4.7	3.5	1/2	50

Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 1.5 x 2	12.2	3.5	1.1	2.0	8.2	0.8	9.4	3.4	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 4	16.1	3.5	1.1	2.0	10.2	0.8	11.4	5.3	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 6	20.1	3.5	1.1	2.0	12.2	0.8	13.4	7.3	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 8	24.1	3.5	1.1	2.0	14.2	0.8	15.4	9.3	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 10	28.2	3.5	1.1	2.0	16.2	0.8	17.4	11.4	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 12	32.2	3.5	1.1	2.0	18.2	0.8	19.4	13.4	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 14	36.1	3.5	1.1	2.0	20.2	0.8	21.4	15.3	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 16	40.1	3.5	1.1	2.0	22.2	0.8	23.4	17.3	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 18	44.1	3.5	1.1	2.0	24.2	0.8	25.4	19.3	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 20	48.2	3.5	1.1	2.0	26.2	0.8	27.4	21.4	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°
HD 1.5 x 24	56.2	3.5	1.1	2.0	30.2	0.8	31.4	25.4	6.5	5.5	.55	4.9	1.3	2.5	.63	5.7	2.2	45°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

HD 2.0 x 10 → HD 2.0 x 56



Note: For TF, FF and FR mounting, delete front foot and dimensions.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 2.0 x 10	1.97	10	212,000	9,403,000	25,000	100	5.5	4.4	5/8	51
HD 2.0 x 12	1.97	12	248,000	10,490,000	25,000	100	5.5	4.4	5/8	55
HD 2.0 x 14	1.97	14	290,000	11,577,000	25,000	100	5.5	4.4	5/8	60
HD 2.0 x 16	1.97	16	331,000	12,665,000	25,000	100	5.5	4.4	5/8	64
HD 2.0 x 18	1.97	18	372,000	13,752,000	25,000	100	5.5	4.4	5/8	68
HD 2.0 x 20	1.97	20	414,000	14,818,000	25,000	100	5.5	4.4	5/8	73
HD 2.0 x 24	1.97	24	496,000	16,993,000	25,000	100	5.5	4.4	5/8	79
HD 2.0 x 28	1.97	28	580,000	19,168,000	25,000	100	5.5	4.4	5/8	93
HD 2.0 x 32	1.97	32	662,000	23,005,000	25,000	125	5.5	4.4	5/8	108
HD 2.0 x 36	1.97	36	677,000	25,137,000	22,500	125	5.5	4.4	5/8	117
HD 2.0 x 40	1.97	40	647,000	27,270,000	19,000	125	5.5	4.4	5/8	124
HD 2.0 x 48	1.97	48	542,000	31,534,000	13,500	125	5.5	4.4	5/8	141
HD 2.0 x 56	1.97	56	367,000	22,000,000	7,900	125	5.5	4.4	5/8	161

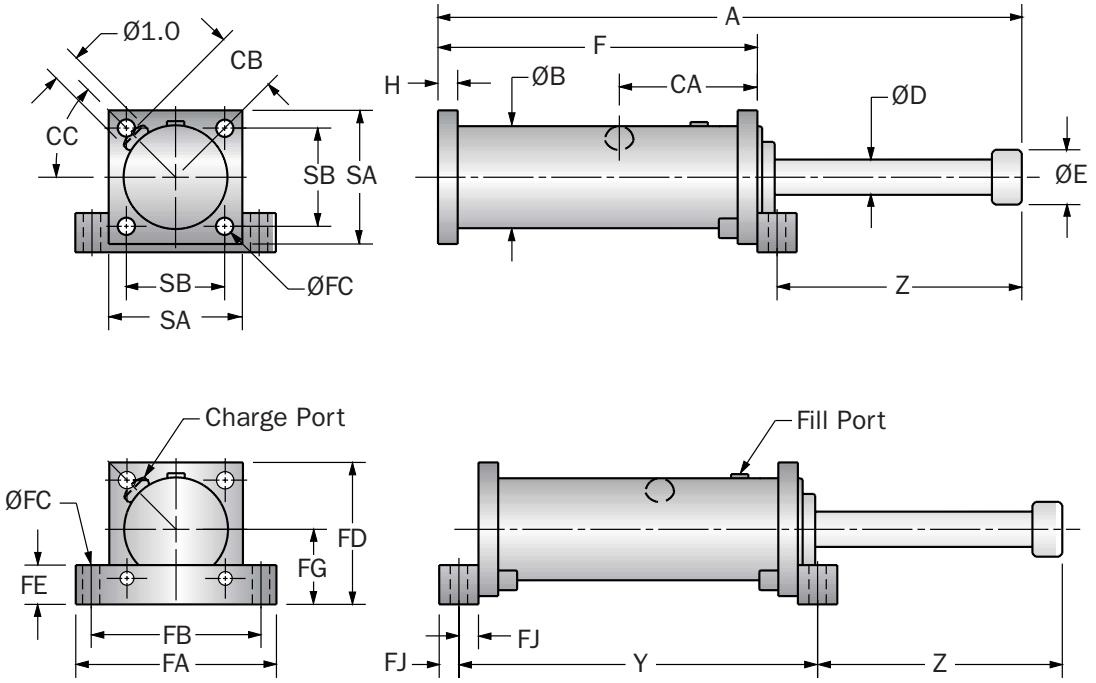
Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 2.0 x 10	29.8	4.3	1.6	2.4	17.4	1.0	19.0	11.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 12	33.8	4.3	1.6	2.4	19.4	1.0	21.0	13.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 14	37.8	4.3	1.6	2.4	21.4	1.0	23.0	15.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 16	41.8	4.3	1.6	2.4	23.4	1.0	25.0	17.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 18	45.8	4.3	1.6	2.4	25.4	1.0	27.0	19.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 20	49.8	4.3	1.6	2.4	27.4	1.0	29.0	21.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 24	57.8	4.3	1.6	2.4	31.4	1.0	33.0	25.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 28	65.8	4.3	1.6	2.4	35.4	1.0	37.0	29.6	8.7	7.0	.67	5.8	1.6	3.0	.80	7.2	2.6	30°
HD 2.0 x 32	76.9	4.3	1.6	2.4	42.5	1.0	44.0	33.7	8.7	7.0	.67	5.8	1.6	3.0	.80	10.4	2.6	30°
HD 2.0 x 36	84.7	4.3	1.6	2.4	46.4	1.0	48.0	37.5	8.7	7.0	.67	5.8	1.6	3.0	.80	10.4	2.6	30°
HD 2.0 x 40	92.6	4.3	1.6	2.4	50.4	1.0	52.0	41.4	8.7	7.0	.67	5.8	1.6	3.0	.80	10.4	2.6	30°
HD 2.0 x 48	108.3	4.3	1.6	2.4	58.2	1.0	59.8	49.3	8.7	7.0	.67	5.8	1.6	3.0	.80	10.4	2.6	30°
HD 2.0 x 56	124.8	4.3	1.6	2.4	66.5	1.0	68.1	57.5	8.7	7.0	.67	5.8	1.6	3.0	.80	10.4	2.6	30°

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

All dimensions in inches.

HD/HDA Series

HD(A) 3.0 x 2 → HD 3.0 x 18



Note: For TF, FF and FR mounting, delete front foot and dimensions.

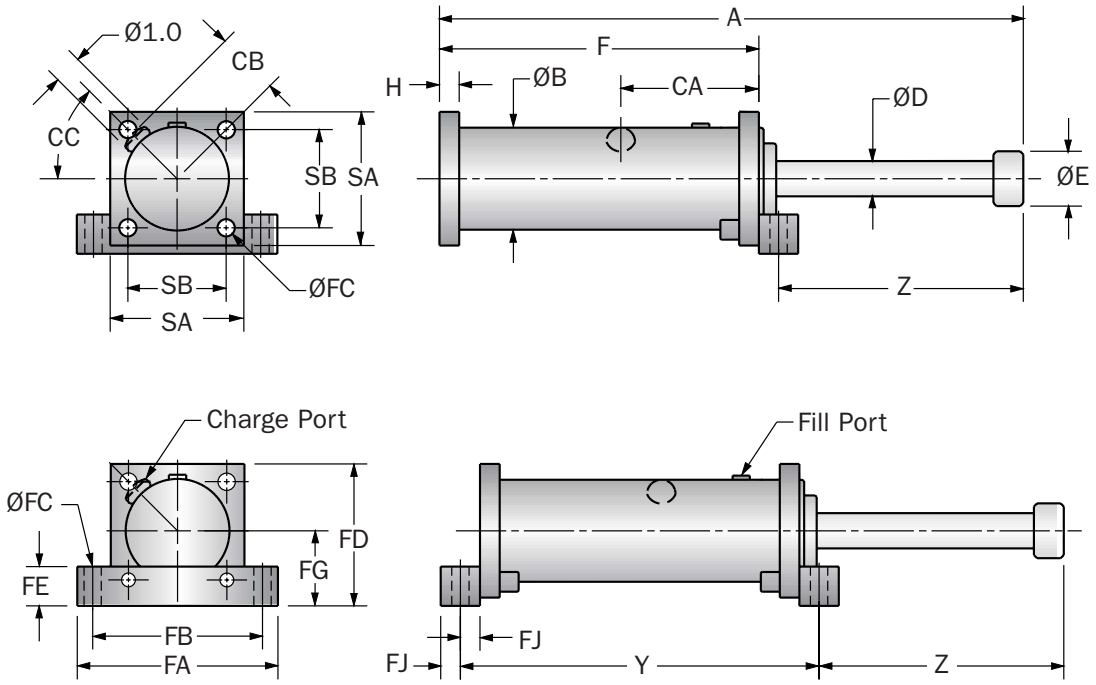
Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	HD (E_T) Max. in.-lbs./cycle	HD (E_TC) Max. in.-lbs./hour	HDA (E_T) Max. in.-lbs./cycle	HDA (E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions SA	SB	Rec. Bolt Size	Model Weight (lbs.)
HD(A) 3.0 x 2	2.95	2	83,000	4,965,000	40,000	2,400,000	50,000	125	6.7	4.9	3/4	40
HD(A) 3.0 x 3	2.95	3	124,000	5,924,000	60,000	3,600,000	50,000	125	6.7	4.9	3/4	42
HD(A) 3.0 x 5	2.95	5	207,000	7,210,000	100,000	6,000,000	50,000	125	6.7	4.9	3/4	48
HD(A) 3.0 x 8	2.95	8	331,000	9,100,000	160,000	9,400,000	50,000	125	6.7	4.9	3/4	57
HD 3.0 x 10	2.95	10	414,000	10,386,000	N/A	N/A	50,000	125	6.7	4.9	3/4	64
HD(A) 3.0 x 12	2.95	12	497,000	11,672,000	240,000	12,000,000	50,000	125	6.7	4.9	3/4	71
HD 3.0 x 14	2.95	14	580,000	14,218,000	N/A	N/A	50,000	125	6.7	4.9	3/4	88
HD 3.0 x 16	2.95	16	662,000	15,478,000	N/A	N/A	50,000	125	6.7	4.9	3/4	93
HD 3.0 x 18	2.95	18	745,000	16,789,000	N/A	N/A	50,000	125	6.7	4.9	3/4	99

Catalog No. (Model)	A	B	D	E	HD F	HDA F	H	HD Y	HDA Y	HD Z	HDA Z	Foot Mount Dimensions FA	FB	FC	FD	FE	FG	FJ	Charge Port Dimensions CA	CB	CC
HD(A) 3.0 x 2	13.2	5.1	1.8	2.8	8.0	8.4	1.0	10.0	10.4	4.2	3.8	10.0	8.5	.87	6.8	2.0	3.5	1.0	5.3	3.0	30°
HD(A) 3.0 x 3	15.2	5.1	1.8	2.8	9.0	9.4	1.0	11.0	11.4	5.2	4.8	10.0	8.5	.87	6.8	2.0	3.5	1.0	5.3	3.0	30°
HD(A) 3.0 x 5	19.2	5.1	1.8	2.8	11.0	11.4	1.0	13.0	13.4	7.2	6.8	10.0	8.5	.87	6.8	2.0	3.5	1.0	5.3	3.0	30°
HD(A) 3.0 x 8	25.2	5.1	1.8	2.8	14.0	14.4	1.0	16.0	16.4	10.2	9.8	10.0	8.5	.87	6.8	2.0	3.5	1.0	5.3	3.0	30°
HD 3.0 x 10	29.2	5.1	1.8	2.8	16.0	N/A	1.0	18.0	N/A	12.2	N/A	10.0	8.5	.87	6.8	2.0	3.5	1.0	5.3	3.0	30°
HD(A) 3.0 x 12	33.2	5.1	1.8	2.8	18.0	18.4	1.0	20.0	20.4	14.2	13.8	10.0	8.5	.87	6.8	2.0	3.5	1.0	5.3	3.0	30°
HD 3.0 x 14	39.2	5.1	1.8	2.8	22.0	N/A	1.0	24.0	N/A	16.2	N/A	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°
HD 3.0 x 16	43.2	5.1	1.8	2.8	24.0	N/A	1.0	26.0	N/A	18.2	N/A	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°
HD 3.0 x 18	47.2	5.1	1.8	2.8	26.0	N/A	1.0	28.0	N/A	20.2	N/A	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
HDA models will function satisfactorily at 10% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. HDA models which have an impact velocity below 30 in./sec., please contact Enidine for sizing assistance.
6. Maximum cycle rate is 60 cycles/hr.

HD 3.0 x 20 → HD 3.0 x 56



Note: For TF, FF and FR mounting, delete front foot and dimensions.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 3.0 x 20	2.95	20	828,000	18,075,000	50,000	125	6.7	4.9	3/4	106
HD 3.0 x 24	2.95	24	993,000	20,621,000	50,000	125	6.7	4.9	3/4	119
HD 3.0 x 28	2.95	28	1,159,000	23,192,000	50,000	125	6.7	4.9	3/4	130
HD 3.0 x 32	2.95	32	1,083,000	25,738,000	40,500	160	6.7	4.9	3/4	143
HD 3.0 x 36	2.95	36	1,083,000	29,343,000	36,000	160	6.7	4.9	3/4	163
HD 3.0 x 40	2.95	40	1,053,000	31,864,000	31,500	160	6.7	4.9	3/4	176
HD 3.0 x 48	2.95	48	867,000	36,905,000	21,500	160	6.7	4.9	3/4	200
HD 3.0 x 56	2.95	56	576,000	34,320,000	12,500	160	6.7	4.9	3/4	235

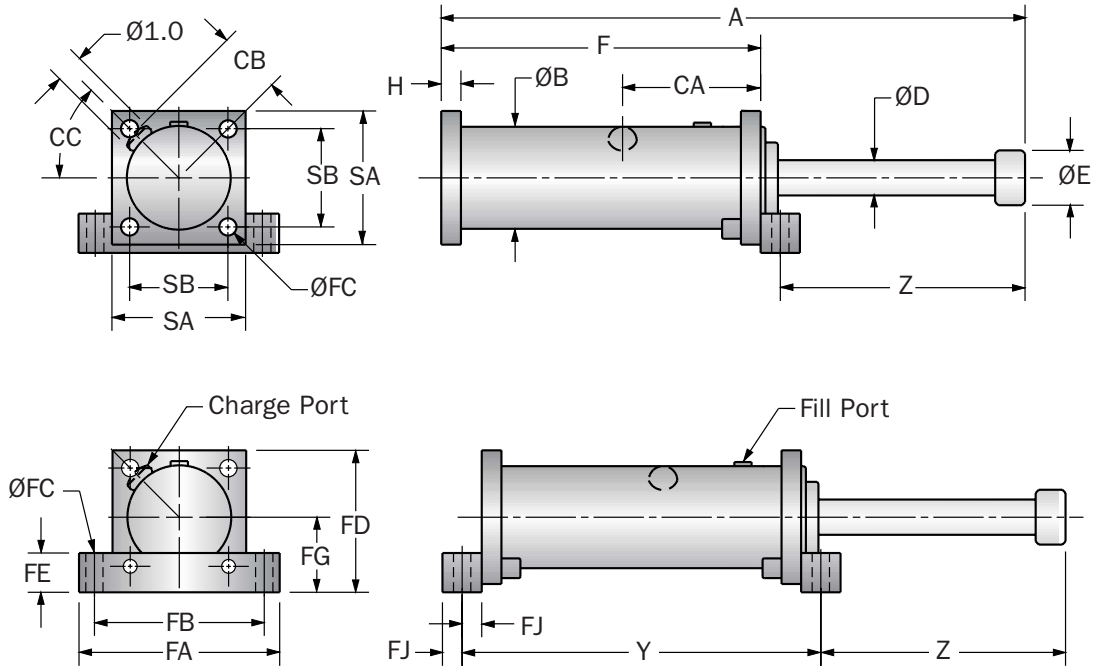
Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 3.0 x 20	51.2	5.1	1.8	2.8	28.0	1.0	30.0	22.2	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°
HD 3.0 x 24	59.2	5.1	1.8	2.8	32.0	1.0	34.0	26.2	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°
HD 3.0 x 28	67.2	5.1	1.8	2.8	36.0	1.0	38.0	30.2	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°
HD 3.0 x 32	75.2	5.1	1.8	2.8	40.0	1.0	42.0	34.2	10.0	8.5	.87	6.8	2.0	3.5	1.0	7.2	3.0	30°
HD 3.0 x 36	84.9	5.1	1.8	2.8	45.8	1.0	47.8	38.1	10.0	8.5	.87	6.8	2.0	3.5	1.0	9.2	3.0	30°
HD 3.0 x 40	92.8	5.1	1.8	2.8	49.8	1.0	51.7	42.1	10.0	8.5	.87	6.8	2.0	3.5	1.0	9.2	3.0	30°
HD 3.0 x 48	108.5	5.1	1.8	2.8	57.6	1.0	59.6	49.9	10.0	8.5	.87	6.8	2.0	3.5	1.0	9.2	3.0	30°
HD 3.0 x 56	124.2	5.1	1.8	2.8	65.5	1.0	61.6	57.7	10.0	8.5	.87	6.8	2.0	3.5	1.0	9.2	3.0	30°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

HD Series

HD 3.5 x 2 → HD 3.5 x 16



Note: ØFC on HD 3.5 foot mount only, is 1.0 inch.

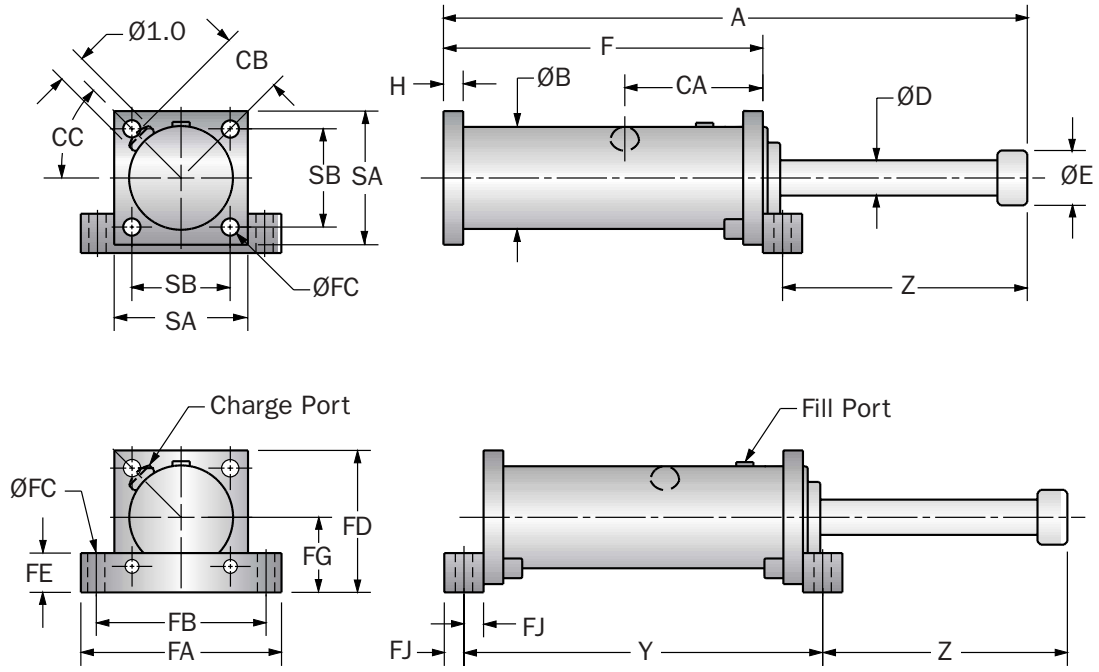
Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 3.5 x 2	3.15	2	112,500	7,345,500	67,500	195	7.9	6.3	3/4	73
HD 3.5 x 4	3.15	4	225,500	8,850,000	67,500	195	7.9	6.3	3/4	82
HD 3.5 x 6	3.15	6	338,500	10,620,000	67,500	195	7.9	6.3	3/4	90
HD 3.5 x 8	3.15	8	451,500	11,947,500	67,500	195	7.9	6.3	3/4	99
HD 3.5 x 10	3.15	10	564,000	13,717,500	67,500	195	7.9	6.3	3/4	108
HD 3.5 x 12	3.15	12	677,000	15,045,000	67,500	195	7.9	6.3	3/4	117
HD 3.5 x 16	3.15	16	903,000	18,142,500	67,500	195	7.9	6.3	3/4	132

Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 3.5 x 2	13.9	6.1	2.2	3.2	9.6	1.0	11.6	3.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°
HD 3.5 x 4	18.0	6.1	2.2	3.2	11.6	1.0	13.6	5.4	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°
HD 3.5 x 6	21.9	6.1	2.2	3.2	13.6	1.0	15.6	7.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°
HD 3.5 x 8	25.9	6.1	2.2	3.2	15.6	1.0	17.6	9.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°
HD 3.5 x 10	29.9	6.1	2.2	3.2	17.6	1.0	19.6	11.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°
HD 3.5 x 12	33.9	6.1	2.2	3.2	19.6	1.0	21.6	13.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°
HD 3.5 x 16	41.9	6.1	2.2	3.2	23.6	1.0	25.6	17.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	5.5	3.4	90°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

HD 3.5 x 20 → HD 3.5 x 48



Note: ØFC on HD 3.5 foot mount only, is 1.0 inch.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 3.5 x 20	3.15	20	1,128,500	23,010,000	67,500	195	7.9	6.3	3/4	163
HD 3.5 x 24	3.15	24	1,354,000	25,665,000	67,500	195	7.9	6.3	3/4	179
HD 3.5 x 28	3.15	28	1,580,000	28,762,500	67,500	195	7.9	6.3	3/4	196
HD 3.5 x 32	3.15	32	1,805,500	31,860,000	67,500	195	7.9	6.3	3/4	214
HD 3.5 x 36	3.15	36	1,760,000	34,957,500	58,500	195	7.9	6.3	3/4	231
HD 3.5 x 40	3.15	40	1,617,500	38,055,000	48,500	195	7.9	6.3	3/4	247
HD 3.5 x 48	3.15	48	1,400,000	44,250,000	35,000	195	7.9	6.3	3/4	282

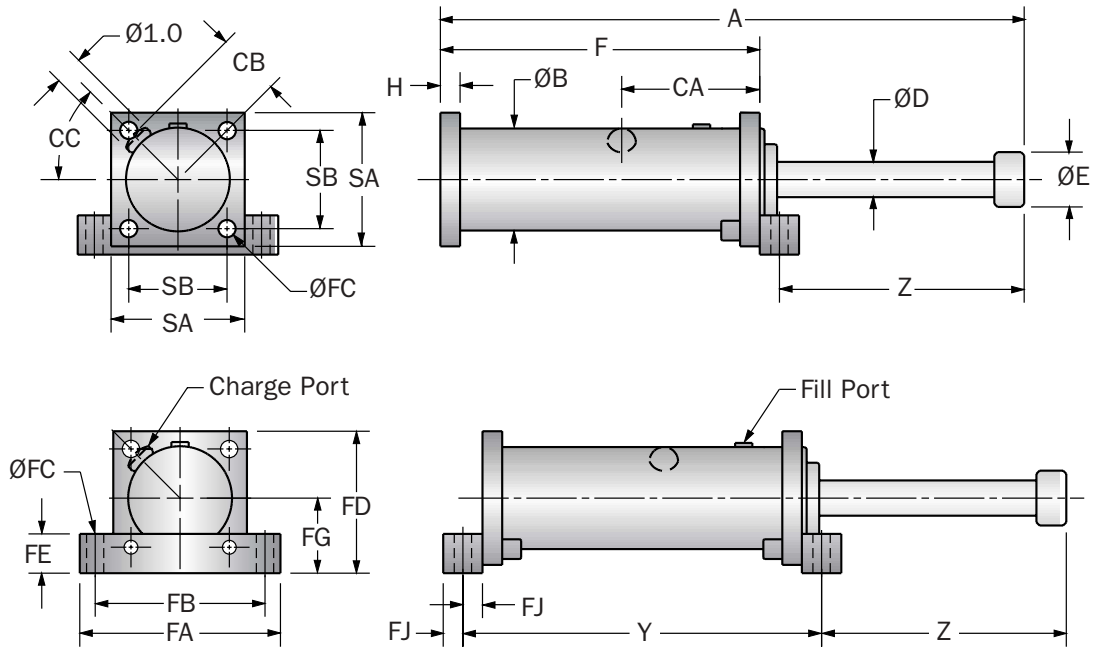
Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 3.5 x 20	52.0	6.1	2.2	3.2	29.8	1.0	31.8	21.2	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°
HD 3.5 x 24	60.1	6.1	2.2	3.2	33.8	1.0	35.8	25.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°
HD 3.5 x 28	68.0	6.1	2.2	3.2	37.8	1.0	39.8	29.2	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°
HD 3.5 x 32	76.1	6.1	2.2	3.2	41.8	1.0	43.8	33.2	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°
HD 3.5 x 36	84.1	6.1	2.2	3.2	45.8	1.0	47.8	37.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°
HD 3.5 x 40	92.1	6.1	2.2	3.2	49.8	1.0	51.8	41.3	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°
HD 3.5 x 48	107.8	6.1	2.2	3.2	57.6	1.0	59.6	49.2	11.8	9.8	.87	8.3	2.0	4.3	1.0	7.6	3.4	90°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

HD/HDA Series

HD(A) 4.0 x 2 → HD 4.0 x 16



Note: For TF, FF and FR mounting, delete front foot and dimensions.

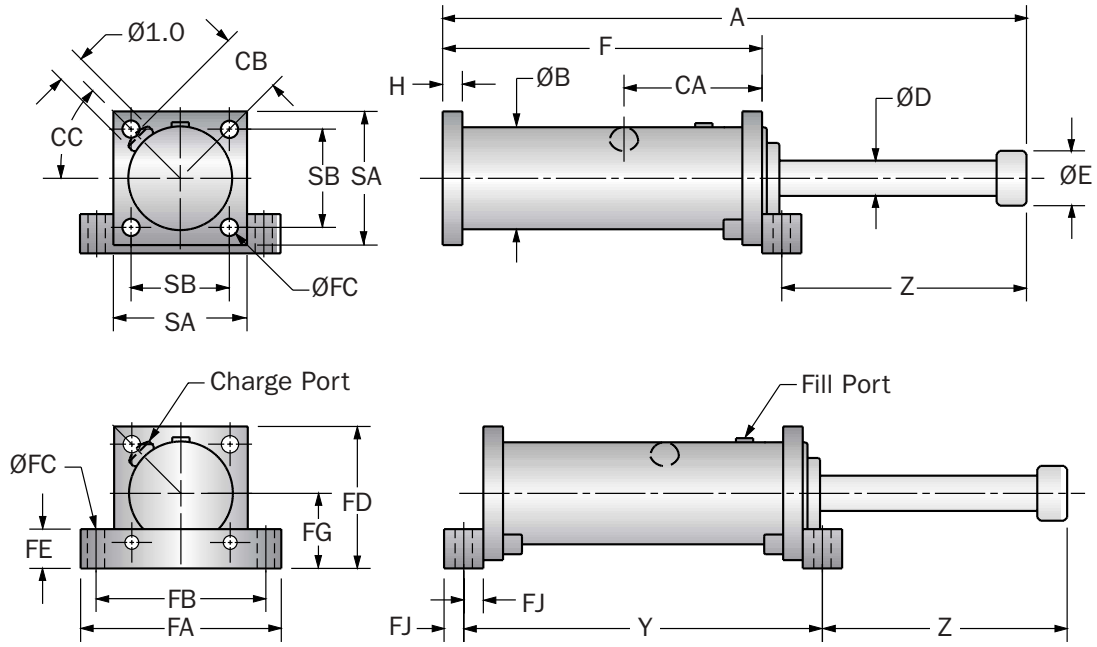
Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	HD		HDA		(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
			(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour			SA	SB	Rec. Bolt Size	
HD(A) 4.0 x 2	3.94	2	134,000	8,018,000	120,000	7,200,000	80,000	245	9.8	7.8	1	141
HD(A) 4.0 x 4	3.94	4	268,000	13,302,000	240,000	13,700,000	80,000	245	9.8	7.8	1	154
HD(A) 4.0 x 6	3.94	6	400,000	15,230,000	360,000	15,600,000	80,000	245	9.8	7.8	1	168
HD(A) 4.0 x 8	3.94	8	535,000	17,235,000	480,000	17,600,000	80,000	245	9.8	7.8	1	181
HD(A) 4.0 x 10	3.94	10	668,000	19,163,000	600,000	19,600,000	80,000	245	9.8	7.8	1	192
HD 4.0 x 12	3.94	12	800,000	24,754,000	N/A	N/A	80,000	245	9.8	7.8	1	238
HD 4.0 x 16	3.94	16	1,068,000	28,648,000	N/A	N/A	80,000	245	9.8	7.8	1	265

Catalog No. (Model)	A	B	D	E	HD F	HDA F	H	HD Y	HDA Y	HD Z	HDA Z	Foot Mount Dimensions							Charge Port Dimensions		
												FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD(A) 4.0 x 2	16.9	7.9	2.5	3.9	11.6	12.0	1.6	13.5	13.9	4.4	4.0	14.2	12.5	1.06	9.9	2.0	5.0	1.0	8.7	4.2	155°
HD(A) 4.0 x 4	20.9	7.9	2.5	3.9	13.6	14.0	1.6	15.5	15.9	6.4	6.0	14.2	12.5	1.06	9.9	2.0	5.0	1.0	8.7	4.2	155°
HD(A) 4.0 x 6	24.9	7.9	2.5	3.9	15.6	16.0	1.6	17.5	17.9	8.4	8.0	14.2	12.5	1.06	9.9	2.0	5.0	1.0	8.7	4.2	155°
HD(A) 4.0 x 8	28.9	7.9	2.5	3.9	17.6	18.0	1.6	19.5	19.9	10.4	10.0	14.2	12.5	1.06	9.9	2.0	5.0	1.0	8.7	4.2	155°
HD(A) 4.0 x 10	32.9	7.9	2.5	3.9	19.6	20.0	1.6	21.5	21.9	12.4	12.0	14.2	12.5	1.06	9.9	2.0	5.0	1.0	8.7	4.2	155°
HD 4.0 x 12	40.6	7.9	2.5	3.9	25.3	N/A	1.6	27.2	N/A	14.4	N/A	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 16	48.6	7.9	2.5	3.9	29.3	N/A	1.6	31.2	N/A	18.4	N/A	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
HDA models will function satisfactorily at 10% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. HDA models which have an impact velocity below 30 in./sec., please contact Enidine for sizing assistance.
6. Maximum cycle rate is 60 cycles/hr.

HD 4.0 x 20 → HD 4.0 x 48



Note: For TF, FF and FR mounting, delete front foot and dimensions.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 4.0 x 20	3.94	20	1,336,000	32,581,000	80,000	245	9.8	7.8	1	290
HD 4.0 x 24	3.94	24	1,602,000	36,514,000	80,000	245	9.8	7.8	1	317
HD 4.0 x 28	3.94	28	1,870,000	40,408,000	80,000	245	9.8	7.8	1	346
HD 4.0 x 32	3.94	32	2,137,000	44,341,000	80,000	245	9.8	7.8	1	375
HD 4.0 x 36	3.94	36	2,404,000	48,274,000	80,000	245	9.8	7.8	1	403
HD 4.0 x 40	3.94	40	2,182,000	52,168,000	65,000	245	9.8	7.8	1	430
HD 4.0 x 48	3.94	48	1,806,000	59,880,000	45,000	245	9.8	7.8	1	485

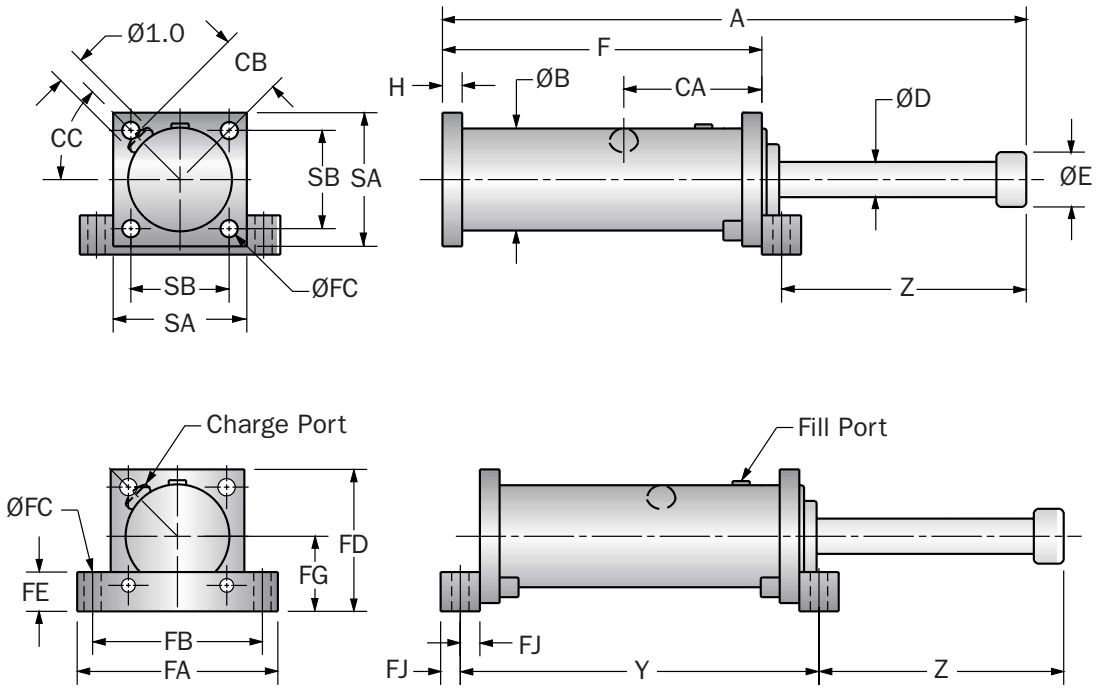
Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 4.0 x 20	56.6	7.9	2.5	3.9	33.3	1.6	35.2	22.4	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 24	64.6	7.9	2.5	3.9	37.3	1.6	39.2	26.5	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 28	72.6	7.9	2.5	3.9	41.3	1.6	43.2	30.4	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 32	80.6	7.9	2.5	3.9	45.3	1.6	47.2	4.4	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 36	88.7	7.9	2.5	3.9	49.3	1.6	51.2	38.5	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 40	96.6	7.9	2.5	3.9	53.3	1.6	55.2	42.4	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°
HD 4.0 x 48	112.4	7.9	2.5	3.9	61.1	1.6	63.1	50.3	14.2	12.5	1.06	9.9	2.0	5.0	1.0	12.2	4.2	30°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

HD/HDA Series

HD(A) 5.0 x 4 → HD(A) 5.0 x 12



Note: For TF, FF and FR mounting, delete front foot and dimensions.

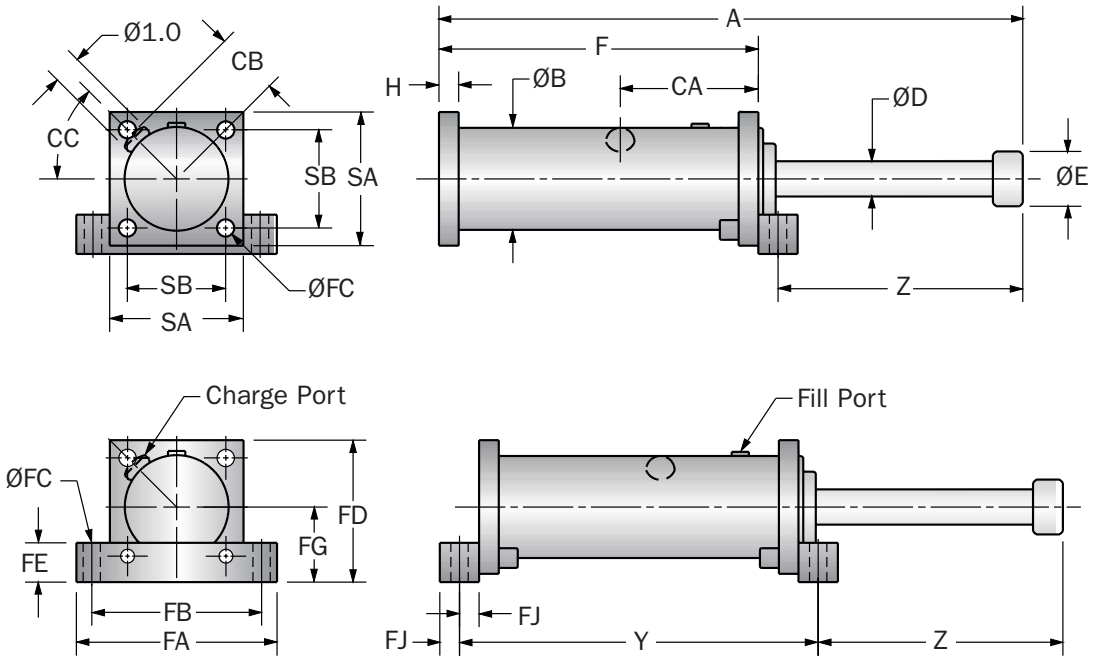
Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	HD (E_T) Max. in.-lbs./cycle	HD (E_TC) Max. in.-lbs./hour	HDA (E_T) Max. in.-lbs./cycle	HDA (E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions SA	SB	Rec. Bolt Size	Model Weight (lbs.)
HD(A) 5.0 x 4	4.92	4	414,000	15,600,000	327,000	16,000,000	124,000	400	10.8	8.7	1 1/4	192
HD(A) 5.0 x 6	4.92	6	620,000	17,720,000	500,000	18,000,000	124,000	400	10.8	8.7	1 1/4	207
HD(A) 5.0 x 8	4.92	8	828,000	19,841,000	660,000	20,250,000	124,000	400	10.8	8.7	1 1/4	223
HD(A) 5.0 x 10	4.92	10	1,036,000	21,921,000	827,000	22,300,000	124,000	400	10.8	8.7	1 1/4	238
HD(A) 5.0 x 12	4.92	12	1,239,000	24,042,000	990,000	24,500,000	124,000	400	10.8	8.7	1 1/4	251

Catalog No. (Model)	A	B	D	E	HD F	HDA F	H	HD Y	HDA Y	HD Z	HDA Z	Foot Mount Dimensions FA	FB	FC	FD	FE	FG	FJ	Charge Port Dimensions CA	CB	CC
HD(A) 5.0 x 4	23.3	8.5	3.1	4.9	14.8	15.2	1.6	17.1	17.5	7.4	7.0	15.7	13.4	1.3	10.9	2.4	5.5	1.2	9.1	4.6	25°
HD(A) 5.0 x 6	27.3	8.5	3.1	4.9	16.8	17.2	1.6	19.1	19.5	9.4	9.0	15.7	13.4	1.3	10.9	2.4	5.5	1.2	9.1	4.6	25°
HD(A) 5.0 x 8	31.3	8.5	3.1	4.9	18.8	19.2	1.6	21.1	21.5	11.4	11.0	15.7	13.4	1.3	10.9	2.4	5.5	1.2	9.1	4.6	25°
HD(A) 5.0 x 10	35.3	8.5	3.1	4.9	20.8	21.2	1.6	23.1	23.5	13.4	13.0	15.7	13.4	1.3	10.9	2.4	5.5	1.2	9.1	4.6	25°
HD(A) 5.0 x 12	39.3	8.5	3.1	4.9	22.8	23.2	1.6	25.1	25.5	15.4	15.0	15.7	13.4	1.3	10.9	2.4	5.5	1.2	9.1	4.6	25°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
HDA models will function satisfactorily at 10% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. HDA models which have an impact velocity below 30 in./sec., please contact Enidine for sizing assistance.
6. Maximum cycle rate is 60 cycles/hr.

HD 5.0 x 16 → HD 5.0 x 48



Note: For TF, FF and FR mounting, delete front foot and dimensions.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions			Model Weight (lbs.)
							SA	SB	Rec. Bolt Size	
HD 5.0 x 16	4.92	16	1,655,000	28,285,000	124,000	400	10.8	8.7	1 1/4	282
HD 5.0 x 20	4.92	20	2,071,000	36,688,000	124,000	400	10.8	8.7	1 1/4	348
HD 5.0 x 24	4.92	24	2,478,000	40,930,000	124,000	400	10.8	8.7	1 1/4	377
HD 5.0 x 28	4.92	28	2,894,000	45,132,000	124,000	400	10.8	8.7	1 1/4	407
HD 5.0 x 32	4.92	32	3,310,000	49,374,000	124,000	400	10.8	8.7	1 1/4	437
HD 5.0 x 40	4.92	40	4,133,000	57,818,000	124,000	400	10.8	8.7	1 1/4	496
HD 5.0 x 48	4.92	48	3,700,000	66,262,000	92,000	400	10.8	8.7	1 1/4	534

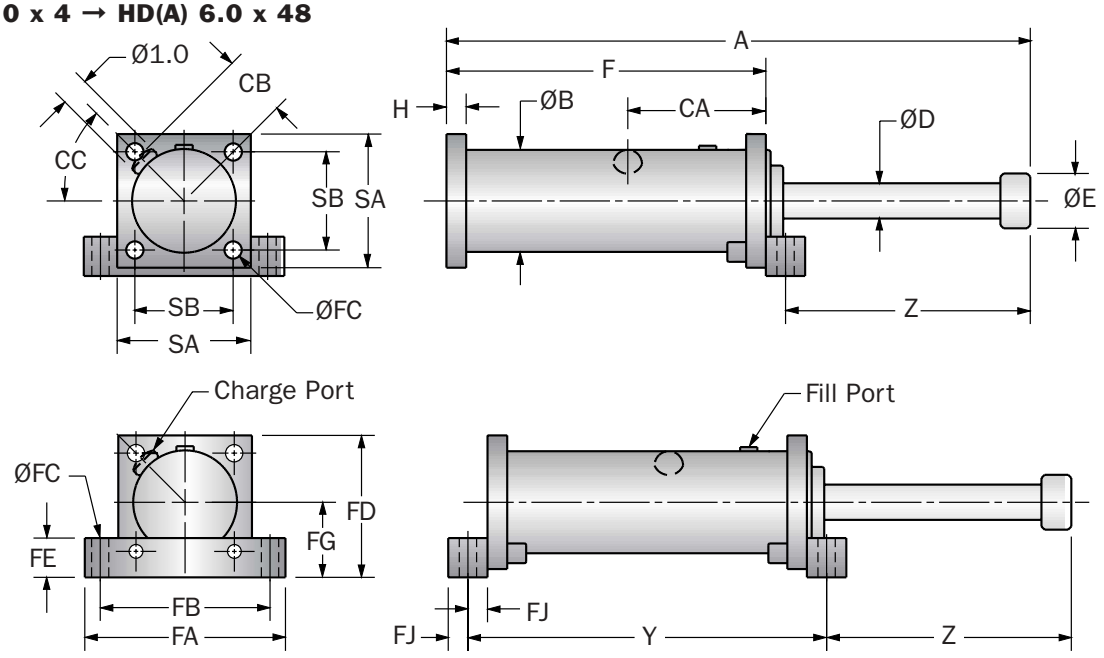
Catalog No. (Model)	A	B	D	E	F	H	Y	Z	Foot Mount Dimensions							Charge Port Dimensions		
									FA	FB	FC	FD	FE	FG	FJ	CA	CB	CC
HD 5.0 x 16	47.3	8.5	3.1	4.9	26.8	1.6	29.1	19.4	15.7	13.4	1.3	10.9	2.4	5.5	1.2	9.1	4.6	25°
HD 5.0 x 20	59.2	8.5	3.1	4.9	34.7	1.6	37.1	23.3	15.7	13.4	1.3	10.9	2.4	5.5	1.2	13.0	4.6	25°
HD 5.0 x 24	67.2	8.5	3.1	4.9	38.7	1.6	41.1	27.3	15.7	13.4	1.3	10.9	2.4	5.5	1.2	13.0	4.6	25°
HD 5.0 x 28	75.2	8.5	3.1	4.9	42.7	1.6	45.1	31.3	15.7	13.4	1.3	10.9	2.4	5.5	1.2	13.0	4.6	25°
HD 5.0 x 32	83.2	8.5	3.1	4.9	46.7	1.6	49.1	35.3	15.7	13.4	1.3	10.9	2.4	5.5	1.2	13.0	4.6	25°
HD 5.0 x 40	99.2	8.5	3.1	4.9	54.7	1.6	57.1	43.3	15.7	13.4	1.3	10.9	2.4	5.5	1.2	13.0	4.6	25°
HD 5.0 x 48	115.0	8.5	3.1	4.9	62.6	1.6	65.0	51.3	15.7	13.4	1.3	10.9	2.4	5.5	1.2	13.0	4.6	25°

All dimensions in inches.

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.

HD/HDA Series

HD(A) 6.0 x 4 → HD(A) 6.0 x 48



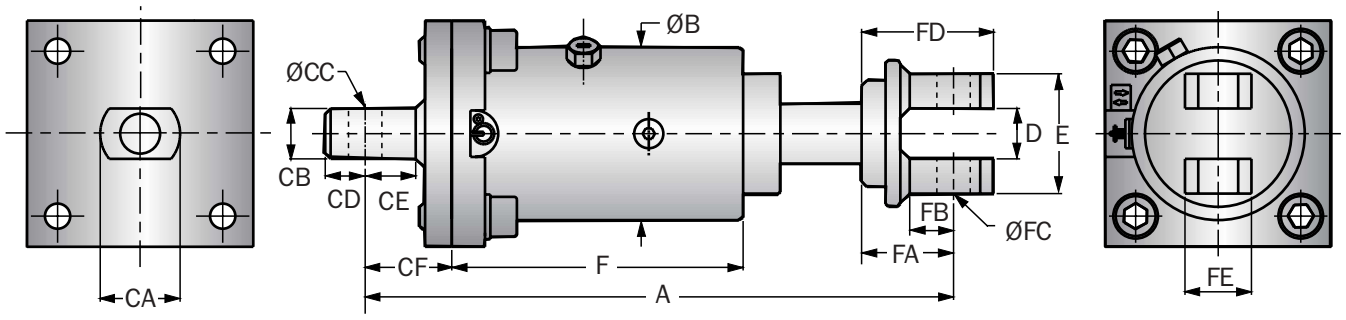
Note: For TF, FF and FR mounting, delete front foot and dimensions.

Catalog No. (Model)	Bore Size (in.)	(S) Stroke (in.)	HD (E_T) Max. in.-lbs./cycle	HD (E_TC) Max. in.-lbs./hour	HDA (E_T) Max. in.-lbs./cycle	HDA (E_TC) Max. in.-lbs./hour	(F_P) Max. Shock Force (lbs.)	Nominal Return Force (lbs.)	Flange Dimensions SA	SB	Rec. Bolt Size	Model Weight (lbs.)
HD(A) 6.0 x 4	6.30	4	677,000	21,280,000	540,000	22,000,000	202,250	625	13.0	10.2	1 ½	362
HD(A) 6.0 x 6	6.30	6	1,010,000	23,933,000	810,000	24,500,000	202,250	625	13.0	10.2	1 ½	386
HD(A) 6.0 x 8	6.30	8	1,354,000	26,586,000	1,080,000	27,000,000	202,250	625	13.0	10.2	1 ½	410
HD(A) 6.0 x 10	6.30	10	1,690,000	29,345,000	1,350,000	30,000,000	202,250	625	13.0	10.2	1 ½	432
HD(A) 6.0 x 12	6.30	12	1,982,000	32,052,000	1,620,000	33,000,000	202,250	625	13.0	10.2	1 ½	456
HD 6.0 x 16	6.30	16	2,708,000	37,465,000	N/A	N/A	202,250	625	13.0	10.2	1 ½	503
HD 6.0 x 20	6.30	20	3,380,000	42,877,000	N/A	N/A	202,250	625	13.0	10.2	1 ½	551
HD 6.0 x 24	6.30	24	4,062,000	53,862,000	N/A	N/A	202,250	625	13.0	10.2	1 ½	681
HD 6.0 x 30	6.30	30	5,070,000	61,928,000	N/A	N/A	202,250	625	13.0	10.2	1 ½	752
HD 6.0 x 36	6.30	36	6,093,000	70,047,000	N/A	N/A	202,250	625	13.0	10.2	1 ½	822
HD 6.0 X 42	6.30	42	7,106,000	78,113,000	N/A	N/A	202,250	625	13.0	10.2	1 ½	893
HD 6.0 x 48	6.30	48	7,125,000	86,232,000	N/A	N/A	178,000	625	13.0	10.2	1 ½	966

Catalog No. (Model)	A	B	D	E	HD F	HDA F	H	HD Y	HDA Y	HD Z	HDA Z	Foot Mount Dimensions FA	FB	FC	FD	FE	FG	FJ	Charge Port Dimensions CA	CB	CC
HD(A) 6.0 x 4	25.1	10.8	3.9	6.3	15.4	15.8	2.0	18.2	18.6	8.3	7.9	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD(A) 6.0 x 6	29.1	10.8	3.9	6.3	17.4	17.8	2.0	20.2	20.6	10.3	9.9	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD(A) 6.0 x 8	33.1	10.8	3.9	6.3	19.4	19.8	2.0	22.2	22.6	12.3	11.9	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD(A) 6.0 x 10	37.1	10.8	3.9	6.3	21.4	21.8	2.0	24.2	24.6	14.3	13.9	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD(A) 6.0 x 12	41.1	10.8	3.9	6.3	23.4	23.8	2.0	26.2	26.6	16.3	15.9	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD 6.0 x 16	49.1	10.8	3.9	6.3	27.4	N/A	2.0	30.2	N/A	20.3	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD 6.0 x 20	57.1	10.8	3.9	6.3	31.4	N/A	2.0	34.2	N/A	24.3	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	7.8	5.7	30°
HD 6.0 x 24	69.7	10.8	3.9	6.3	40.0	N/A	2.0	42.7	N/A	28.4	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	12.3	5.7	30°
HD 6.0 x 30	81.6	10.8	3.9	6.3	46.0	N/A	2.0	48.7	N/A	34.3	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	12.3	5.7	30°
HD 6.0 x 36	93.7	10.8	3.9	6.3	52.0	N/A	2.0	54.7	N/A	40.4	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	12.3	5.7	30°
HD 6.0 x 42	105.6	10.8	3.9	6.3	58.0	N/A	2.0	60.7	N/A	46.3	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	12.3	5.7	30°
HD 6.0 x 48	117.7	10.8	3.9	6.3	64.0	N/A	2.0	66.7	N/A	52.4	N/A	17.7	15.0	1.6	13.1	2.8	6.6	1.4	12.3	5.7	30°

Notes: 1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. All dimensions in inches.
HDA models will function satisfactorily at 10% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified.
2. It is recommended that the customer consult Enidine for safety-related overhead crane applications.
3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact Enidine for sizing assistance.
4. Rear flange mounting of 12 inch strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.

HD(A) 3.0 x 2 → HD(A) 5.0 x 12



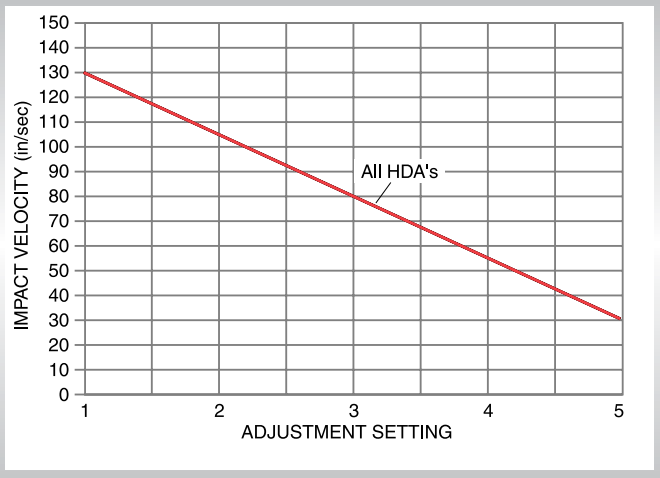
Note: Piston clevis dimensions are typical both ends on HD(A) 4.0 and 5.0 models.

							Cylinder Clevis Dimensions						Piston Clevis Dimensions				
	A	B	D	E	HD F	HDA F	CA	CB	CC	CD	CE	CF	FA	FB	FC	FD	FE
HD(A) 3.0 x 2	17.0	5.1	1.5	3.5	8.2	8.6	2.4	1.5	1.0	1.2	1.5	2.6	2.7	1.3	1.0	3.9	2.0
HD(A) 3.0 x 3	19.0	5.1	1.5	3.5	9.2	9.6	2.4	1.5	1.0	1.2	1.5	2.6	2.7	1.3	1.0	3.9	2.0
HD(A) 3.0 x 5	23.0	5.1	1.5	3.5	11.2	11.6	2.4	1.5	1.0	1.2	1.5	2.6	2.7	1.3	1.0	3.9	2.0
HD(A) 3.0 x 8	29.0	5.1	1.5	3.5	14.2	14.6	2.4	1.5	1.0	1.2	1.5	2.6	2.7	1.3	1.0	3.9	2.0
HD(A) 3.0 x 12	37.0	5.1	1.5	3.5	16.8	17.2	2.4	1.5	1.0	1.2	1.5	2.6	2.7	1.3	1.0	3.9	2.0
HD(A) 4.0 x 2	22.4	7.9	2.6	5.5	12.0	12.4	N/A	N/A	N/A	N/A	N/A	3.5	3.9	2.0	2.0	5.9	3.9
HD(A) 4.0 x 4	26.4	7.9	2.6	5.5	14.0	14.4	N/A	N/A	N/A	N/A	N/A	3.5	3.9	2.0	2.0	5.9	3.9
HD(A) 4.0 x 6	30.4	7.9	2.6	5.5	16.0	16.4	N/A	N/A	N/A	N/A	N/A	3.5	3.9	2.0	2.0	5.9	3.9
HD(A) 4.0 x 8	34.4	7.9	2.6	5.5	18.0	18.4	N/A	N/A	N/A	N/A	N/A	3.5	3.9	2.0	2.0	5.9	3.9
HD(A) 4.0 x 10	38.4	7.9	2.6	5.5	20.0	20.4	N/A	N/A	N/A	N/A	N/A	3.5	3.9	2.0	2.0	5.9	3.9
HD(A) 5.0 x 4	29.6	8.5	2.8	5.9	15.2	15.6	N/A	N/A	N/A	N/A	N/A	3.9	4.5	2.8	2.3	6.9	3.9
HD(A) 5.0 x 6	33.6	8.5	2.8	5.9	17.2	17.6	N/A	N/A	N/A	N/A	N/A	3.9	4.5	2.8	2.3	6.9	3.9
HD(A) 5.0 x 8	37.6	8.5	2.8	5.9	19.2	19.6	N/A	N/A	N/A	N/A	N/A	3.9	4.5	2.8	2.3	6.9	3.9
HD(A) 5.0 x 10	41.6	8.5	2.8	5.9	21.2	21.6	N/A	N/A	N/A	N/A	N/A	3.9	4.5	2.8	2.3	6.9	3.9
HD(A) 5.0 x 12	45.6	8.5	2.8	5.9	23.2	23.6	N/A	N/A	N/A	N/A	N/A	3.9	4.5	2.8	2.3	6.9	3.9

All dimensions in inches.

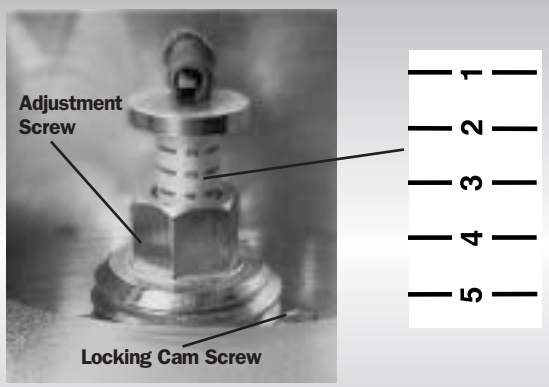
Useable Adjustment Setting Range

HDA



Damping Force

Position 1 provides minimum damping force.
Position 5 provides maximum damping force.



Adjustment is accomplished by turning the adjustment screw. Once the desired setting has been reached, lock in place by tightening the locking cam screw.

After properly sizing an HDA shock absorber, the useable range of adjustment settings can be determined:

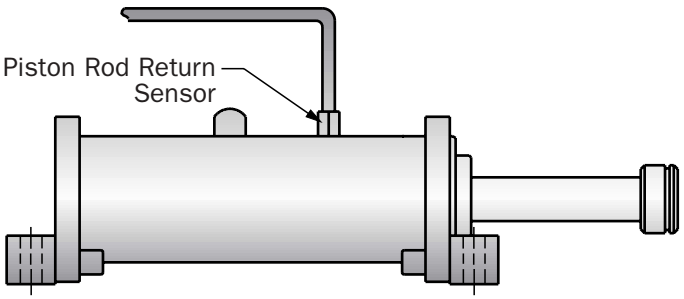
1. Locate the intersection point of the application's impact velocity and the HDA model graph line.
2. The intersection is the maximum adjustment setting to be used. Adjustments exceeding this setting could overload the shock absorber.
3. The useable adjustment setting range is from setting 1 to the MAXIMUM adjustment setting as determined in step 2.

EXAMPLE: HDA Series

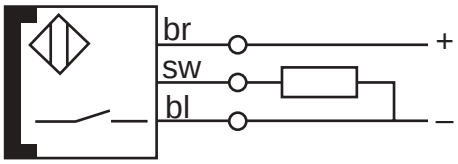
1. Impact Velocity: 80 in./sec.
2. Intersection Point: Adjustment Setting 3
3. Useable Adjustment Setting Range: 1 to 3

Optional Piston Rod Return Sensor

- Magnetic proximity sensor indicates complete piston rod return with 10-foot long cable.
- If complete piston rod does not return the circuit remains open. This can be used to trigger a system shut-off.
- Contact Enidine for other available sensor types.



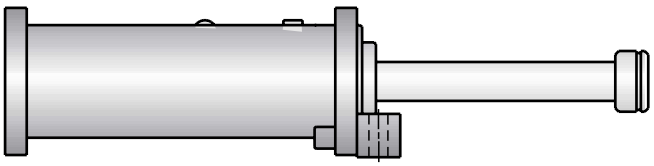
Sensor Specifications



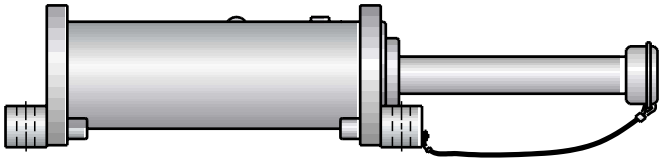
- Voltage 10 - 30V
- Load Current ≤ 200 µA
- Leakage Current ≤ 80 µA
- Load Capacitance ≤ 1.0 µF
- Ambient Temperature: -15° to 160°F

HD/HDA Series Mounting Options

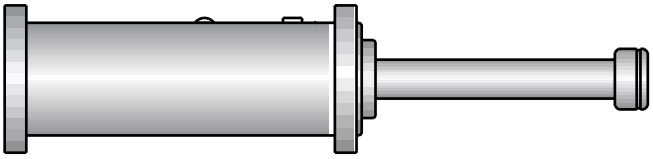
Typical mounting methods are shown below. Special mounting requirements can be accommodated upon request.



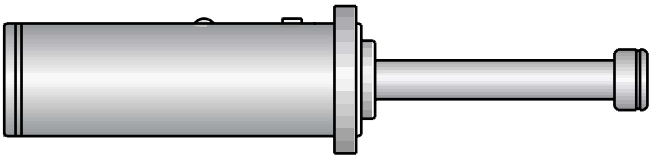
TM: Rear Flange Front Foot Mount



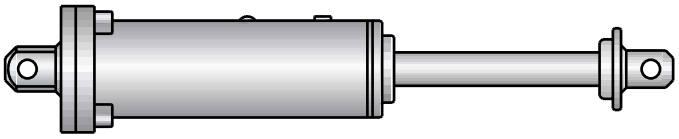
FM: Front and Rear Foot Mount
Also shown is optional safety cable, typically used in overhead applications.



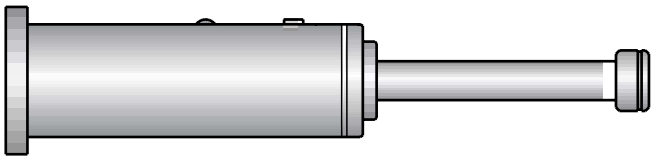
TF: Front and Rear Flanges



FF: Front Flange



CJ: Clevis Mount



FR: Rear Flange

Note: Rear flange mounting not recommended for stroke lengths above 12 inches.

HD/HDA Ordering Information

Note: HD models are custom-orificed, therefore all information must be provided to Enidine for unique part number assignment.

Example:

4
Select quantity

HD 3.0 x 5
Select HD (Non-Adjustable) or HDA (Adjustable) Catalog No. from Engineering Data Chart

TM
Select mounting method
- TM (Rear flange front foot mount)
- FM (Front and rear foot mount)
- TF (Front and rear flanges)
- FF (Front flange)
- FR (Rear flange)
- CJ (Clevis mount)

C
Options
- C (Sensor)
- SC (Safety cable)

APPLICATION DATA
Required for HD models:
- Vertical or horizontal motion
- Weight
- Impact velocity
- Propelling force (if any)
- Cycles/Hr
- Other (temperature or other environmental conditions, safety standards, etc.)

Enidine's Heavy Industry (HI) Series buffers safely protect heavy machinery and equipment during the transfer of materials and movement of products. The large-bore, high-capacity buffers are individually designed to decelerate moving loads under various conditions and in compliance with industry mandated safety standards. Control of bridge cranes, trolley platforms, large container transfer and transportation safety stops are typical installations. Industry-proven design technologies, coupled with the experience of a globally installed product base, ensure deliverable performance that exceeds customer expectations.

The oversize bore area results in optimal energy absorption capabilities and increased internal safety factors. State-of-the-art testing facilities ensure integrity of design and product performance.

Features and Benefits

- *Compact design smoothly and safely decelerates large energy capacity loads up to 4 million in-lbs. per cycle with standard stroke lengths.*
- *Engineered to meet OSHA, AISE, CMMA and other safety specifications such as DIN and FEM.*
- *Nitrogen-charged return system allows for soft deceleration and positive return in a maintenance-free package.*
- *Wide variety of optional configurations including protective bellows and safety cables.*
- *Available in custom-orificed non-adjustable models.*
- *Incorporating optional fluids and seal packages available to expand standard operating temperature range from (0 to 175°F) to (-30° to 250°F).*
- *Surface treatment (Sea water resistant)*
  Housing: gray color, three-part epoxy
  Piston Rod: hard-chrome plated steel
- *Special epoxy painting and rod materials are available for use in highly corrosive environments.*

HI Series buffer models can decelerate loads with varying velocities from 6 in./sec. up to 200 in./sec. (0.15 m/sec. to 5.0 m/sec.).

All models are custom-orificed for specific application requirements.

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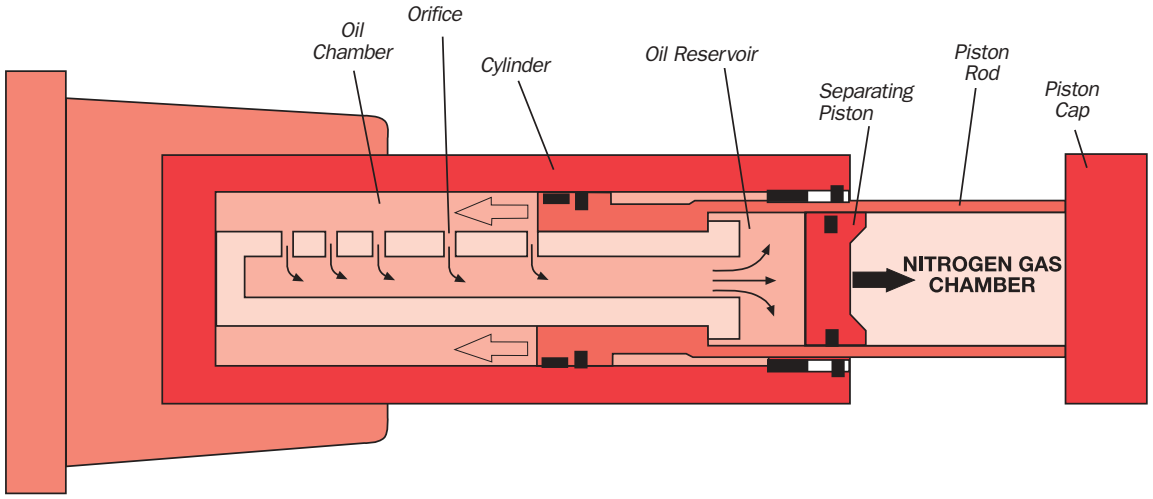
Heavy Industry (HI) Series Buffers

Enidine's Heavy Industry Series (HI) buffers safely protect heavy machinery and equipment during the transfer of materials and movement of products. The large-bore, high-capacity buffers are individually designed to decelerate moving loads under various conditions and in compliance with industry mandated safety standards. Control of bridge cranes, trolley platforms, large container transfer and transportation safety stops are typical installation examples. Industry-proven design technologies, coupled with the experience of a globally installed product base, ensure deliverable performance that exceeds customer expectations.

Prior to HI Series buffer manufacture, computer-simulated response curves are generated to model actual conditions, verify product performance, confirm damping characteristics and generate unique custom-orificed designs that accommodate multi-condition or specific damping requirements.

Characteristics of the HI Series include a nitrogen-charged return system that allows for soft deceleration and positive return in a maintenance-free package. The oversize bore area results in optimal energy absorption capabilities and increased internal safety factors. State-of-the-art testing facilities ensure integrity of design and product performance.



Design Overview

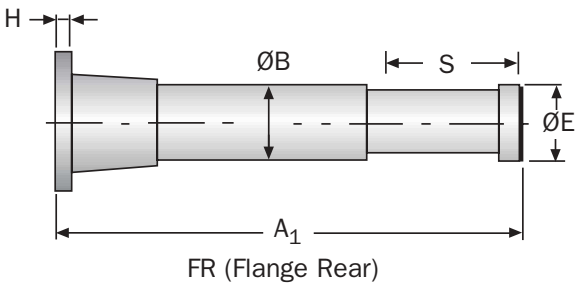
The HI Series buffer design incorporates a proven damping system of multiple orifice patterns drilled down the shock tube length, for precise deceleration profiles, coupled with a nitrogen return system for controlled extension of the piston rod to its original position.

During piston movement, oil is forced through the orifice pattern into the oil reservoir chamber. This controlled movement of a piston head by decreasing the orifice area results in precise decay of impact velocity and safe deceleration of the moving load. The oil volume evacuated from the high pressure chamber moves the separating piston, compensating for the oil differential within the unit.

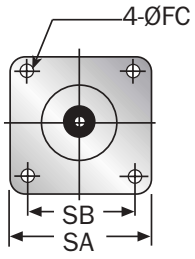
Extension of the piston rod for the next impact is accomplished by the force created from the compressed nitrogen chamber, which acts as both an oil volume compensator and return force mechanism. The pressure created pushes the fluid back into the oil chamber and creates a force to reposition the piston rod to the fully extended position, ready for the next impact sequence. The nitrogen return system enables the HI Series to be designed for the maximum energy absorption within the smallest envelope size.

HI Series

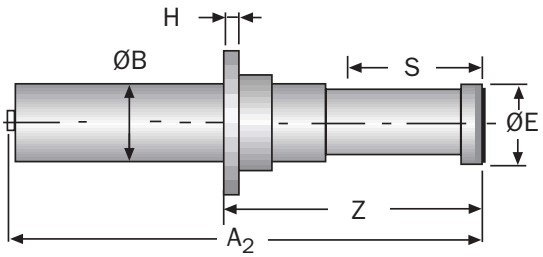
HI 100 x 50 → HI 120 x 1000



FR (Flange Rear)



Mounting Flange

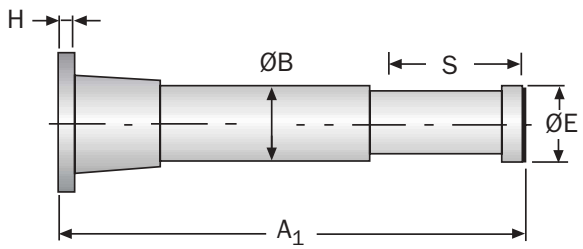


FF (Flange Front)

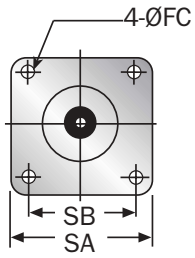
Model	S Stroke (in.)	Max. Energy/cycle (in.-lbs.)	Max. Shock Force (lbs.)	Return Force		Weight (lbs.)	A_1	A_2	Z	H	ØB	SA	SB	ØFC	Rec. BOLT SIZE	ØE
				Extension (lbs.)	Compression (lbs.)											
HI 100 x 50	2	88,500	56,200	370	4,050	36	11.9	11.8	6.9	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 100 x 100	3.9	177,000	56,200	370	4,050	49	18.9	18.6	9.7	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 100 x 150	5.9	265,500	56,200	370	4,050	24.3	24.1	11.8	0.8	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 100 x 200	7.9	354,000	56,200	370	4,050	71	29.8	29.5	15.4	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 100 x 500	19.7	831,900	52,800	370	4,050	115	N/A	63.6	35.0	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 100 x 600	23.6	991,200	51,700	370	4,050	128	N/A	74.3	40.9	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 100 x 800	31.5	1,168,200	46,085	370	4,050	152	N/A	95.5	52.9	0.8	3.93	5.90	4.72	0.70	5/8	3.89
HI 120 x 100	3.9	283,200	89,920	630	11,250	75	18.5	18.4	10.6	0.8	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 150	5.9	424,800	89,920	630	11,250	86	23.5	23.3	13.0	0.8	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 200	7.9	566,400	89,920	630	11,250	95	28.5	28.3	15.4	0.8	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 300	11.8	831,900	89,920	630	11,250	117	38.3	38.1	20.5	0.8	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 400	15.7	1,106,300	89,920	630	11,250	192	48.2	48.1	26.8	1.0	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 600	23.6	1,663,900	89,920	630	11,250	232	N/A	67.9	36.0	1.0	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 800	31.5	1,991,250	78,630	630	11,250	242	N/A	91.8	50.8	1.0	4.72	8.66	6.69	1.03	1	4.68
HI 120 x 1000	39.4	2,301,000	73,060	630	11,250	255	N/A	111.6	61.4	1.0	4.72	8.66	6.69	1.03	1	4.68

All dimensions in inches.

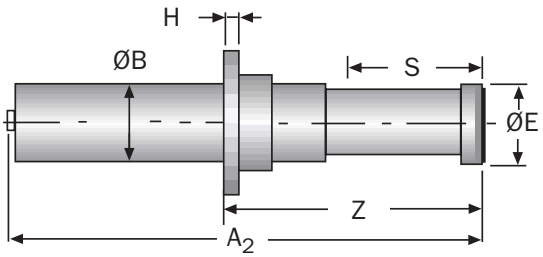
HI 130 x 250 → HI 150 x 1000



FR (Flange Rear)



Mounting Flange



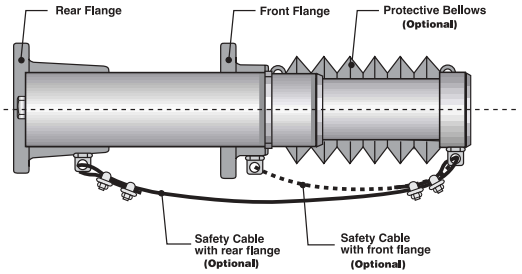
FF (Flange Front)

Model	S Stroke (in.)	Max. Energy/cycle (in.-lbs.)	Max. Shock Force (lbs.)	Return Force		Weight (lbs.)	A_1	A_2	Z	H	ØB	SA	SB	ØFC	Rec. BOLT SIZE	ØE
				Extension (lbs.)	Compression (lbs.)											
HI 130 x 250	9.8	885,000	112,400	720	14,400	159	35.3	35.2	21.5	1.0	5.12	10.62	8.26	1.03	1	5.07
HI 130 x 300	11.8	1,062,000	112,400	720	14,400	175	40.5	40.3	23.8	1.0	5.12	10.62	8.26	1.03	1	5.07
HI 130 x 400	15.7	1,416,100	112,400	720	14,400	199	50.9	50.8	28.9	1.0	5.12	10.62	8.26	1.03	1	5.07
HI 130 x 600	23.6	1,853,500	97,790	720	14,400	263	N/A	75.5	41.7	1.0	5.12	10.62	8.26	1.03	1	5.07
HI 130 x 800	31.5	2,388,500	94,415	720	14,400	308	N/A	96.3	53.2	1.0	5.12	10.62	8.26	1.03	1	5.07
HI 150 x 115	4.5	548,700	150,600	1,125	21,600	124	20.3	20.2	12.6	0.8	5.90	10.62	8.26	1.03	1	5.86
HI 150 x 150	5.9	725,700	150,600	1,125	21,600	130	23.9	23.7	13.9	0.8	5.90	10.62	8.26	1.03	1	5.86
HI 150 x 400	15.7	1,947,000	150,600	1,125	21,600	216	49.2	49.0	27.9	1.0	5.90	10.62	8.26	1.03	1	5.86
HI 150 x 500	19.7	2,433,900	150,600	1,125	21,600	243	N/A	58.9	30.3	1.0	5.90	10.62	8.26	1.03	1	5.86
HI 150 x 600	23.6	2,920,700	150,600	1,125	21,600	265	N/A	68.9	34.4	1.0	5.90	10.62	8.26	1.03	1	5.86
HI 150 x 800	31.5	3,965,100	157,360	1,125	21,600	364	N/A	90.8	48.8	1.4	5.90	10.62	8.26	1.03	1	5.86
HI 150 x 1000	39.4	4,513,500	142,750	1,125	21,600	397	N/A	113.4	62.8	1.4	5.90	10.62	8.26	1.03	1	5.86

All dimensions in inches.

HI Series Ordering Information

Mounting bracket flange:
Standard: Rear or Front mount



Example:

4
Select quantity

HI 120 x 100
Select HI Series model from Engineering Data Chart

FR
Select mounting method
- FF (Flange Front)
- FR (Flange Rear)

B
Additional Options
- B Protective Bellows
- C Safety cable

APPLICATION DATA
Required for all models:
- Vertical/Horizontal Motion
- Weight
- Impact Velocity
- Propelling Force (if any)
- Cycles/Hour
- Temperature/Environment
- Applicable Standards

Enidine Rate Controls are designed to regulate the speed and time required for a mechanism to move from one position to another. Adjustable and non-adjustable models are available to accommodate a wide variety of motion control applications. Both single and double acting hydraulic damper designs allow smooth, controllable machine operation by providing rate control for both linear and rotational (hinged) loads. Each product family offers a variety of stroke lengths from which to choose.

Features and Benefits

- *Extensive product line offers flexibility in both size and load capacities to fulfill a wide range of application requirements.*
- *ISO quality standards result in reliable, long-life operation.*
- *A select variety of surface finishes maintains original quality appearance and provides the longest corrosion resistance protection.*
- *Custom stroke lengths and damping characteristics can be designed to suit your application requirements.*
- *Incorporating optional fluids can expand the standard operational temperature range from (15°F to 180°F) to (–30°F to 210°F).*
- *Special materials and finishes available to meet specific customer requirements.*

Adjustable, Double Acting (ADA 500 and ADA 700 Series) *rate controls regulate speed in both tension and/or compression modes independently. ADA products let the user adjust the rate to suit specific application requirements. Fixed orifice interchangeable cartridges are available for the ADA 500 Series, which provide tamperproof operation once the desired rate has been determined. An optional remote adjustment cable provides adjustment control in otherwise inaccessible locations for the ADA 500 Series.*

Pages 71-75

*The **DA Series** are non-adjustable, custom-orificed at factory, double acting rate controls which provide smooth, reliable motion control for high load capacities.*

Tow Bar (TB) snubbers are specially designed DA's which dampen the abrupt starts and stops of power and free conveying systems.

Page 76

Use this Enidine Product Selection Guide to quickly locate potential rate control models most suited for your requirements.

ADJUSTABLE RATE CONTROLS

Catalog No. (Model)	(S) Stroke (in.)	(F_D) Max. Propelling Force		(E_TC) Max. in.-lbs./hour	Page No.
		Tension (lbs.)	Compression (lbs.)		
ADA 505	2.00	450	450	650,000	71
ADA 510	4.00	450	375	850,000	71
ADA 515	6.00	450	300	1,050,000	71
ADA 520	8.00	450	200	1,250,000	71
ADA 525	10.00	450	125	1,450,000	71
ADA 705	2.00	2,500	2,500	1,100,000	74
ADA 710	4.00	2,500	2,500	1,400,000	74
ADA 715	6.00	2,500	2,500	1,800,000	74
ADA 720	8.00	2,500	2,500	2,100,000	74
ADA 725	10.00	2,500	2,500	2,500,000	74
ADA 730	12.00	2,500	2,500	2,800,000	74
ADA 735	14.00	2,500	2,500	3,200,000	74
ADA 740	16.00	2,500	2,500	3,500,000	74
ADA 745	18.00	2,500	2,000	3,900,000	74
ADA 750	20.00	2,500	1,700	4,200,000	74
ADA 755	22.00	2,500	1,400	4,600,000	74
ADA 760	24.00	2,500	1,200	4,900,000	74
ADA 765	26.00	2,500	1,000	5,300,000	74
ADA 770	28.00	2,500	900	5,600,000	74
ADA 775	30.00	2,500	800	6,000,000	74
ADA 780	32.00	2,500	700	6,300,000	74

NON-ADJUSTABLE RATE CONTROLS

Catalog No. (Model)	(S) Stroke (in.)	(F_D) Max. Propelling Force		(E_TC) Max. in.-lbs./hour	Page No.
		Tension (lbs.)	Compression (lbs.)		
DA 50 x 2	2.00	2,500	2,500	1,400,000	76
DA 50 x 4	4.00	2,500	2,500	1,700,000	76
DA 50 x 6	6.00	2,500	2,500	2,000,000	76
DA 50 x 8	8.00	2,500	2,500	2,300,000	76
DA 75 x 2	2.00	5,000	5,000	2,700,000	76
DA 75 x 4	4.00	5,000	5,000	3,100,000	76
DA 75 x 6	6.00	5,000	5,000	3,600,000	76
DA 75 x 8	8.00	5,000	5,000	4,100,000	76
DA 75 x 10	10.00	5,000	5,000	4,500,000	76
TB 100 x 4*	4.00	10,000	10,000	4,400,000	76
TB 100 x 6*	6.00	10,000	10,000	4,400,000	76

*Note: Tow Bar (TB) snubbers are specially designed DA's which dampen the abrupt starts and stops of power and free conveying systems.

Rate Controls Sizing

1. Determine the damping direction (tension [T], compression [C] or both [T and C]), stroke (in.) required, propelling force (lbs.), desired velocity (in./sec.) and cycles per hour.

2. Calculate total energy per hour (in-lbs./hr).

3. Compare the damping direction (T, C, or T and C), stroke (in.) required, propelling force (lbs.) and total energy per hour (in-lbs./hr) to the values listed in the Rate Controls Engineering Data charts.

NOTE: Propelling force and velocity should be measured at the location of the rate control.

4. Determine if adjustable or non-adjustable model is desired.

5. Select the appropriate rate control model.
A. For adjustable rate control models, refer to the Useable Adjustment Settings section for the selected model to determine the proper adjustment setting.
B. For non-adjustable rate control models, refer to the Damping Constant Selection Instructions for the selected model to determine the proper damping constant.

Example:

1. Damping Direction (T, C or T and C): T and C
Stroke (S): 4 in.
Propelling Force (F_D): 200 lbs. (T and C)
Velocity (V): 8 in./sec.
Cycles/Hour (C): 20

2. Total Energy/Hour (in-lbs./hr): 16,000 in-lbs./hr compression
16,000 in-lbs./hr tension
32,000 in-lbs./hr Total

3. Compare damping direction (T and C), stroke (4 in.), propelling force (200 lbs.) and total energy per hour (32,000 in-lbs./hr), to the values listed in the rate controls engineering data charts (pages 71-76).

4. An adjustable model is desired.

5. Selection: ADA 510 TC
The proper adjustment is two (2) in tension and compression per the ADA 500 Series Useable Adjustment Setting Range Curves (page 72).

Design Profiles

Enidine Rate Controls are used to regulate the speed or time required for a mechanism to move from one position to another. They use proven technology to enhance performance in a variety of product applications. Rate controls are typically used to control pneumatic cylinders, linear slides, lids, and other moving mechanisms.

The advantages of using rate controls include:

1. Longer Machine Life – The use of rate controls significantly reduces shock and vibration to machinery caused by uncontrolled machine operation. This further reduces machinery damage, downtime and maintenance costs, while increasing machine life.

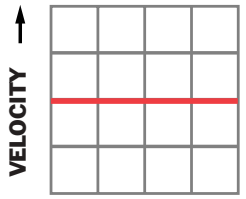
2. Improved Production Quality – Harmful effects of uncontrolled motion, such as noise, vibration and damaging impacts, are moderated or eliminated so that production quality is improved.

3. Safer Machinery Operation – Rate controls protect machinery and equipment operators by offering predictable, reliable and controlled machine operation.

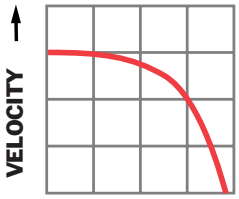
4. Competitive Advantage – Machines and end products become more valuable because of increased productivity, longer life, lower maintenance and safer operation.

Enidine offers a wide range of rate controls that provide motion control in tension, compression, or both directions. Adjustable and non-adjustable tamperproof models are available to fit your particular application requirements.

The resisting force provided by Enidine rate controls is typically constant over the entire stroke when the piston rod is moved at a constant velocity, since the rate controls are single orifice products. DA Series models (see page 76) can be custom orificed to provide increasing resisting force over the stroke through the use of multiple orifices in the shock tube. This can be beneficial when controlling the velocity of a lid as it closes, since the torque from the weight of the lid changes as it closes.



SINGLE ORIFICE RATE CONTROL
CONSTANT FORCE OPERATION



MULTIPLE ORIFICE RATE CONTROL
CONSTANT FORCE OPERATION

Rate Control Adjustment Techniques

A properly adjusted rate control safely controls machinery operation, and reduces noise levels from uncontrolled motion. To correctly adjust the rate control after it has been properly sized for the application, set the adjustment knob (per the useable adjustment setting graphs on pages 72 and 75) for the applicable model. Cycle the mechanism and observe the motion of the system.

If the motion of the mechanism is too fast, move the adjustment dial to the next largest number until the desired velocity is achieved.

If the motion of the mechanism is too slow, move the adjustment dial to the next smallest number until the desired velocity is achieved.

Selecting the Proper Enidine Rate Control

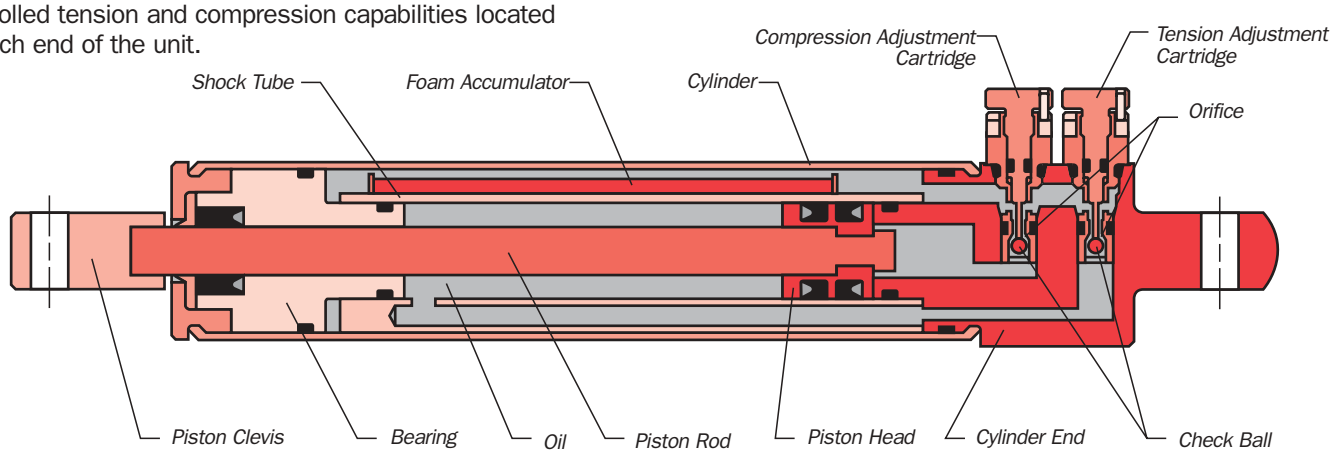
1. When sizing a rate control, determine the velocity and drive force at the rate control.
2. Do not bottom the rate control in tension or compression. Provide an external positive stop.
3. Environment (ambient temperature, corrosive conditions, etc.) must be considered.
4. When both tension and compression rate control are required, select an ADA or DA model, which can accommodate your specific application requirement.
5. For hard-to-reach applications which require adjustment, a remote adjustment cable is available with the ADA 500 Series.

Adjustable, Double Acting (ADA Series) Rate Controls

Enidine Double Acting Adjustable (ADA) rate controls control the velocity of both linear and rotational loads throughout their entire motion. Adjustment cartridges on the ADA 500 Series allow flexibility in controlling the speed for an applied force in both the tension and compression directions. Maximum damping is achieved by turning the adjustment knob to the number eight (8) setting, while turning the knob to the zero (0) setting provides minimal resistance. Interchangeable, threaded, fixed-orifice cartridges can provide consistent, tamper-resistant damping to meet particular application requirements.

The ADA 500 Series utilizes two independent adjustment cartridges for motion control in each direction, housed in the cylinder end. The ADA 700 Series has independently controlled tension and compression capabilities located at each end of the unit.

Resistance is controlled by using a wrench key at either end of the rate control and adjusting the movement by following the stiffer (+) or softer (-) indications. When the rate control is compressed, the oil is orificed through the compression adjustment cartridge and flows freely through the tension adjustment cartridge. The tension cartridge check ball unseats and allows free flow of the oil to the rod end of the shock tube. A foam accumulator is utilized to accept the volume of oil displaced by the piston rod. When the rate control is extended, oil is moved through an internal flow path in the shock tube and is orificed through the tension adjustment cartridge. The compression cartridge check ball unseats and allows free flow of the oil into the blind end of the shock tube.

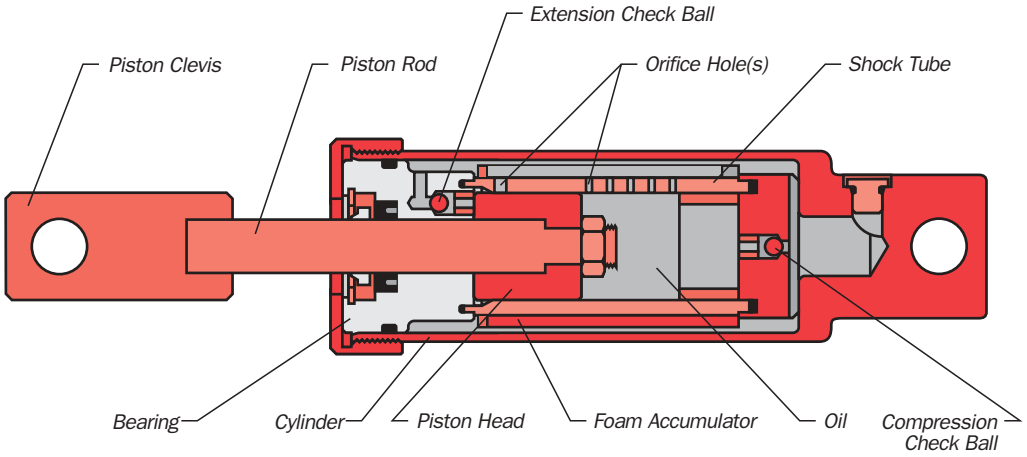


Non-Adjustable, Double Acting (DA Series) Rate Controls

DA Series rate controls are ideally suited for high-energy, heavy load applications requiring rate control in tension, compression or both directions. These non-adjustable, custom-orificed units are designed to specific input conditions, and allow for single and multiple orifice configurations.

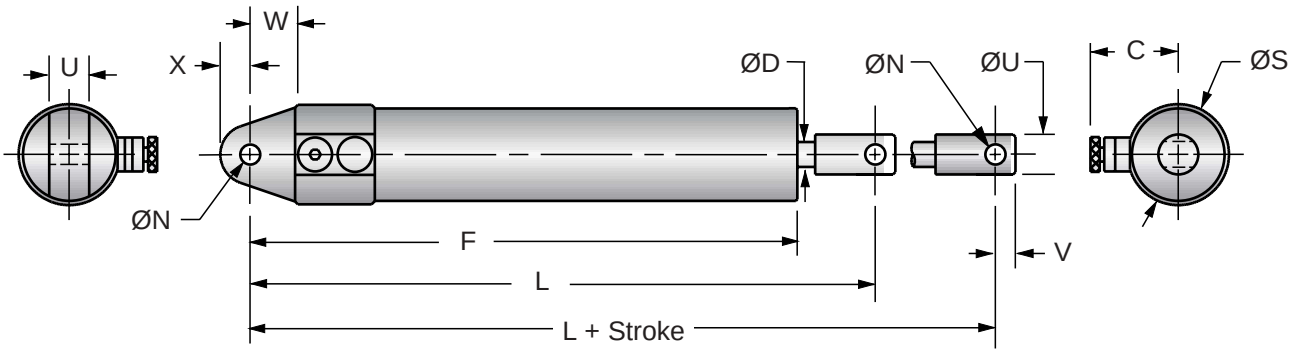
Upon compression of the rate control, the compression check ball seats. As the piston head moves, oil is forced through the orifice hole(s) located in the shock tube, producing the required damping force. After the oil has passed through the orifice hole(s), a portion of the oil passes through the extension check valve and fills the rod end of the shock tube. The remainder of the oil volume displaced by the piston rod compresses the foam accumulator.

Upon extension of the rate control, the extension check ball seats. As the piston head moves, oil is forced through the orifice hole(s) located in the shock tube producing the required damping force. The compression check ball is unseated by the flow of oil which fills the blind end of the shock tube.



ADA 500 Series

ADA 505 → ADA 525



Catalog No. (Model)	Damping Direction	Bore Size (in.)	(S) Stroke (in.)	(F_D) Max. Propelling Force		(E_TC) Max. in.-lbs./hour	Model Weight
				Extension (lbs.)	Compression (lbs.)		
ADA 505	T, C or T and C	.63	2	450	450	650,000	11.0 oz.
ADA 510	T, C or T and C	.63	4	450	375	850,000	13.0 oz.
ADA 515	T, C or T and C	.63	6	450	300	1,050,000	1.0 lb.
ADA 520	T, C or T and C	.63	8	450	200	1,250,000	1.1 lbs.
ADA 525	T, C or T and C	.63	10	450	125	1,450,000	1.3 lbs.

Catalog No. (Model)	C	D	F	N +.005/-.000	L	U +.000/-.015	S	V	W	X	(S) Stroke (in.)	Damping Direction
ADA 505	1.06	.31	6.87	7.81	.251	1.25	.500	.25	.563	.375	2	T, C or T and C
ADA 510	1.06	.31	8.87	9.81	.251	1.25	.500	.25	.563	.375	4	T, C or T and C
ADA 515	1.06	.31	10.87	11.81	.251	1.25	.500	.25	.563	.375	6	T, C or T and C
ADA 520	1.06	.31	12.87	13.81	.251	1.25	.500	.25	.563	.375	8	T, C or T and C
ADA 525	1.06	.31	14.87	15.81	.251	1.25	.500	.25	.563	.375	10	T, C or T and C

All dimensions in inches.

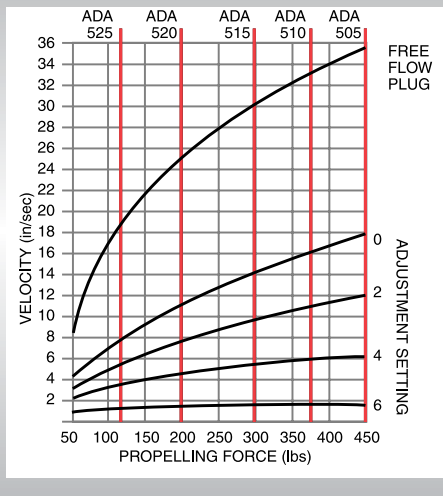
Useable Adjustment Setting Range

Red lines are model's maximum allowable propelling force.

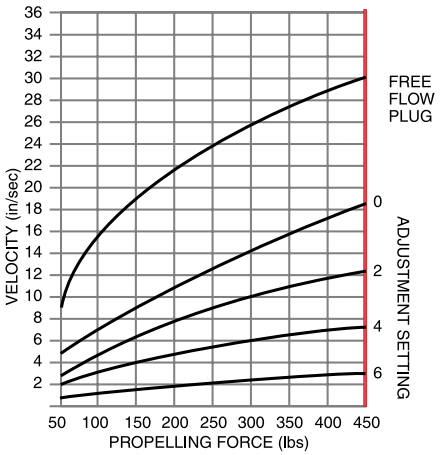
Damping Force

ADA 500

Compression Mode Adjustment Setting Curve



Tension Mode Adjustment Setting Curve



Position 0 provides minimum damping force.
Position 8 provides maximum damping force.
180° adjustment with setscrew locking.

After properly sizing the ADA as described on page 68, the adjustment setting can be determined.

1. To determine the approximate adjustment setting when the selected model, propelling force, and velocity are known: compare velocity to the propelling force in the compression and/or tension mode adjustment setting curves. The intersection point of the velocity and the propelling force is the approximate adjustment setting to be used. Adjustment higher or lower than this setting will result in slower or faster damper operation, respectively.

2. To determine the velocity when the selected model, adjustment setting, and propelling force are known: compare the propelling force to the adjustment setting in the compression and/or tension mode adjustment setting curves. The intersection point of the propelling force and the adjustment setting is the approximate velocity for the selected model. Higher velocities are obtained at lower adjustment settings and lower velocities are obtained at higher adjustment settings.

EXAMPLE: Double Acting Application

Stroke required:	2 in.
Control direction:	Tension and Compression
Propelling force:	350 lbs. (tension), 400 lbs. (compression)
Selection:	ADA 505
1. Velocity:	11 in./sec. (tension), 6 in./sec. (compression)
Intersection point:	Adjustment setting 2 (tension), 4 (compression)
2. Adjustment setting:	2 (tension), 4 (compression)
Velocity:	11 in./sec. (tension), 6 in./sec. (compression)

NOTE: When a free flow plug is used, the intersection point of the propelling force and free flow plug curve determines the velocity.

NOTE: Propelling force and velocity should be measured at the location of the rate control.

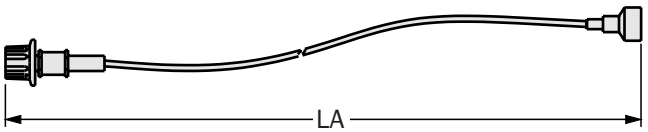
RATE CONTROLS

Accessories

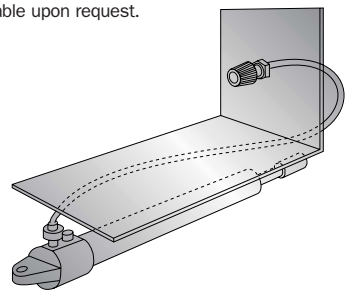
Enidine will custom fit a remote adjustment cable for applications where the ADA unit will be mounted in non-accessible locations. Contact Enidine for more information.

Remote Adjustment Cable

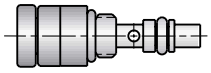
Note: If rotary application, please complete application worksheet on page 81 and forward to Enidine.



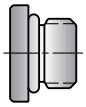
Standard remote adjustment cable length is 48". Optional lengths available upon request.
Note: Remote adjustment cable can be used in a single position only.



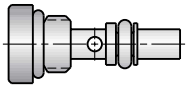
Adjustable Cartridge



Free Flow Plug



Non-Adjustable Cartridge



Catalog No.	Part Number	Accessory Description	LA	Weight
RAC48	1K495748	Remote Adjustment Cable	48	7 oz
			Notes	
RAC4957	AJ4957325	Adjustable Cartridge		
NAC "x"	NJ"x"4957327	Non-Adjustable Cartridge (0-6)	"x" specify desired setting "0-6." May be used in place of adjustable cartridge.	
CW4957	2L4957302	Cartridge Wrench	For installing adjustable and non-adjustable cartridges.	
FFP4957	PA4957326	Free Flow Plug	Provides least amount of damping force for ADA Models.	

All dimensions in inches.

Ordering Information

Example:

10 — Select quantity

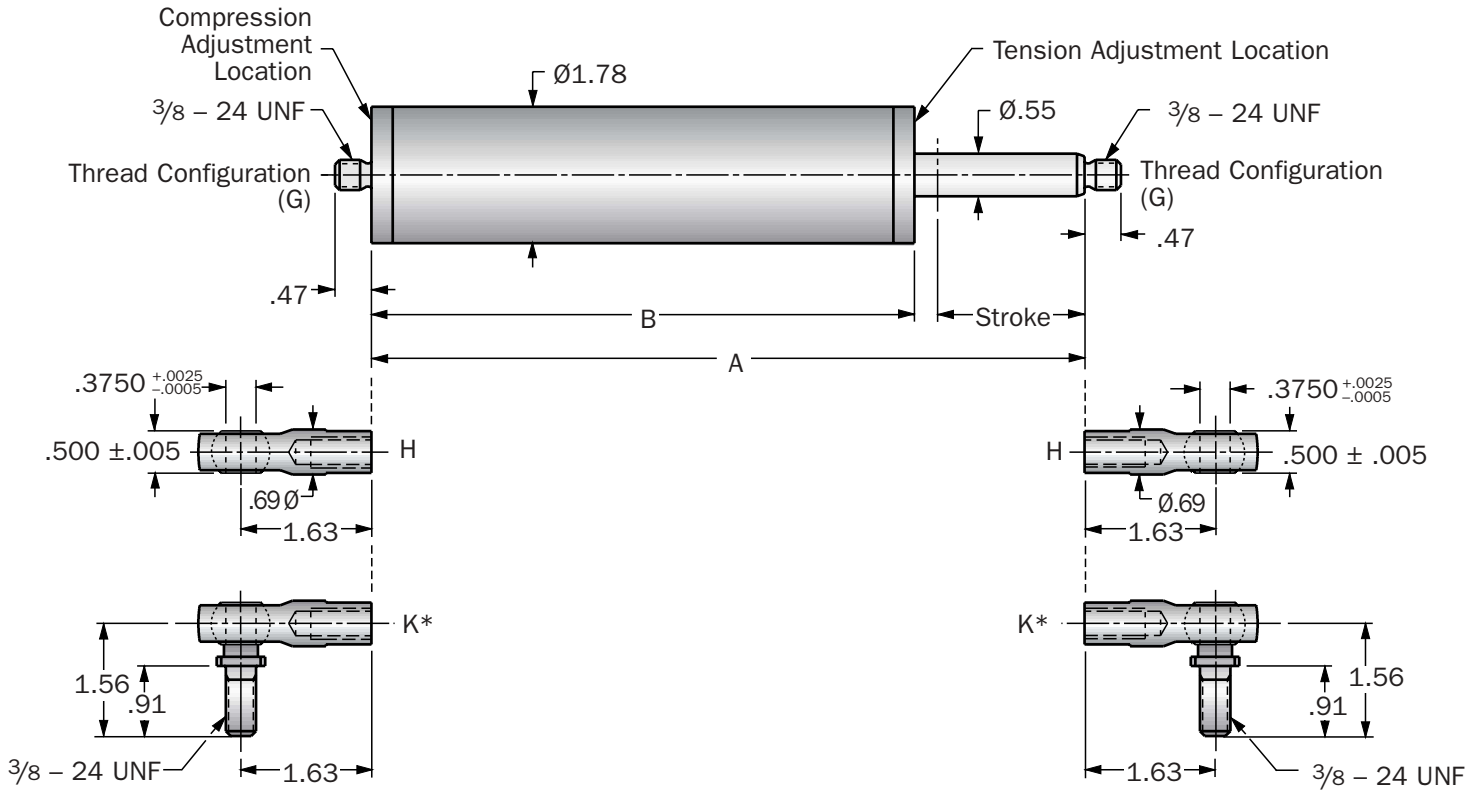
ADA 505 — Select Catalog No. from Engineering Data chart or Accessory chart

T4 — Select Tension Mode
- •T Adjustable
- •T (0-6) Non-Adjustable*
- •P Free Flow

C — Select Compression Mode
- •C Adjustable
- •C (0-6) Non-Adjustable*
- •P Free Flow

*Note: Select adjustment setting (from Adjustment Setting Curve[s]) to be duplicated in non-adjustable cartridge.

ADA 705 → ADA 780



Catalog No. (Model)	Damping Direction	Bore Size (in.)	(S) Stroke (in.)	(F_D) Max. Propelling Force		(E_TC) Max in.-lbs./hour	Model Weight (oz.)	A	B
				Tension (lbs.)	Compression (lbs.)				
ADA 705	T, C or T and C	.98	2	2,500	2,500	1,100,000	3.5	9.35	7.10
ADA 710	T, C or T and C	.98	4	2,500	2,500	1,400,000	4.4	13.35	9.10
ADA 715	T, C or T and C	.98	6	2,500	2,500	1,800,000	5.1	17.35	11.10
ADA 720	T, C or T and C	.98	8	2,500	2,500	2,100,000	5.7	21.30	13.10
ADA 725	T, C or T and C	.98	10	2,500	2,500	2,500,000	6.4	25.30	15.10
ADA 730	T, C or T and C	.98	12	2,500	2,500	2,800,000	7.1	29.35	17.10
ADA 735	T, C or T and C	.98	14	2,500	2,500	3,200,000	7.9	33.35	19.10
ADA 740	T, C or T and C	.98	16	2,500	2,500	3,500,000	8.6	37.30	21.10
ADA 745	T, C or T and C	.98	18	2,500	2,000	3,900,000	9.3	41.30	23.10
ADA 750	T, C or T and C	.98	20	2,500	1,700	4,200,000	9.9	45.30	25.10
ADA 755	T, C or T and C	.98	22	2,500	1,400	4,600,000	10.6	49.35	27.10
ADA 760	T, C or T and C	.98	24	2,500	1,200	4,900,000	11.5	53.35	29.10
ADA 765	T, C or T and C	.98	26	2,500	1,000	5,300,000	12.1	57.35	31.10
ADA 770	T, C or T and C	.98	28	2,500	900	5,600,000	12.8	61.30	33.10
ADA 775	T, C or T and C	.98	30	2,500	800	6,000,000	13.4	65.30	35.10
ADA 780	T, C or T and C	.98	32	2,500	700	6,300,000	14.3	69.35	37.10

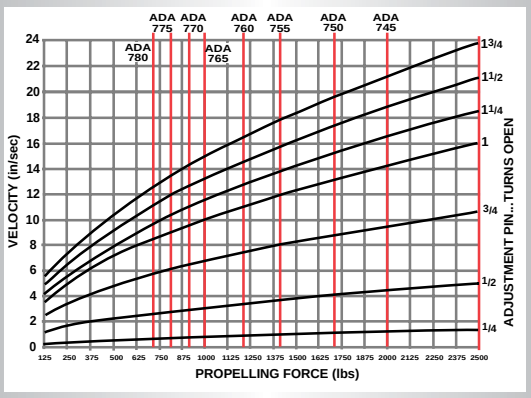
*Note: The maximum load capacity for mounting option K is 650 lbs.

All dimensions in inches.

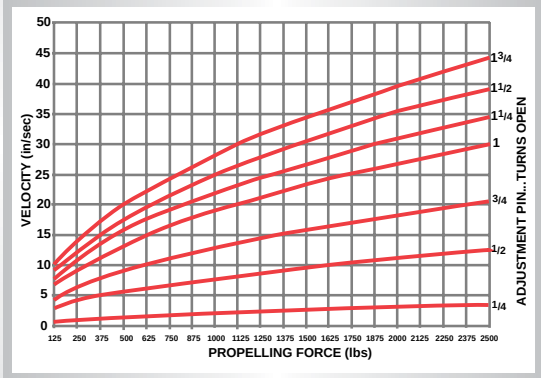
ADA 700 Series

Useable Adjustment Setting Range
Red lines are model's maximum allowable propelling force.

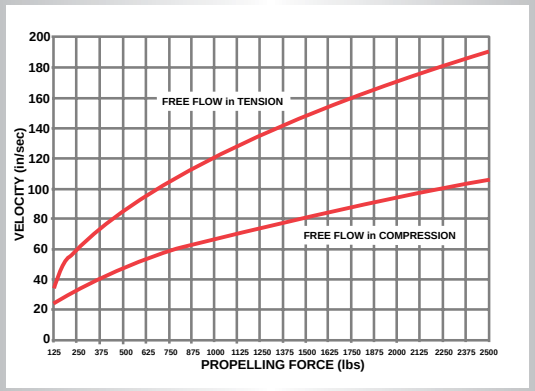
Compression



Tension



Free Flow



Damping Force

Turn adjustment pin 1 3/4 turns open to provide minimum damping force. Turn adjustment pin fully closed to provide maximum damping force.

After properly sizing the ADA as described on page 68, the adjustment setting can be determined.

1. To determine the approximate adjustment setting, when the selected model, propelling force, and velocity are known, compare velocity to the propelling force in the compression and/or tension mode adjustment setting curves. The intersection point of the velocity and the propelling force is the approximate adjustment setting to be used. Adjustment lower or higher than this setting will result in slower or faster damper operation respectively.
2. To determine the velocity, when the selected model, adjustment setting, and propelling force are known, compare the propelling force to the adjustment setting in the compression and/or tension mode adjustment setting curves. The intersection point of the propelling force and the adjustment setting is the approximate velocity for the selected model. Higher velocities are obtained at higher adjustment settings and lower velocities are obtained at lower adjustment settings.
3. A 1.5mm Hex Wrench (provided) is required to adjust the unit.

NOTE: When a free flow plug is used, the intersection point of the propelling force and free flow plug curve determines the velocity.

EXAMPLE: Adjustable Double Acting Rate Control Application

Stroke required:	6 in.
Control direction:	Tension and Compression
Propelling force:	1,000 lbs. (tension), 1,625 lbs. (compression)
Selection:	ADA 715
1. Velocity:	25 in./sec. (tension), 4 in./sec. (compression)
Intersection point:	Adjustment setting 1 1/2 (tension), 1/2 (compression)
2. Adjustment setting:	1 1/2 (tension), 1/2 (compression)
Velocity:	25 in./sec. (tension), 4 in./sec. (compression)

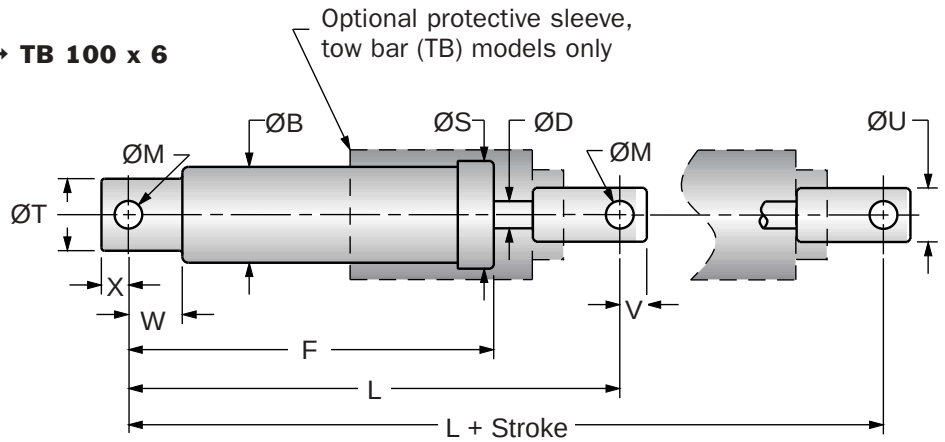
NOTE: Propelling force and velocity should be measured at the location of the rate control.

ADA 700 Ordering Information

Example:

10	ADA 770	T	C	H	K
Select quantity	Model Designation	Tension Mode: Adjustable (P = Free Flow)	Compression Mode: Adjustable (P = Free Flow)	G - Threaded Only H - Swivel Bearing K - Knee Joint	G - Threaded Only H - Swivel Bearing K - Knee Joint

DA 50 x 2 → TB 100 x 6



Catalog No. (Model)	Damping Direction	Bore Size (in.)	(S) Stroke (in.)	(F_D) Max. Propelling Force (lbs.)	(E_T) Max. in.-lbs./cycle	(E_TC) Max. in-lbs/hr	Model Weight (lbs.)
DA 50 x 2	T, C or T and C	1.13	2	2,500	5,000	1,400,000	3.5
DA 50 x 4	T, C or T and C	1.13	4	2,500	10,000	1,700,000	5.0
DA 50 x 6	T, C or T and C	1.13	6	2,500	15,000	2,000,000	6.5
DA 50 x 8	T, C or T and C	1.13	8	2,500	20,000	2,300,000	8.0
DA 75 x 2	T, C or T and C	1.50	2	5,000	10,000	2,700,000	25.0
DA 75 x 4	T, C or T and C	1.50	4	5,000	20,000	3,100,000	29.0
DA 75 x 6	T, C or T and C	1.50	6	5,000	30,000	3,600,000	33.0
DA 75 x 8	T, C or T and C	1.50	8	5,000	40,000	4,100,000	37.0
DA 75 x 10	T, C or T and C	1.50	10	5,000	50,000	4,500,000	41.0
TB 100 x 4	T and C	2.25	4	10,000	40,000	4,400,000	32.0
TB 100 x 6	T and C	2.25	6	10,000	60,000	4,400,000	32.0

Catalog No. (Model)	B	D	F	L	M ±.015	S	T ±.015	U ±.010	V	W	X	(S) Stroke (in.)
DA 50 x 2	2.00	0.56	7.59	9.98	.578	2.25	1.50	1.125	.56	1.13	.56	2
DA 50 x 4	2.00	0.56	9.59	11.98	.578	2.25	1.50	1.125	.56	1.13	.56	4
DA 50 x 6	2.00	0.56	11.59	13.98	.578	2.25	1.50	1.125	.56	1.13	.56	6
DA 50 x 8	2.00	0.56	13.59	15.98	.578	2.25	1.50	1.125	.56	1.13	.56	8
DA 75 x 2	3.00	0.75	9.58	13.75	.765	3.38	2.00	1.500	.81	1.50	.75	2
DA 75 x 4	3.00	0.75	11.58	15.75	.765	3.38	2.00	1.500	.81	1.50	.75	4
DA 75 x 6	3.00	0.75	13.58	17.75	.765	3.38	2.00	1.500	.81	1.50	.75	6
DA 75 x 8	3.00	0.75	15.58	19.75	.765	3.38	2.00	1.500	.81	1.50	.75	8
DA 75 x 10	3.00	0.75	17.58	21.75	.765	3.38	2.00	1.500	.81	1.50	.75	10
TB 100 x 4	2.75	1.00	18.88	24.25**	.750	3.25*	2.50	1.500	.75	1.75	.75	4
TB 100 x 6	2.75	1.00	18.88	22.25**	.750	3.25*	2.50	1.500	.75	1.75	.75	6

Notes: 1. DA Models will function at 10% of their maximum rated energy per cycle. If less than 10%, a smaller model should be specified.
2. Provide a positive stop .12 in. before end of stroke in tension and compression to prevent internal bottoming.
3. For optimal performance in vertical applications using compression, mount the rate control with the piston rod down.
4. * ØS indicates outside diameter of optional protective sleeve for TB models.
5. ** Dimension L is controlled by a 2.0 in. stroke limiter.

All dimensions in inches.

DA Model Sizing and Ordering Information

All DA Models are custom orificed. Application data must be supplied when ordering (see application worksheet, page 81)

Please provide all application data for unique part number assignment.

Example: **10** **DA 50 X 2**

Select quantity

Select Catalog No. from Engineering Data chart

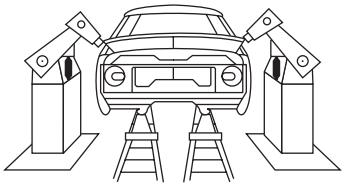
APPLICATION DATA

Specify for damping in tension, compression or both, as applicable:
- Vertical, Horizontal or Rotary† Motion
- Propelling Force
- Other (temperature, environmental conditions, etc.)
- Velocity
- Cycles per Hour
- Weight

NOTE: Propelling force and velocity should be measured at the location of the rate control.

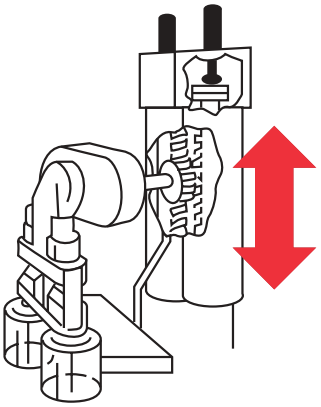
Application Examples

The following are examples of shock absorber and rate control applications:



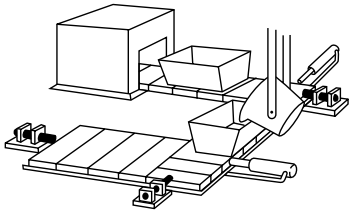
AUTOMOTIVE – ROBOTICS

Low Range OEM shock absorbers, mounted close to the pivot point of body side assembly robots, control high drive forces for precise robot positioning and improved assembled product quality.



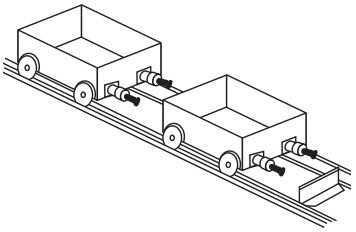
GLASS FORMING EQUIPMENT

A single OEM adjustable shock absorber replaces three distinct non-adjustable units, to cushion the high velocity motion of the take out-out, take out-in, and blow head positions of a glass forming machine. The single unit simplifies installation, reduces inventory costs and improves machine uptime.



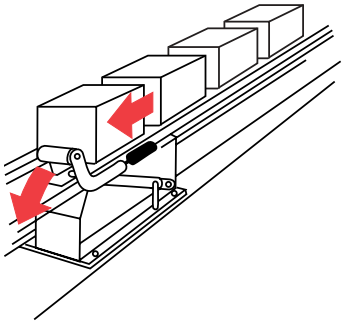
FOUNDRY – CONVEYOR LINE

An OEM shock absorber smoothly decelerates metal flasks traveling on a conveyor line, eliminating damage to flasks and decreasing foundry scrap caused by mold defects.



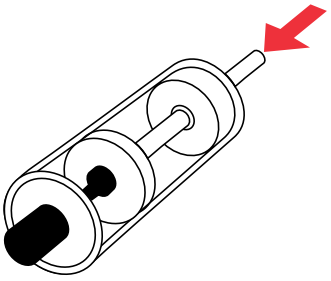
MANUFACTURING FACILITY – RAIL CARTS

OEM Low Profile shock absorbers offer smooth, steady resistance that prevents assembly carts from over-traveling endstops, while also protecting transported goods from potential damage.



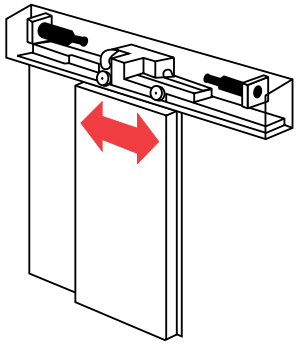
PALLET STOP

An OEM model, used in conjunction with a pallet stop, smoothly decelerates and precisely positions assembled parts as they move to various production stations on a motorized conveyor system.



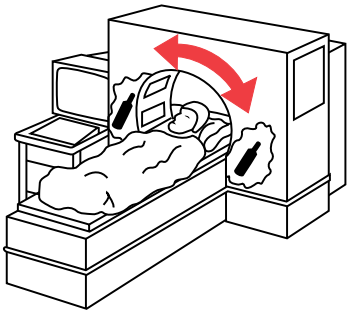
AIR CYLINDER

As air cylinders operate at higher velocities and with increased loads, the cylinder cushion becomes ineffective. An OEM model with BAC package is needed to accommodate high impact forces, allow quieter operation, increase production rates and extend cylinder life.



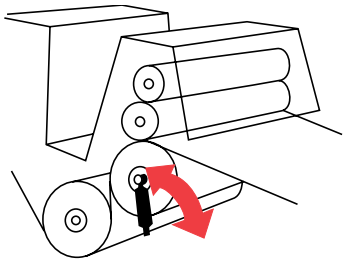
ROLLING DOOR

As automatic rolling doors open and close, OEM models are used for linear deceleration to decrease noise, protect precision mechanical components and prolong door life.



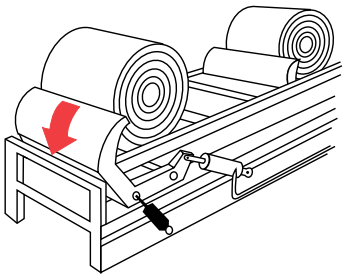
CAT SCAN EQUIPMENT

OEM models assist with deceleration and protection of delicate CAT scan camera during start/stop patient scanning procedures.



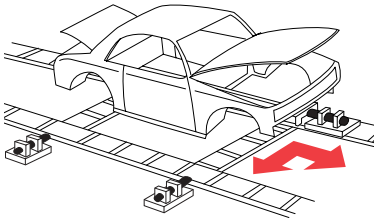
PRINTING

An OEM large shock absorber assists in paper positioning and prevents equipment damage during printing test runs (when the press is stopped frequently to confirm proper colors, focus and paper position).



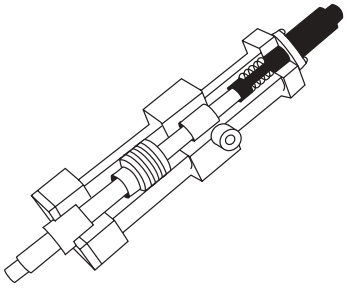
PAPER ROLLS

Shock absorbers used in conjunction with stop arm mechanisms/air cylinders quickly decelerate large paper rolls moving through production on inclined planes, without damage or jolting. This increases operating speed and decreases machinery damage and paper waste.



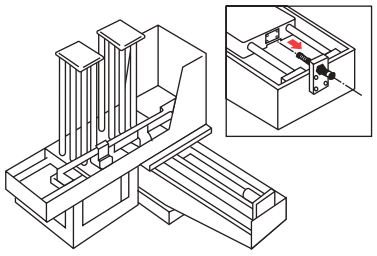
AUTOMOTIVE – TRANSFER LINE

Automated assembly plants use OEM large shock absorbers extensively to decelerate and protect shuttle/ transfer line systems. This is especially beneficial in the robotic welding location.



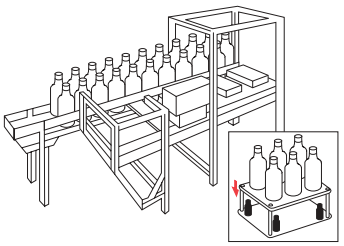
AIR CYLINDER

Special OEM series shock absorber installed on a trunion mounted, thru-rod pneumatic cylinder absorbs the energy created from this drive actuator, which controls the seal and cut operation on a vertical form, fill seal and packaging machine.



ROBOTIC ASSEMBLY EQUIPMENT

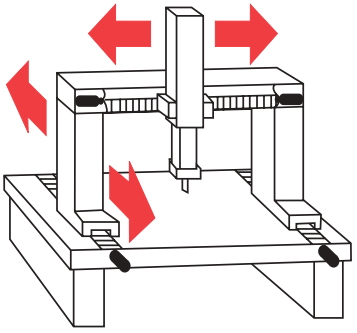
Use of an HP 110 on high speed robotic assembly equipment prevents potential equipment damage from slide mechanism overrun and increases maximum equipment operating speed.



PACKAGING MACHINERY

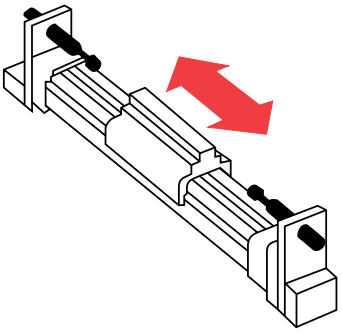
Standard HP models control rapid movement of a table transporting loaded packages to an automated case packer sealing station, for safe and precise machinery operation.

Applications Examples



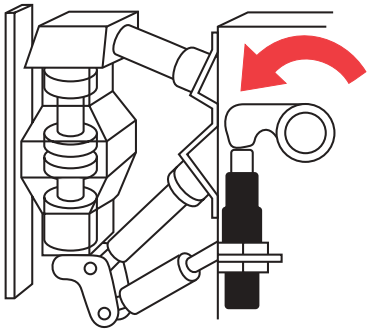
COORDINATE MEASURING MACHINE

PRO Series shock absorbers decelerate horizontal movement of tower to protect delicate electronic device from damage. PRO model also decelerates total carriage movement during override conditions.



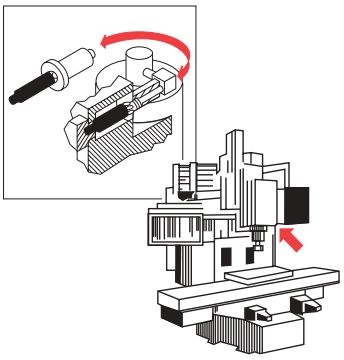
RODLESS CYLINDERS

PRO Series shock absorbers permit higher rod cylinder loads/ velocities, as well as increased operational life, by providing smooth, even deceleration.



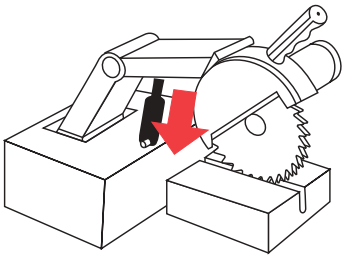
CIRCUIT BREAKER

On an industrial circuit breaker, an STH is used to extend equipment life by controlling the bounce back of the large springs used to open and close circuit connections.



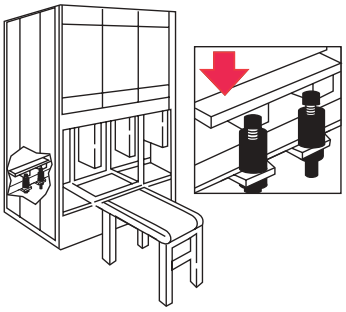
MACHINE TOOLS

PM shock absorbers installed on a vertical CNC tool changer allow rapid tool changing by controlling rotational motion, vibration and impact noise of the spindle.



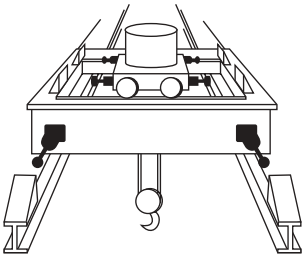
WOODWORKING EQUIPMENT

An ADA 500 model ensures consistent cutting speeds through varied material on a cut-off saw.



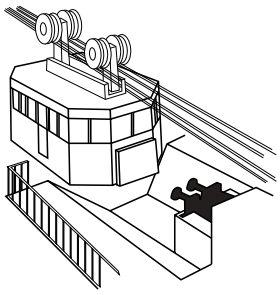
AUTOMATED STORAGE & RETRIEVAL SYSTEM

HP models serve as industry approved safety stops and also cushion a vertical carriage's deceleration in an automatic storage/retrieval system for more accurate carriage positioning, decreased product spillage and increased system life.



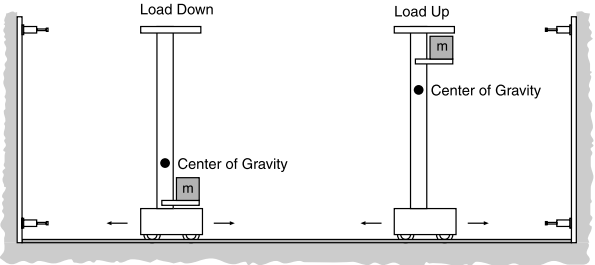
OVERHEAD CRANES

Shock absorbers softly yet quickly decelerate trolley movement and serve as safety stops when mounted at each end of an overhead crane bridge (can be designed to meet various safety standards).



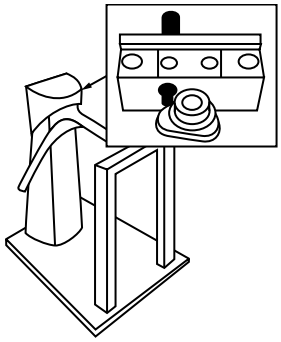
TRANSPORT EQUIPMENT

Jarring of passengers and cargo is eliminated when HD shock absorbers are installed at end positions of cable and other transport systems.



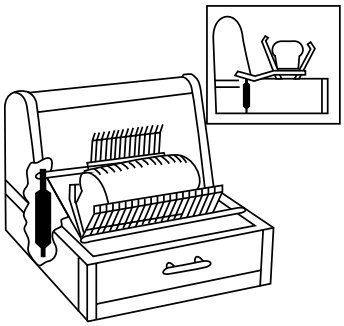
STACKER CRANES

Large bore shock absorbers designed to meet custom operational requirements provide reliable, positive deceleration and prevent potential tipping of a computer-operated stacker crane under runaway conditions.



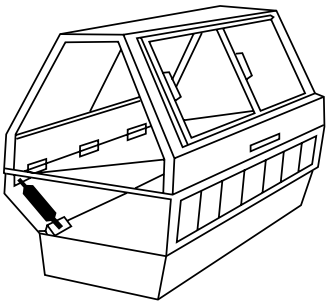
TURNSTILE

A PM Series shock absorber on a turnstile eliminates over-rotation and bounce back of turnstile arms, which prolongs the turnstile's life, while providing for a more comfortable entry and exit.



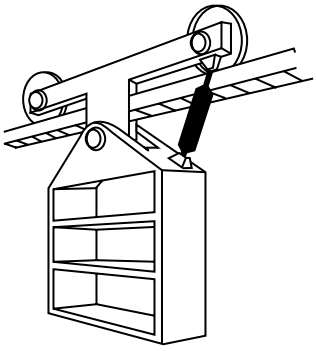
FOOD PROCESSING

Using an Enidine ADA Series unit on a bread/food slicer controls blade descent rate to extend slicer life expectancy, eliminates bread/food breakage when slicing, increases safety of the slicing operation and reduces frequency of knife sharpening.



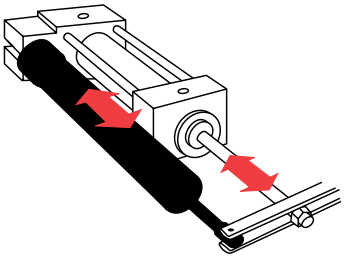
REFRIGERATION CASE

Installation of an ADA Series rate control on a refrigeration case allows both controlled opening and closing of a refrigeration case lid, resulting in improved energy savings, customer safety, and decreased case damage.



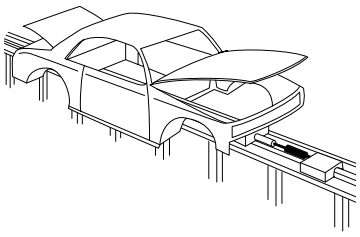
MATERIAL HANDLING

Potential damage to transported parts caused by swinging of overhead conveyor system is eliminated by employing an ADA Series rate control to stabilize swinging load.



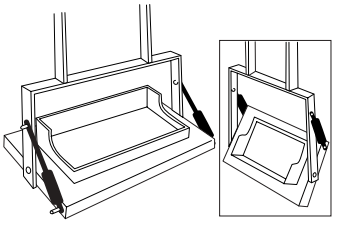
AIR CYLINDER

An ADA Series rate control attached to an air cylinder allows it to operate with the smooth, operational consistency of a hydraulic cylinder.



POWER & FREE CONVEYOR

Special Double Acting DA's or Tow-Bar (TB) snubbers are used on a conveyor system to eliminate the abrupt start and stop motion imposed on the transported load. This eliminates damage to the load and conveyor.



OVERHEAD CARRIER

DA models mounted on an overhead carrier allow the loaded transport bed to be smoothly and safely unfolded for assembly and refolded for compact travel through the production line.

Application Worksheet

FAX NO.: _____

DATE: _____

ATTN: _____

COMPANY: _____

The Enidine Application Worksheet makes shock absorber and rate control sizing and selection easier.

Fax, phone, or mail worksheet data to Enidine headquarters or your nearest Enidine subsidiary/affiliate or distributor. (See catalog back cover for Enidine locations, or visit www.enidine.com for a list of Enidine distributors.)

Upon Enidine's receipt of this worksheet, you will receive a detailed analysis of your application and product recommendations. (For custom design projects, Enidine representatives will consult with you for specification requirements.)

GENERAL INFORMATION

CONTACT: _____

DEPT/TITLE: _____

COMPANY: _____

ADDRESS: _____

_____

TEL: _____ FAX: _____

EMAIL: _____

PRODUCTS MANUFACTURED: _____

_____

APPLICATION DATA

Description: _____

_____

Motion Direction (Check One):

☐ Horizontal ☐ Vertical ☐ Up ☐ Down ☐ Incline

☐ Rotary Horizontal ☐ Rotary Vertical ☐ Up ☐ Down

Weight (Min./Max.): _____ (lbs.)

Cycle Rate _____ (cycles/hour)

Additional Propelling Force (If Known) _____ (lbs.)

☐ Air Cyl: Bore ____ (in.) Max. Pressure ____(psi) Rod Dia.__(in.)

☐ Hydraulic Cyl: Bore ____ (in.) Max. Pressure ____(psi)
Rod Dia.___ (in.)

☐ Motor _____ (hp) Torque _____(in-lbs.)

Ambient Temp. _____ °F

Environmental Considerations: _____

_____

SHOCK ABSORBER APPLICATION

(All Data Taken at Shock Absorber)

Number Shock Absorbers to Stop Load _____

Impact Velocity (min./max.) _____ (in./sec.)

Shock Absorber Stroke Requirements: _____(in.)

G Load Requirements _____(G)

RATE CONTROL APPLICATION

(All Data Taken at Rate Control)

Number of Rate Controls to Control the Load _____

Control Direction: ☐ Tension (T) ☐ Compression (C)

Required Stroke: _____(in.) Est. Stroke Time _____(sec.)

Estimated Velocity at the Rate Control _____(in./sec.)

APPLICATION SKETCH/NOTES

Lifetime Warranty – Consult factory for details.

Enidine reserves the right to alter or improve product design specifications without prior notice.

Solutions in Energy Absorption and Vibration Isolation.

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ENIDINE INDUSTRIAL PRODUCTS

Shock Absorbers • Rate Controls • Air Springs • One-Shot Emergency Stops
Elastomeric Isolators • Wire Rope Isolators • Compact Wire Rope Isolators • Heavy Industry Buffers

CHECK OUT www.enidine.com OUR WEB SITE




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