Shock Absorbers and Rate Controls
ITT Enidine provides quality energy absorption and vibration isolation products and services to a variety of heavy industries throughout the globe. These industries include steel and aluminum rolling mills, manufacturers of mill equipment, gantry cranes, ship to shore cranes, overhead bridge crane manufacturers and automated stacker cranes. ITT is a diversified leading manufacturer of highly engineered critical components and customized technology solutions for growing industrial end-markets in energy infrastructure, electronics, aerospace and transportation.

Building on its heritage of innovation, ITT partners with its customers to deliver enduring solutions to the key industries that underpin our modern way of life. Founded in 1920, ITT is headquartered in White Plains, NY, with employees in more than fifteen countries and sales in more than 125 countries. The company generated pro forma 2010 revenues of approximately $2 billion.

As part of our strategy to make the customer central to everything we do, our core technologies, engineering strength and global scale offers greater value for customers in terms of quality, cost and delivery.
# Table of Contents

## Product Selection

### Shock Absorber Products

<table>
<thead>
<tr>
<th>Series</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO OEM/OEMXT Series (Adjustable Shock Absorbers)</td>
<td>19-20</td>
</tr>
<tr>
<td>TK/STH Series (Non-Adjustable Shock Absorbers)</td>
<td>37-38</td>
</tr>
<tr>
<td>ECO Series (Non-Adjustable Shock Absorbers)</td>
<td>45-46</td>
</tr>
<tr>
<td>PMXT Series (Non-Adjustable Shock Absorbers)</td>
<td>57-58</td>
</tr>
<tr>
<td>HDN/HD/HDA Series (Heavy Duty Shock Absorbers)</td>
<td>65</td>
</tr>
<tr>
<td>HI Series (Heavy Industry Buffers)</td>
<td>79-80</td>
</tr>
<tr>
<td>Jarret Series</td>
<td>83-84</td>
</tr>
</tbody>
</table>

### Rate Control Products

<table>
<thead>
<tr>
<th>Series</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate Controls</td>
<td>95-97</td>
</tr>
<tr>
<td>ADA Technical Data, Accessories</td>
<td>101-104</td>
</tr>
<tr>
<td>DA Technical Data, Accessories</td>
<td>105-106</td>
</tr>
<tr>
<td>Application Worksheet</td>
<td>107</td>
</tr>
</tbody>
</table>

---

**Company Overview**

1

**New Technologies and Enhancements**

2

**Theory of Energy Absorption**

3-4

**Sizing Examples**

5-14

**Quick Selection Guide**

15-16

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With its world headquarters located in Orchard Park, New York, USA, ITT ENIDINE Inc. is a world leader in the design and manufacture of standard and custom energy absorption and vibration isolation product solutions within the Industrial, Aerospace, Defense, Marine and Rail markets. Product ranges include shock absorbers, gas springs, rate controls, air springs, wire rope isolators, heavy industry buffers and emergency stops. With facilities strategically located throughout the world and in partnership with our vast global network of distributors, Enidine Incorporated continues to strengthen its presence within marketplace.

Founded in 1966, ITT Enidine Incorporated now has close to 600 employees located throughout the globe in the United States, Germany, France, Japan, China and Korea. With a team of professionals in engineering, computer science, manufacturing, production and marketing our employees provide our customers the very best in service and application solutions.

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

From Original Equipment Manufacturers (OEM) to aftermarket applications, ITT Enidine offers a unique combination of product selection, engineering excellence and technical support to meet even the toughest energy absorption application requirements.

Global Manufacturing and Sales Facilities offer our customers:

• Highly Trained Distribution Network
• State-of-the Art Engineering Capabilities
• Custom Solution Development
• Customer Service Specialists
• Multiple Open Communication Channels

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.

Products/Engineering/Technical Support

ITT Enidine continually strives to provide the widest selection of shock absorbers and rate control products in the global marketplace. Through constant evaluation and testing, we bring our customers the most cost effective products with more features, greater performance and improved ease of use.
ITT 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 such as our new ECO Series shock absorbers and our new HDN Series shock absorbers.

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 ITT Enidine engineers do the same for you.

New Technologies and Enhancements
Research and Development

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
- 3-D Soluble Support Technology
- Finite Element Analysis
- Complete Product Verification Testing Facility

Custom designs are not an exception at ITT 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 customized to your exact specifications.

Global Service and Support

ITT Enidine offers its customers a global network of customer service staff, technical sales personnel that are available to assist you with all of your application needs.

- Operating with lean manufacturing and cellular production, ITT Enidine produces higher quality custom and standard products with greater efficiency and within shorter lead times.
- An authorized Global Distribution Network is trained regularly by ITT Enidine staff on new products and services ensuring they are better able to serve you.
- New Enisize sizing portal provides our customer with the necessary sizing and design tools. www.enisize.com
- Global operations in United States, Germany, France, China, Japan and Korea.
- A comprehensive, website full of application information, technical data, sizing examples and information to assist in selecting the product that’s right for you.

Our website also features a searchable worldwide distributor lookup to help facilitate fast, localized service. Contact us today for assistance with all of your application needs.

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

Our global customer service and technical sales departments are available to assist you find the solution that’s right for your application needs. Call us at 1-800-852-8508 or email us at industrialsales@enidine.com and let us get started today.
Overview

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.

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.
Theory of Energy Absorption
ITT Enidine Inc.

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 endurable 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.

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.

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.
**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.)(Kg)
- B. Velocity of the load upon impact with the shock absorber (in/sec.)(m/s)
- C. External (propelling) forces acting on the load (lbs.) (N), 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).

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

\[ E_K = \frac{1}{2} MV^2 \]  
(Note: 772 = 2 x acceleration due to gravity)

**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.

\[ E_W = FD \times S \]  
(Note: 772 = 2 x acceleration due to gravity)

**STEP 4:** Calculate the total energy per cycle \( E_T = E_K + E_W \)

**STEP 5:** Calculate the energy that must be absorbed per hour. Even though the cycle rate is too high, select a larger model and recalculate the work energy.

**STEP 6:** Calculate the total energy per hour \( E_T = E_K + E_W \) for each direction. The model selected must have an energy per hour capacity greater than the values listed in the Rate Controls Engineering Data Charts (pages 97-106).

**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.)(Kg)
- B. Desired velocity of the load (in/sec.)(m/s)
- C. External (propelling) forces acting on the load (lbs.) (N), 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./mm)

**STEP 2:** Calculate the propelling force at the rate control in each direction damping is required.

(Same sizing examples on page 6-12)

**STEP 3:** Calculate the total energy per cycle \( E_T = E_W (tension) + E_W (compression) \)

**STEP 4:** Calculate the total energy per hour \( E_T = E_W \times C \)

The model selected must have an energy per hour capacity greater than this calculated figure. If not, choose a model with a greater 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 97-106).

**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.

**Overview**
4. To Determine Propelling Force of Pneumatic or Hydraulic Cylinders

\[ FD = 0.7854 \times d^2 \times P \]

5. Free Fall Applications

A. Find Velocity for a Free Falling Weight:

\[ V = \sqrt{2 \times g \times H} \]  

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

\[ G = FP - FD \]

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

\[ S = \frac{E_K}{GW} \times 0.85 - 0.15 FD \]

\[ * \text{For PRO/PM and TK Models:} \]

\[ S = \frac{E_K}{GW} \times 0.5 - 0.5 FD \]

NOTE: Constants are printed in bold.

The following examples are shown using Imperial formulas and units of measure.

**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

\[ E_W = W \times H \]

\[ E_W = 3,400 \times 20 = 68,000 \text{ in-lbs.} \]

Assume Model OEM 4.0M x 6 is adequate (Page 31).

**STEP 3:** Calculate work energy

\[ E_W = W \times H \]

\[ E_W = 3,400 \times 20 = 68,000 \text{ in-lbs.} \]

**STEP 4:** Calculate total energy per cycle

\[ E_T = E_F + E_W \]

\[ E_T = 88,400 \text{ in-lbs./c} \]

**STEP 5:** Calculate total energy per hour

\[ E_{TC} = E_T \times C \]

\[ E_{TC} = 88,400 \times 2 \]

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.
- (C) Cycles/hr = 4 in.
- (P) Pressure = 70 psi
- (C) Cycles/hr = 200

**STEP 2:** Calculate kinetic energy

\[ E_W = \frac{W \times V^2}{2 \times g} \]

\[ E_W = 3,400 \times 80^2 \times \frac{1}{2 \times 32.2} = 28,187 \text{ in-lbs.} \]

Assume Model OEM 4.0M x 4 is adequate (Page 31).

**STEP 3:** Calculate work energy

\[ E_W = \frac{W \times F \times S}{V} \]

\[ E_W = \frac{3,400 \times 4280 \times 4}{80} = 17,120 \text{ in-lbs.} \]

**STEP 4:** Calculate total energy per cycle

\[ E_T = E_F + E_W \]

\[ E_T = 28,187 + 17,120 = 45,307 \text{ in-lbs./c} \]

**STEP 5:** Calculate total energy per hour

\[ E_{TC} = E_T \times C \]

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.
- **P** (Operating pressure) = 70 psi
- **C** (Cycles/Hr) = 200

**STEP 2: Calculate kinetic energy**

\[
E_k = \frac{W}{v^2} \times v^2 = \frac{772}{772} = 80^2
\]

\[
E_k = 28,187 \text{ in-lbs.}
\]

Assume Model OEM 3.0M x 5 is adequate (Page 31).

**STEP 3: Calculate work energy**

\[
F_D = \frac{2 \times \pi \times 0.7854 \times d^2 \times P}{v} - W
\]

\[
F_D = \frac{2 \times \pi \times 0.7854 \times 6^2 \times 70}{80} - 3,400
\]

\[
F_D = 558 \text{ lbs.}
\]

\[
E_W = F_D \times S
\]

\[
E_W = 558 \times 5
\]

\[
E_W = 2,790 \text{ in-lbs.}
\]

**STEP 4: Calculate total energy per cycle**

\[
E_T = E_K + E_W
\]

\[
E_T = 28,187 + 2,790
\]

\[
E_T = 30,977 \text{ in-lbs./c}
\]

**STEP 5: Calculate total energy per hour**

\[
E_{TC} = E_T \times C
\]

\[
E_{TC} = 30,977 \times 200
\]

\[
E_{TC} = 6,195,400 \text{ in-lbs./hr}
\]

Model OEM 3.0M x 5 is adequate.

### EXAMPLE 4: Vertical Moving Load with Propelling Force from Motor

**STEP 1: Application Data**
- **W** (Weight) = 1,950 lbs.
- **V** (Velocity) = 60 in./sec.
- **Hp** (Motor horsepower) = 1.5 Hp
- **C** (Cycles/Hr) = 200

**STEP 2: Calculate kinetic energy**

\[
E_k = \frac{W}{v^2} \times v^2 = \frac{772}{772} = 60^2
\]

\[
E_k = 933 \text{ in-lbs.}
\]

Assume Model OEMXT 2.0M x 2 is adequate (Page 29).

**STEP 3: Calculate work energy**

\[
F_D = \frac{19,800 \times v}{v} - W
\]

\[
F_D = 19,800 \times 60 - 1,950
\]

\[
F_D = 295 \text{ lbs.}
\]

**STEP 4: Calculate total energy per hour**

\[
E_{TC} = E_T \times C
\]

\[
E_{TC} = 933 \times 200
\]

\[
E_{TC} = 186,600 \text{ in-lbs./hr}
\]

Model OEM XT 2.0M x 2 is adequate.

**STEP 5: Calculate total energy per hour**

\[
E_{TC} = E_T \times C
\]

\[
E_{TC} = 295 \times 200
\]

\[
E_{TC} = 59,000 \text{ in-lbs./hr}
\]

Model OEM 1.25 x 2 is adequate.
**Shock Absorber Sizing Examples**

**Typical Shock Absorber Applications**

### EXAMPLE 6: Horizontal Moving Load with Propelling Force

**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**

\[ E_k = \frac{W \times V^2}{772} \]

\[ E_k = \frac{2,200 \times 60^2}{772} \]

\[ E_k = 10,259 \text{ in-lbs.} \]

Assume Model OEMXT 2.0M x 2 is adequate (Page 29).

**STEP 3: Calculate work energy**

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

\[ F_D = 500 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 500 \times 2 \]

\[ E_W = 1,000 \text{ in-lbs.} \]

**STEP 4: Calculate total energy per cycle**

\[ E_T = E_K + E_W \]

\[ E_T = 10,259 + 1,000 \]

\[ E_T = 11,249 \text{ in-lbs./c} \]

**STEP 5: Calculate total energy per hour**

\[ E_{TC} = E_T \times C \]

\[ E_{TC} = 11,249 \times 120 \]

\[ E_{TC} = 1,349,880 \text{ in-lbs./hr} \]

Model OEMXT 2.0M x 2 is adequate.

### EXAMPLE 7: Horizontal Moving Load, Motor Driven

**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**

\[ E_k = W \times H \]

\[ E_k = 550 \times 8 \]

\[ E_k = 4,400 \text{ in-lbs.} \]

Assume Model OEMXT 1.5M x 3 is adequate (Page 27).

**STEP 3: Calculate work energy**

\[ F_D = W \times \sin \alpha \]

\[ F_D = 550 \times 0.5 \]

\[ F_D = 275 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 275 \times 3 \]

\[ E_W = 825 \text{ in-lbs.} \]

**STEP 4: Calculate total energy per cycle**

\[ E_T = E_K + E_W \]

\[ E_T = 4,400 + 825 \]

\[ E_T = 5,225 \text{ in-lbs./c} \]

**STEP 5: Calculate total energy per hour**

\[ E_{TC} = E_T \times C \]

\[ E_{TC} = 5,225 \times 250 \]

\[ E_{TC} = 1,306,250 \text{ in-lbs./hr} \]

Model OEMXT 1.5M x 3 is adequate.

### EXAMPLE 8: Free Moving Load Down an Inclined Plane

**STEP 1: Application Data**
- (W) Weight = 550 lbs.
- (H) Height = 8 in.
- (α) Angle of incline = 30°

**STEP 2: Calculate kinetic energy**

\[ E_k = W \times H \]

\[ E_k = 550 \times 8 \]

\[ E_k = 4,400 \text{ in-lbs.} \]

Assume Model OEMXT 1.5M x 3 is adequate (Page 27).

**STEP 3: Calculate work energy**

\[ F_D = W \times \sin \alpha \]

\[ F_D = 550 \times 0.5 \]

\[ F_D = 275 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 275 \times 3 \]

\[ E_W = 825 \text{ in-lbs.} \]

**STEP 4: Calculate total energy per cycle**

\[ E_T = E_K + E_W \]

\[ E_T = 4,400 + 825 \]

\[ E_T = 5,225 \text{ in-lbs./c} \]

**STEP 5: Calculate total energy per hour**

\[ E_{TC} = E_T \times C \]

\[ E_{TC} = 5,225 \times 250 \]

\[ E_{TC} = 1,306,250 \text{ in-lbs./hr} \]

Model OEMXT 1.5M x 3 is adequate.
Typical Shock Absorber Applications

**EXAMPLE 9:** Horizontal Rotating Mass

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

**STEP 2: Calculate kinetic energy**

\[
I = \frac{W}{386} \times A^2 + B^2
\]

\[I = \frac{50}{386} \times 40^2 + .5^2\]

\[I = 69 \text{ in-lbs./sec}^2\]

**STEP 3: Calculate work energy**

\[
F_D = \frac{T}{RS}
\]

\[F_D = \frac{100}{20}\]

\[F_D = 5 \text{ lbs.}\]

\[
E_W = F_D \times S = 5 \times .5 = 2.5 \text{ in-lbs.}\]

**STEP 4: Calculate total energy per cycle**

\[
E_T = E_K + E_W = 69 + 2.5 = 71.5 \text{ in-lbs.}\]

**STEP 5: Calculate total energy per hour**

Not applicable, C = 250.

**STEP 6: Calculate impact velocity and confirm selection**

\[
V = RS \times \omega
\]

\[V = 20 \times 2.5 = 50 \text{ in./sec.}\]

Model OEM .5 is adequate.

**EXAMPLE 10:** Horizontal Rotating Door

**STEP 1: Application Data**
- (W) Weight = 440 lbs.
- (W1) Installed load = 110 lbs.
- Rotational speed = 10 RPM
- (T) Torque = 2,200 in-lbs.
- (KLoad) Radius of gyration = 8 in.
- (RS) Mounting radius = 8.86 in.
- (C) Cycles/Hr = 1

**STEP 2: Calculate kinetic energy**

\[
I_{Table} = \frac{W}{386} \times (K_{Table})^2
\]

\[I_{Table} = \frac{440}{386} \times 8.86^2 = 7.07 \text{ in-lbs./sec}^2\]

\[
I_{Load} = \frac{W}{386} \times (K_{Load})^2
\]

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

**STEP 3: Calculate work energy**

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

\[E_K = \frac{(7.07 + 18)}{2} \times 1.047^2 = 41 \text{ in-lbs.}\]

Assume Model ECO 50 is adequate.

**EXAMPLE 11:** Horizontal Moving Load, Rotary Table Motor Driven with Additional Load Installed

**STEP 1: Application Data**
- (W) Weight = 440 lbs.
- (W1) Installed load = 110 lbs.
- Rotational speed = 10 RPM
- (T) Torque = 2,200 in-lbs.
- (K) Table Radius = 10 in.
- (KLoad) Radius of gyration = 8 in.
- (C) Cycles/Hr = 1

**STEP 2: Calculate kinetic energy**

\[(R_{e.app}) = \frac{W}{386} \times (K_{Table})^2\]

\[R_{e.app} = \frac{440}{386} \times 10.707^2 = 57 \text{ in-lbs./sec}^2\]

\[(R_{c.load}) = \frac{W}{386} \times (K_{Load})^2\]

\[R_{c.load} = \frac{110}{386} \times 8^2 = 18 \text{ in-lbs./sec}^2\]

\[
E_K = \frac{(R_{e.app} + R_{c.load})}{2} = 41 \text{ in-lbs.}\]

Assume Model ECO 50 is adequate.
### Example 12:

**Vertical Motor Driven Rotating Arm with Attached Load**

#### 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°
- **RS** Mounting radius = 16 in.
- **C** Cycles/Hr = 1

#### Step 2: Calculate kinetic energy

\[
I = \frac{1}{2} W \times \omega^2 = \frac{110 \times 2^2}{2} = 164 \text{ in-lbs-sec}^2
\]

#### Step 3: Calculate work energy

\[
F_D = [T + (W \times K \times \sin (θ + Ø))]
\]

\[
F_D = [3,100 + (110 \times 24 \times 0.77)]
\]

\[
F_D = 365 \text{ lbs.}
\]

#### Step 4: Calculate total energy per cycle

\[
E_T = E_K + E_W = 328 + 365 = 693 \text{ in-lbs.}
\]

#### Step 5: Calculate impact velocity

\[
V = \sqrt{\frac{2E_T}{m}} = \sqrt{\frac{2 \times 693}{24}} = 70 \text{ in./sec.}
\]

Model LROEM 1.0 is adequate.

### Example 13:

**Vertical Motor Driven Rotating Arm with Attached Load**

#### 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°
- **RS** Mounting radius = 20 in.
- **L** Length = 24 in.
- **B** Thickness = 2.5 in.
- **C** Cycles/Hr = 1

#### Step 2: Calculate kinetic energy

\[
I = \frac{1}{2} W \times \omega^2 = \frac{540 \times 3.5^2}{2} = 688.6 \text{ in-lbs-sec}^2
\]

#### Step 3: Calculate work energy

\[
F_D = [T - (W \times K \times \sin (θ - Ø))]
\]

\[
F_D = [250 - (540 \times 13.89 \times 0.73)]
\]

\[
F_D = 365 \text{ lbs.}
\]

### Example 14:

**Vertical Rotating Beam**

#### Application Data

- **W** Weight = 640 lbs.
- **ω** Angular velocity = 3.0 rad./sec.
- **T** Torque = 300 in-lbs.
- **θ** Starting point of load from true vertical = 30°
- **Ø** Angle of rotation at impact = 60°
- **RS** Mounting radius = 20 in.
- **C** Cycles/Hr = 1

#### Step 2: Calculate kinetic energy

\[
I = \frac{1}{2} W \times \omega^2 = \frac{640 \times 3.0^2}{2} = 960 \text{ in-lbs-sec}^2
\]

#### Step 3: Calculate work energy

\[
F_D = [T + (W \times K \times \sin (θ - Ø))]
\]

\[
F_D = [300 + (640 \times 13.89 \times 0.52)]
\]

\[
F_D = 1,059 \text{ lbs.}
\]

### Summary

- **Model Selection**

  - For **Example 12**, Model LROEM 1.0 is adequate.
  - For **Example 13**, Model LROEM 1.0 is adequate.
  - For **Example 14**, Model LROEM 1.5M x 2 is adequate.
**EXAMPLE 15:**

**Vertical Rotating Lid**

**STEP 1: Application Data**

(W) Weight = 220.5 lbs.

(ω) Angular velocity = 2 rad/sec.

(T) Torque = 2,750 in-lbs.

(I) Known inertia = 885 in-lbs/sec²

(C/G) Center of Gravity = 6 in.

(θ) Starting point from true vertical = 60° (Ø) Angle of rotation at impact = 30°

(R) Mounting radius = 10 in.

(C) Cycles/W = 1

**STEP 2: Calculate kinetic energy**

\[
K = \frac{(I \times \omega^2)}{2}
\]

\[
K = \frac{(885 \times 2^2)}{2} = 1,770 \text{ in-lbs.}
\]

**STEP 3: Calculate work energy**

\[
FD = \frac{(T - (W \times C/G \times \sin(\theta + \theta)))}{R}
\]

\[
F_D = \frac{(2,750 - (220.5 \times 12 \times \sin(60° + 30°))}{10} = 264.6 \text{ lbs.}
\]

\[
EW = F_D \times S = 264.6 \times 1 = 264.6 \text{ in-lbs.}
\]

**STEP 4: Calculate total energy per cycle**

\[
ET = E_K + E_W = 1,770 + 264.6
\]

\[
ET = 2,034.6 \text{ in-lbs/cyc.}
\]

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

\[
ETC = ET \times C = 2,034.6 \times 1 = 2,034.6 \text{ in-lbs/hr.}
\]

**STEP 6: Calculate impact velocity and confirm selection**

\[
V = RS \times \frac{\omega}{2} = 10 \times \frac{2}{2} = 10 \text{ in./sec.}
\]

Model OEM 1.15 x 1 is adequate (Page 24).
**EXAMPLE 18:** Vertical Rotation with Known Intertia Aided by Gravity (w/Torque)

STEP 1: Application Data
- (W) Weight = 220.5 lbs.
- (\(\omega\)) Angular velocity = 2 rad./sec.
- (T) Torque = 2,750 in-lbs.
- (A) Length = 40 in.
- (\(R_s\)) Mounting radius = 10 in.
- (B) Thickness = 2 in.
- (C) Cycles/\(\text{hr}\) = 100

STEP 2: Calculate kinetic energy
- \(E_k = \frac{I \times \omega^2}{2}\)
- \(E_k = \frac{885 \times 2^2}{2} = 1,770\) in-lbs.

STEP 3: Calculate work energy
- \(F_D = \frac{T - (W \times C/G \times \sin(\theta - \phi))}{R_S}\)
- \(F_D = \frac{2,750 - (220.5 \times 12 \times \sin(120^\circ - 30^\circ))}{10} = 10.4\) lbs.
- \(E_W = F_D \times \delta = 10.4 \times 1 = 10.4\) in-lbs.

STEP 4: Calculate total energy per cycle
- \(E_T = E_k + E_W = 1,770 + 10.4 = 1,780.4\) in-lbs/cycle.

STEP 5: Calculate total energy per hour
- \(E_{TC} = E_T \times C = 1,780.4 \times 100 = 178,040\) in-lbs/hr.

STEP 6: Calculate impact velocity and confirm selection
- \(V = R_s \times \omega = 10 \times 2 = 20\) in./sec.
- Model OEMXT 1.5M x 1 is adequate (Page 27).

**EXAMPLE 19:** Vertical Rotation pinned at Center (w/Torque)

STEP 1: Application Data
- (W) Weight = 220.5 lbs.
- (\(\omega\)) Angular velocity = 2 rad./sec.
- (T) Torque = 2,750 in-lbs.
- (\(I\)) Known Intertia = 885 in-lbs/sec²
- (\(C/G\)) Center-of-Gravity = 12 in.
- (\(\theta\)) Starting point from true vertical = 120°
- (B) Angle of rotation at impact = 30°
- (\(R_s\)) Mounting radius = 10 in.
- (C) Cycles/\(\text{hr}\) = 100

STEP 2: Calculate kinetic energy
- \(E_{k1} = \frac{I_1 \times \omega_{1}^2}{2}\)
- \(E_{k1} = \frac{2205 \times 2^2}{2} = 2,205\) in-lbs.

STEP 3: Calculate work energy
- \(F_D = \frac{T - (W \times C/G \times \sin(\theta - \phi))}{R_S}\)
- \(F_D = \frac{2,750 - (220.5 \times 12 \times \sin(120^\circ - 30^\circ))}{10} = 12.5\) lbs.
- \(E_W = F_D \times \delta = 12.5 \times 1 = 12.5\) in-lbs.

STEP 4: Calculate total energy per cycle
- \(E_T = E_{k1} + E_W = 2,205 + 12.5 = 2,217.5\) in-lbs/cycle.

STEP 5: Calculate total energy per hour
- \(E_{TC} = E_T \times C = 2,217.5 \times 1 = 2,217.5\) in-lbs/hr.

STEP 6: Calculate impact velocity and confirm selection
- \(V = R_s \times \omega = 10 \times 2 = 20\) in./sec.
- Model OEM 1.0 is adequate.
Shock Absorber Sizing Examples
Typical Shock Absorber and Crane Applications

Calculations assume worst case scenario of 90% trolley weight over one rail.

Crane A

<table>
<thead>
<tr>
<th>Per Buffer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Propelling Force Crane</td>
<td>lbs.</td>
</tr>
<tr>
<td>Propelling Force Trolley</td>
<td>lbs.</td>
</tr>
<tr>
<td>Weight of Crane (W_{a})</td>
<td>lbs.</td>
</tr>
<tr>
<td>Weight of Trolley (W_{t})</td>
<td>lbs.</td>
</tr>
<tr>
<td>Crane Velocity (V_{a})</td>
<td>in./sec.</td>
</tr>
<tr>
<td>Trolley Velocity (V_{t})</td>
<td>in./sec.</td>
</tr>
</tbody>
</table>

Crane B

<table>
<thead>
<tr>
<th>Per Buffer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Propelling Force Crane</td>
<td>lbs.</td>
</tr>
<tr>
<td>Propelling Force Trolley</td>
<td>lbs.</td>
</tr>
<tr>
<td>Weight of Crane (W_{b})</td>
<td>lbs.</td>
</tr>
<tr>
<td>Weight of Trolley (W_{t})</td>
<td>lbs.</td>
</tr>
<tr>
<td>Crane Velocity (V_{b})</td>
<td>in./sec.</td>
</tr>
<tr>
<td>Trolley Velocity (V_{t})</td>
<td>in./sec.</td>
</tr>
</tbody>
</table>

Crane C

<table>
<thead>
<tr>
<th>Per Buffer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Propelling Force Crane</td>
<td>lbs.</td>
</tr>
<tr>
<td>Propelling Force Trolley</td>
<td>lbs.</td>
</tr>
<tr>
<td>Weight of Crane (W_{c})</td>
<td>lbs.</td>
</tr>
<tr>
<td>Weight of Trolley (W_{t})</td>
<td>lbs.</td>
</tr>
<tr>
<td>Crane Velocity (V_{c})</td>
<td>in./sec.</td>
</tr>
<tr>
<td>Trolley Velocity (V_{t})</td>
<td>in./sec.</td>
</tr>
</tbody>
</table>

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

* 100% velocity \( v \) and
* 100% propelling force \( F_D \)

Application 1
Crane A against Solid Stop

Velocity:
\[ V_r = V_a \]

Impact weight per buffer:
\[ W_I = W_a + (1.8) W_{ta} \]

Application 2
Crane A against Crane B

Velocity:
\[ V_r = V_a + V_b \]

Impact weight per buffer:
\[ W_I = W_a + (1.8) W_{ta} \]
\[ W_I = W_b + (1.8) W_{tb} \]
\[ W_I = 2 W_{I}(\text{Total Number of Shocks}) \]

Application 3
Crane B against Crane C

Velocity:
\[ V_r = V_b + V_c \]

Impact weight per buffer:
\[ W_I = W_b + (1.8) W_{tb} \]
\[ W_I = W_c + (1.8) W_{tc} \]
\[ W_I = 2 W_{I}(\text{Total Number of Shocks}) \]

Application 4
Crane C against Solid Stop with Buffer

Velocity:
\[ V_r = V_c \]

Impact weight per buffer:
\[ W_I = W_c + (1.8) W_{tc} \]
\[ W_I = 2 W_{I}(\text{Number of Shocks Per Rail}) \]

Front View

Plan Views

Application 1
Crane A against Solid Stop

Velocity:
\[ V_r = V_a \]

Impact weight per buffer:
\[ W_I = W_a + (1.8) W_{ta} \]

Total Number of Shocks

Application 2
Crane A against Crane B

Velocity:
\[ V_r = V_a + V_b \]

Impact weight per buffer:
\[ W_I = W_a + (1.8) W_{ta} \]
\[ W_I = W_b + (1.8) W_{tb} \]
\[ W_I = 2 W_{I}(\text{Total Number of Shocks}) \]

Application 3
Crane B against Crane C

Velocity:
\[ V_r = V_b + V_c \]

Impact weight per buffer:
\[ W_I = W_b + (1.8) W_{tb} \]
\[ W_I = W_c + (1.8) W_{tc} \]
\[ W_I = 2 W_{I}(\text{Total Number of Shocks}) \]

Application 4
Crane C against Solid Stop

Velocity:
\[ V_r = V_c \]

Impact weight per buffer:
\[ W_I = W_c + (1.8) W_{tc} \]
\[ W_I = 2 W_{I}(\text{Number of Shocks Per Rail}) \]
### Shock Absorber Sizing Examples

Typical Shock Absorber and Crane Applications

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.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bridge Weight:</strong></td>
<td>837,750 lbs.</td>
<td></td>
</tr>
<tr>
<td><strong>Weight of Trolley:</strong></td>
<td>99,200 lbs.</td>
<td></td>
</tr>
<tr>
<td><strong>Crane Velocity:</strong></td>
<td>60 in./sec.</td>
<td></td>
</tr>
<tr>
<td><strong>Required Stroke:</strong></td>
<td>24 in.</td>
<td></td>
</tr>
<tr>
<td><strong>Trolley Velocity:</strong></td>
<td>160 in./sec.</td>
<td></td>
</tr>
<tr>
<td><strong>Required Stroke:</strong></td>
<td>40 in.</td>
<td></td>
</tr>
</tbody>
</table>

**Overview**

**Total Number of Shocks**

\[
W_d = \frac{W_a \times (1.8) \times W_{ta}}{2}
\]

\[
W_d = \frac{837,750 \times (1.8)(99,200)}{2}
\]

\[
W_d = 508,155 \text{ lbs.}
\]

**Determination of the Maximum Impact Weight**

\[
E_K = \frac{W_d \times V_r^2}{772}
\]

\[
E_K = \frac{508,155 \times (60 \text{ in./sec.})^2}{772}
\]

\[
E_K = 2,369,635 \text{ in-lbs.}
\]

Selecting for required 24-inch stroke:

HD 5.0 x 24, maximum shock force ca. 116,159 lbs = \( F_s \)

\[
\frac{E_K}{\eta}
\]

**Determine Size of Shock Absorber**

**for Crane**

**Given Values**

\[
W_d = \text{Trolley Weight per Shock Absorber}
\]

\[
W_d = \frac{99,200 \text{ lbs.}}{2}
\]

\[
W_d = 49,600 \text{ lbs.}
\]

\[
E_d = \frac{W_d \times V_t^2}{772}
\]

\[
E_d = \frac{49,600 \times (160 \text{ in./sec.})^2}{772}
\]

\[
E_d = 1,644,767 \text{ in-lbs.}
\]

Selecting for required 40-inch stroke:

HDN 4.0 x 40, maximum shock force ca. 48,376 lbs. = \( F_s \)

\[
\frac{E_d}{\eta}
\]
**Calculation Example**

**Stacker Cranes**

Please note that this example shows how to calculate the maximum impact weight on the upper and lower shock absorbers for a stacker crane.

**Given Values**

- Distance Between Buffers: \(H = 60 \text{ ft.}\)
- Distance to C of G1 - Upper: \(X_1 = 45 \text{ ft.}\)
- Distance to C of G1 - Lower: \(Y_1 = 15 \text{ ft.}\)
- Distance to C of G2 - Upper: \(X_2 = 21 \text{ ft.}\)
- Distance to C of G1 - Lower: \(Y_2 = 39 \text{ ft.}\)
- Total Weight: \(W = 40,000 \text{ lbs.}\)

**Calculation for Lower Shock Absorbers**

\[
W_{\text{max} \text{ d}} = \frac{X_1}{H} \times W
\]

\(
W_{\text{max} \text{ d}} = \frac{15 \text{ m}}{20 \text{ m}} \times 20 \text{ t}
\)

\[
W_{\text{max} \text{ d}} = 15 \text{ t}
\]

\[
W_{\text{max} \text{ d}} = \frac{Y_1}{H} \times W
\]

\(
W_{\text{max} \text{ d}} = \frac{5 \text{ m}}{20 \text{ m}} \times 20 \text{ t}
\)

\[
W_{\text{max} \text{ d}} = 5 \text{ t}
\]

**Calculation for Upper Shock Absorbers**

\[
W_{\text{max} \text{ u}} = \frac{X_2}{H} \times W
\]

\(
W_{\text{max} \text{ u}} = \frac{21 \text{ ft.}}{60 \text{ ft.}} \times 40,000 \text{ lbs.}
\)

\[
W_{\text{max} \text{ u}} = 14,000 \text{ lbs.}
\]

\[
W_{\text{max} \text{ u}} = \frac{Y_2}{H} \times W
\]

\(
W_{\text{max} \text{ u}} = \frac{39 \text{ ft.}}{60 \text{ ft.}} \times 40,000 \text{ lbs.}
\)

\[
W_{\text{max} \text{ u}} = 26,000 \text{ lbs.}
\]

Using the value for \(W_{\text{max}}\) obtained above, the kinetic energy can be calculated, and a shock absorber selected.
Shock Absorber Sizing Examples
Typical Shock Absorber and Crane Applications

Overhead Crane Applications

Cargo Crane Applications

Stacker Crane Applications
Use this **ITT Enidine Product Quick Selection Guide** to quickly locate potential 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.

### ITT Enidine Heavy Duty Shock Absorbers

<table>
<thead>
<tr>
<th>Catalog No. (Model)</th>
<th>Stroke (in.)</th>
<th>Min./Max. in.-lbs./cycle</th>
<th>Damping Type</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA 505</td>
<td>2.00</td>
<td>450</td>
<td>C, P, SC</td>
<td>66</td>
</tr>
<tr>
<td>ADA 510</td>
<td>4.00</td>
<td>450</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>ADA 515</td>
<td>6.00</td>
<td>450</td>
<td>C</td>
<td>68</td>
</tr>
<tr>
<td>ADA 520</td>
<td>8.00</td>
<td>450</td>
<td>C</td>
<td>69</td>
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<td>2,500</td>
<td>C</td>
<td>71</td>
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<td>ADA 710</td>
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</tr>
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<td>ADA 720</td>
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<td>ADA 780</td>
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</tbody>
</table>

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

### ITT Enidine Adjustable Rate Controls

<table>
<thead>
<tr>
<th>Catalog No. (Model)</th>
<th>Stroke (in.)</th>
<th>Max. Propelling Force</th>
<th>SC (Fp)</th>
<th>ET</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>ADA 515</td>
<td>6.00</td>
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<td>ADA 520</td>
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<td>125</td>
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<td>6.00</td>
<td>2,500</td>
<td>46</td>
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<td>ADA 720</td>
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<tr>
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<tr>
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<td>14.00</td>
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<td>ADA 770</td>
<td>28.00</td>
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<td>30.00</td>
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<td>ADA 780</td>
<td>32.00</td>
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**Key for Damping Type:**
- D = Dashpot
- C = Conventional
- P = Progressive
- SC = Self-compensating

### ITT Enidine Heavy Industry Shock Absorbers

<table>
<thead>
<tr>
<th>Catalog No. (Model)</th>
<th>Stroke (in.)</th>
<th>Min./Max. in.-lbs./cycle</th>
<th>Damping Type</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI 50 x (Stroke)</td>
<td>2.00</td>
<td>26,500</td>
<td>C, P, SC</td>
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<tr>
<td>HI 85 x (Stroke)</td>
<td>4.00</td>
<td>60,000</td>
<td>C, P, SC</td>
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<td>HI 100 x (Stroke)</td>
<td>6.40</td>
<td>88,000</td>
<td>C, P, SC</td>
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<tr>
<td>HI 120 x (Stroke)</td>
<td>10.32</td>
<td>160,000</td>
<td>C, P, SC</td>
<td>86</td>
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<tr>
<td>HI 130 x (Stroke)</td>
<td>16.50</td>
<td>300,000</td>
<td>C, P, SC</td>
<td>87</td>
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</tbody>
</table>

**Key for Damping Type:**
- D = Dashpot
- P = Progressive
- SC = Self-compensating

### Jarret Shock Absorbers

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>BC1N</td>
<td>0.5-3</td>
<td>885,000</td>
<td>87</td>
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<tr>
<td>RCS</td>
<td>4.7</td>
<td>220,000</td>
<td>88</td>
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<tr>
<td>XLR</td>
<td>6.31.5</td>
<td>50,000</td>
<td>89</td>
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<tr>
<td>LR</td>
<td>16-51</td>
<td>885,000</td>
<td>90</td>
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</table>

**Key for Damping Type:**
- D = Dashpot
- C = Conventional
Adjustable Series Hydraulic Shock Absorbers
ECO OEM and OEMXT Series

Overview

ITT Enidine’s New ECO OEM Series adjustable hydraulic shock absorbers are an expansion of our previously released ECO Series product line. These adjustable shock absorbers provide maximum flexibility in a RoHS compliant package. By simply turning an adjustment knob, the damping force can be changed to accommodate a wide range of conditions. ITT Enidine offers the broadest range of adjustable shock absorbers and mounting accessories in the marketplace today.

The ITT Enidine OEMXT Series provides a low profile adjustment knob offered in imperial or metric thread configurations with stroke lengths of 1 to 6 inches. For drop-in competitive interchange. Low Range (LROEMXT) Series products are also available to control velocities as low as 3 in./sec. and propelling forces as high as 4,000 lbs. OEMXT and OEM Large Series shock absorbers are fully field repairable.

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 increase surface area for improved heat dissipation.
- Operational parameters can be expanded through the use of ITT Enidine’s Low Range and High Performance products.
- Custom orificed non-adjustable units (CBOEM) can be engineered to meet specific application requirements or emergency impact only requirements.
- Special materials and finishes can be designed to meet specific customer requirements.
- Optional fluids and seal packages can expand the standard operating temperature range from (15°F to 180°F) to (~3°F to 210°F).
- Food grade options available
- ISO quality standards result in reliable, long-time operation.
- Fully field repairable units are available in mid-bore and larger bore product ranges.

Added New Features for the ECO OEM Series

- Environmentally friendly materials:
  - ROHS Compliant materials
  - Bio-degradable hydraulic oil
  - Copper-Free design
  - Recyclable packaging materials
- Introducing our new Enicote II surface finish:
  - ROHS Compliant
  - Rated at 350 hours salt spray corrosion protection
- Jam Nut included with every shock absorber.
- Wrench flats promote ease of mounting
- Capability to mount into pressure chambers
- Integrated positive stopping capabilities up to 100 psi (7 bar).

Added New Features for the ECO OEM Series

- Environmentally friendly materials:
  - ROHS Compliant materials
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  - ROHS Compliant
  - Rated at 350 hours salt spray corrosion protection
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Adjustable Series Hydraulic Shock Absorbers
ECO OEM and OEMXT Series

Overview

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. Low velocity range (LR) series configurations are available for controlling velocities that fall below the standard adjustable range.
### Technical Data

#### Adjustable Series Hydraulic Shock Absorbers

**ECO OEM Small Bore Series**

#### Standard

*Note: A1 and F1 apply to button models. One Hex Jam Nut included with every shock absorber.*

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>S (in.)</th>
<th>Strain (in.)</th>
<th>Øx (in.)</th>
<th>Velocity (in./sec)</th>
<th>Hx (in./cycle)</th>
<th>Pmax (lbs)</th>
<th>Reaction (lbs)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO OEM .1M (B)</td>
<td>0.25</td>
<td>2.25</td>
<td>0.19</td>
<td>0.34</td>
<td>1.95</td>
<td>0.04</td>
<td>0.34</td>
<td>0.40</td>
</tr>
<tr>
<td>ECO OEM .15M (B)</td>
<td>0.35</td>
<td>3.22</td>
<td>0.16</td>
<td>0.44</td>
<td>2.91</td>
<td>0.56</td>
<td>0.40</td>
<td>0.68</td>
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<tr>
<td>ECO OEM .25 (B)</td>
<td>0.45</td>
<td>3.88</td>
<td>0.16</td>
<td>0.91</td>
<td>4.09</td>
<td>1.67</td>
<td>0.50</td>
<td>0.88</td>
</tr>
<tr>
<td>ECO OEM 1.0 (B)</td>
<td>0.60</td>
<td>5.12</td>
<td>0.16</td>
<td>1.67</td>
<td>5.09</td>
<td>2.67</td>
<td>0.50</td>
<td>0.88</td>
</tr>
</tbody>
</table>

**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 22-23.
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 1.0M.
### Adjustable Series Hydraulic Shock Absorbers
- **ECO OEM Small Bore Series**

#### Accessories

<table>
<thead>
<tr>
<th>Jam Nut (JN)</th>
<th>Catalog No./Part Number</th>
<th>Model/Ref</th>
<th>CA (In.)</th>
<th>CB (In.)</th>
<th>CA (mm)</th>
<th>CB (mm)</th>
<th>Weight (oz.)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JN M10 x 1</td>
<td>J223840167</td>
<td>OEC OEM 0.1M (B)</td>
<td>0.39</td>
<td>0.35</td>
<td>10.00</td>
<td>28.00</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>JN M12 x 1</td>
<td>J223841035</td>
<td>ECO OEM 1.0M (B)</td>
<td>0.46</td>
<td>0.39</td>
<td>14.00</td>
<td>36.00</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>JN M16 x 1.5</td>
<td>J223841035</td>
<td>OEC EN 1.0M (B)</td>
<td>0.79</td>
<td>0.63</td>
<td>20.00</td>
<td>56.00</td>
<td>–</td>
<td>–</td>
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<tr>
<td>JN 5/16 – 20</td>
<td>J223842166</td>
<td>OEC (LR) OEM 20 M (B)</td>
<td>0.79</td>
<td>0.63</td>
<td>20.00</td>
<td>56.00</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

#### Stop Collar (SC)

| SC M10 x 1   | M923840171               | OEM 0.1M (B) | 0.75 | 0.63 | – | – | 0.5 | 14.3 |
| SC M12 x 1   | M923841058               | OEM 0.15M (B) | 0.75 | 0.63 | – | – | 0.5 | 14.0 |
| SC 1/2 - 20  | M923842057               | (LR)OEM .25 (B) | 1.00 | 0.75 | – | – | 1.0 | 22.0 |
| SC M14 x 1.5 | M923842171               | (M14 x 1,5) | 2.54 | 1.88 | 45.00 | 114.00 | – | – |

#### Universal Retaining Flange (Small Bore) (UF)

| UF M10 x 1   | U16363189                | OEM 0.1M (B) | 1.50 | 0.63 | 12.00 | 31.00 | 4.50 | 127.0 |
| UF M12 x 1   | U15588189                | OEM 0.15M (B) | 1.50 | 0.63 | 12.00 | 31.00 | 4.50 | 127.0 |
| UF 5/16 - 20 | U13935095                | (LR)OEM .25 (B) | 1.50 | 0.63 | 12.00 | 31.00 | 4.50 | 127.0 |
| UF M14 x 1.5 | U13935143                | (M14 x 1,5) | 4.50 | 1.88 | 35.00 | 91.00 | 11.00 | – |
| UF 9/16 -18  | U19018095                | (LR)OEM .35 (B) | 1.81 | 0.62 | 31.00 | 83.00 | 1.99 | 57.0 |
| UF M16 x 1.5 | U19018143                | (M16 x 1,5) | 5.00 | 1.50 | 35.00 | 91.00 | 11.00 | – |
| UF 3/4 -16   | U120275095               | (LR)OEM .5 (B) | 2.00 | 0.62 | 31.00 | 83.00 | 1.99 | 57.0 |
| UF M20 x 1.5 | U19599095                | (M20 x 1,5) | 6.50 | 1.50 | 35.00 | 91.00 | 11.00 | – |

*Note: 1. Do not use with urethane striker cap. 2. Δ = Non-standard lead time items, contact Enidine.*
### Adjustable Series Hydraulic Shock Absorbers

**ECO OEM Small Bore Series**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Man. (Ref)</th>
<th>Stroke (in.)</th>
<th>A (mm)</th>
<th>B (mm)</th>
<th>C (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>S (mm)</th>
<th>WF (mm)</th>
<th>WL (mm)</th>
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</thead>
<tbody>
<tr>
<td>SLA 10MF</td>
<td>SLA 33452</td>
<td>ECO OEM 0.1</td>
<td>0.25</td>
<td>0.47</td>
<td>0.43</td>
<td>0.80</td>
<td>0.10</td>
<td>0.30</td>
<td>0.30</td>
<td>1.25</td>
<td>0.13</td>
</tr>
<tr>
<td>SLA 12MF</td>
<td>SLA 33450</td>
<td>ECO OEM 0.1</td>
<td>0.25</td>
<td>0.71</td>
<td>0.55</td>
<td>1.14</td>
<td>0.10</td>
<td>0.34</td>
<td>0.34</td>
<td>1.78</td>
<td>0.32</td>
</tr>
<tr>
<td>SLA 1/8 – 20 x .50</td>
<td>SLA 33450</td>
<td>ECO OEM 0.1</td>
<td>0.25</td>
<td>0.72</td>
<td>0.55</td>
<td>1.14</td>
<td>0.10</td>
<td>0.34</td>
<td>0.34</td>
<td>1.78</td>
<td>0.32</td>
</tr>
<tr>
<td>SLA 20 MF</td>
<td>SLA 33452</td>
<td>ECO OEM 0.1</td>
<td>0.38</td>
<td>0.94</td>
<td>0.71</td>
<td>1.46</td>
<td>0.20</td>
<td>0.88</td>
<td>0.88</td>
<td>3.15</td>
<td>0.92</td>
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<tr>
<td>SLA 27 MC</td>
<td>SLA 33456</td>
<td>ECO (LR)OEM 0.1</td>
<td>0.5</td>
<td>1.10</td>
<td>0.94</td>
<td>1.88</td>
<td>0.20</td>
<td>1.25</td>
<td>1.25</td>
<td>4.30</td>
<td>1.50</td>
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Note: 1. Maximum sideload angle is 30°. 2. Part Numbers in page color are non-standard lead time items, contact ITT Enidine.

---

**Clevis Mount**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Man. (Ref)</th>
<th>Stroke (in.)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>S (mm)</th>
<th>V (mm)</th>
<th>WF (mm)</th>
<th>WL (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO OEM 1.0 MNS</td>
<td>0.5</td>
<td>0.5</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
</tr>
<tr>
<td>ECO OEM 1.0M MNS</td>
<td>0.5</td>
<td>0.5</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
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</tbody>
</table>

Note: 1. Maximum sideload angle is 20°. 2. All other dimensions and tolerances are non-standard lead time items, contact ITT Enidine.
Adjustable Series Hydraulic Shock Absorbers
ECO OEM Small Bore Series

Technical Data

Catalog No./Model | Model (Ref) | (Ref) |
--- | --- | --- |
ECO (LR)OEM 1.15M x 1 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.15 x 1 | 1.00 | 1.20 |
ECO (LR)OEM 1.15M x 2 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.15 x 2 | 1.00 | 1.20 |

Catalog No./Model | Model (Ref) | (Ref) |
--- | --- | --- |
ECO (LR)OEM 1.25M x 1 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.25 x 1 | 1.00 | 1.20 |
ECO (LR)OEM 1.25M x 2 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.25 x 2 | 1.00 | 1.20 |

Catalog No./Model | Model (Ref) | (Ref) |
--- | --- | --- |
ECO (LR)OEM 1.25M x 1 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.25 x 1 | 1.00 | 1.20 |
ECO (LR)OEM 1.25M x 2 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.25 x 2 | 1.00 | 1.20 |

Catalog No./Model | Model (Ref) | (Ref) |
--- | --- | --- |
ECO (LR)OEM 1.25M x 1 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.25 x 1 | 1.00 | 1.20 |
ECO (LR)OEM 1.25M x 2 | (25,0) | (0,3-3,30) |
ECO (LR)OEM 1.25 x 2 | 1.00 | 1.20 |

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 page 25.
3. Urethane striker caps are available as accessories for models OEM 1.15M x 1 to OEM 1.25M x 2.
4. Δ = Non-standard lead time items, contact ITT Enidine.

Urethane Striker Cap (USC)

Catalog No./Model | Part Number | Model (Ref) | (Ref) |
--- | --- | --- | --- |
UC 9609 | C96095X9 | ECO (LR)OEM 1.15/1.25 |

Adjustable Series
www.enidine.com Email: industrialsales@enidine.com Tel.: 1-800-852-8508 Fax: 1-716-662-0406

Technical Data

Catalog No./Model | Part Number | Model (Ref) | (Ref) |
--- | --- | --- | --- |
UC 9609 | C96095X9 | ECO (LR)OEM 1.15/1.25 |

Adjustable Series
www.enidine.com Email: industrialsales@enidine.com Tel.: 1-800-852-8508 Fax: 1-716-662-0406
Adjustable Series Hydraulic Shock Absorbers

**Jam Nut (JN)**

| Catalog No./ Part Number | Model (Ref) | JA in. (mm) | JR in. (mm) | JR in. (mm) | Weight (oz.)(g) |
|-------------------------|-------------|-------------|-------------|-------------|-----------------|-----------------|
| JN 1/4-12              | 0206/061064 | 1.73        | 1.50        | 25          | 20              | 22              |
| JN M10 x 1.5           | 0206/061065 | 44.0        | 30.0        | 44.0        | 20              | 22              |
| JN 1/4-12              | 0206/061064 | 1.88        | 1.40        | 25          | 20              | 22              |
| JN M10 x 1.5           | 0206/061065 | 44.0        | 30.0        | 44.0        | 20              | 22              |

**Stop Collar (SC)**

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Ref)</th>
<th>SC in. (mm)</th>
<th>CD in. (mm)</th>
<th>WF in. (mm)</th>
<th>WL in. (mm)</th>
<th>Weight (oz.)(g)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SC 1/4-12</td>
<td>0206/061057</td>
<td>1.15</td>
<td>2.50</td>
<td>1.50</td>
<td>–</td>
<td>7.0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>SC M10 x 1.5</td>
<td>0206/061058</td>
<td>43.3</td>
<td>39.0</td>
<td>18</td>
<td>(215)</td>
<td></td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>SC 1/4-12</td>
<td>0206/061057</td>
<td>1.15</td>
<td>2.50</td>
<td>1.50</td>
<td>–</td>
<td>7.0</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>SC M10 x 1.5</td>
<td>0206/061058</td>
<td>43.3</td>
<td>39.0</td>
<td>18</td>
<td>(215)</td>
<td></td>
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</table>

**Rectangular Flange (RF)**

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Ref)</th>
<th>RF in. (mm)</th>
<th>PH in. (mm)</th>
<th>SA in. (mm)</th>
<th>SB in. (mm)</th>
<th>Weight (oz.)(g)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>RF 1/4-12</td>
<td>0337/031919</td>
<td>1.15</td>
<td>1.43</td>
<td>1.80</td>
<td>1.75</td>
<td>7.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>RF M10 x 1.5</td>
<td>0337/031918</td>
<td>41.0</td>
<td>39.0</td>
<td>41.0</td>
<td>39.0</td>
<td>20.0</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>RF 1/4-12</td>
<td>0337/031919</td>
<td>1.15</td>
<td>1.43</td>
<td>1.80</td>
<td>1.75</td>
<td>7.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>RF M10 x 1.5</td>
<td>0337/031918</td>
<td>41.0</td>
<td>39.0</td>
<td>41.0</td>
<td>39.0</td>
<td>20.0</td>
<td>0.05</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Note: 1. *Do not use with urethane striker cap. 2. Δ = Non-standard lead time items, contact Enidine.

www.enidine.com  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406
## Adjustable Series Hydraulic Shock Absorbers

**ECO OEM Small Bore Series**

### Clevis Mount

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>ECO (LR)OEM 1.15 x 1 CM(S)</td>
<td>1.0</td>
<td>6.44</td>
<td>251</td>
<td>351</td>
<td>500</td>
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<td>1.50</td>
<td>88</td>
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<td>ECO (LR)OEM 1.15 x 2 CM(S)</td>
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<tr>
<td>ECO (LR)OEM 1.25 x 2 CM(S)</td>
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<td>9.07</td>
<td>251</td>
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<td>88</td>
<td>23</td>
<td>23</td>
<td>44</td>
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### Flange Foot Mount

<table>
<thead>
<tr>
<th>Catalog No. / Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>T (in.)</th>
<th>Z (in.)</th>
<th>FA (in.)</th>
<th>FB (in.)</th>
<th>FC (in.)</th>
<th>FE (in.)</th>
<th>FG (in.)</th>
<th>FJ (in.)</th>
<th>FK (in.)</th>
<th>Size (in.)</th>
<th>Bolt Weight (lbs)</th>
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<tbody>
<tr>
<td>FM 1 1/4 - 12</td>
<td>2F2149305</td>
<td>ECO (LR)OEM1.15</td>
<td>2.20</td>
<td>3.35</td>
<td>3.75</td>
<td>2.28</td>
<td>23</td>
<td>1.75</td>
<td>0.50</td>
<td>0.96</td>
<td>0.25</td>
<td>0.08</td>
<td>0.18</td>
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<tr>
<td>FM 1 1/4 - 12</td>
<td>3F2139305</td>
<td>ECO (LR)OEM1.25</td>
<td>2.20</td>
<td>3.35</td>
<td>3.75</td>
<td>2.28</td>
<td>23</td>
<td>1.75</td>
<td>0.50</td>
<td>0.96</td>
<td>0.25</td>
<td>0.08</td>
<td>0.18</td>
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<tr>
<td>FM M33 x 1,5</td>
<td>2F2149306</td>
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<td>5.46</td>
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<td>4.60</td>
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<td>0.69</td>
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<td>0.12</td>
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<td>0.18</td>
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<td>4.60</td>
<td>6.0</td>
<td>0.69</td>
<td>0.45</td>
<td>0.12</td>
<td>0.12</td>
<td>0.08</td>
<td>0.18</td>
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**Notes:**
1. “S” designates model is supplied with spring. 2. Δ = Non-standard lead time items, contact ITT Enidine.
Adjustable Series Hydraulic Shock Absorbers

**OEMXT Mid-Bore Series**

**Technical Data**

### Standard

![Diagram of Adjustable Series Hydraulic Shock Absorbers]

**Nominal Coil Spring Force**

<table>
<thead>
<tr>
<th>Imperial Catalog No./Model</th>
<th>(S) Stroke in.</th>
<th>Optimal Velocity Range in./sec.</th>
<th>(E_T) Max. lbs./cycle</th>
<th>(E_T-C) Max. lbs./hour</th>
<th>(F_P) Max. Reaction Force lbs.</th>
<th>Nominal Coil Spring Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEMXT 3/4 x 1</td>
<td>1</td>
<td>12-140</td>
<td>3,750</td>
<td>1,120,000</td>
<td>4,500</td>
<td>11</td>
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<tr>
<td>LROEMXT 3/4 x 1</td>
<td>1</td>
<td>3-55</td>
<td>3,750</td>
<td>1,120,000</td>
<td>4,500</td>
<td>11</td>
</tr>
<tr>
<td>OEMXT 3/4 x 2</td>
<td>2</td>
<td>12-140</td>
<td>7,500</td>
<td>1,475,000</td>
<td>4,500</td>
<td>7</td>
</tr>
<tr>
<td>LROEMXT 3/4 x 2</td>
<td>2</td>
<td>3-55</td>
<td>7,500</td>
<td>1,475,000</td>
<td>4,500</td>
<td>11</td>
</tr>
<tr>
<td>OEMXT 3/4 x 3</td>
<td>3</td>
<td>12-140</td>
<td>11,500</td>
<td>1,775,000</td>
<td>4,500</td>
<td>7</td>
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### Metric

<table>
<thead>
<tr>
<th>Metric Catalog No./Model</th>
<th>(S) Stroke mm</th>
<th>Optimal Velocity Range m/sec.</th>
<th>(E_T) Max. Nm/cycle</th>
<th>(E_T-C) Max. Nm/hour</th>
<th>(F_P) Max. Reaction Force N</th>
<th>Nominal Coil Spring Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEMXT 1.5M x 1</td>
<td>25.0</td>
<td>0.3-3.5</td>
<td>425</td>
<td>126,000</td>
<td>20,000</td>
<td>48</td>
</tr>
<tr>
<td>LROEMXT 1.5M x 1</td>
<td>25.0</td>
<td>0.08-1.3</td>
<td>425</td>
<td>126,000</td>
<td>20,000</td>
<td>48</td>
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<tr>
<td>OEMXT 1.5M x 2</td>
<td>50.0</td>
<td>0.3-3.5</td>
<td>850</td>
<td>167,000</td>
<td>20,000</td>
<td>29</td>
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<tr>
<td>LROEMXT 1.5M x 2</td>
<td>50.0</td>
<td>0.08-1.3</td>
<td>850</td>
<td>167,000</td>
<td>20,000</td>
<td>48</td>
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<td>OEMXT 1.5M x 3</td>
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<td>1,300</td>
<td>201,000</td>
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### Imperial Catalog No./Model

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<tr>
<th>Metric Catalog No./Model</th>
<th>C</th>
<th>A</th>
<th>A_1</th>
<th>B</th>
<th>D</th>
<th>E</th>
<th>E_T</th>
<th>F</th>
<th>K</th>
<th>K_1</th>
<th>WF</th>
<th>WL</th>
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<tbody>
<tr>
<td>(LR)OEMXT 1.5M x 1</td>
<td>M42 x 1.5</td>
<td>144</td>
<td>162</td>
<td>58</td>
<td>13</td>
<td>38</td>
<td>44</td>
<td>92</td>
<td>32</td>
<td>32</td>
<td>40.5</td>
<td>19</td>
</tr>
<tr>
<td>(LR)OEMXT 1.5M x 2</td>
<td>M42 x 1.5</td>
<td>195</td>
<td>213</td>
<td>58</td>
<td>13</td>
<td>38</td>
<td>44</td>
<td>118</td>
<td>45</td>
<td>45</td>
<td>40.5</td>
<td>19</td>
</tr>
<tr>
<td>(LR)OEMXT 1.5M x 3</td>
<td>M42 x 1.5</td>
<td>246</td>
<td>264</td>
<td>58</td>
<td>13</td>
<td>38</td>
<td>44</td>
<td>143</td>
<td>57</td>
<td>57</td>
<td>40.5</td>
<td>19</td>
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<tr>
<td>(LR)OEMXT 45M x 1</td>
<td>M45 x 1.5</td>
<td>144</td>
<td>162</td>
<td>58</td>
<td>13</td>
<td>38</td>
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<td>40.5</td>
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<tr>
<td>(LR)OEMXT 45M x 2</td>
<td>M45 x 1.5</td>
<td>195</td>
<td>213</td>
<td>58</td>
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<td>118</td>
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<tr>
<td>(LR)OEMXT 45M x 3</td>
<td>M45 x 1.5</td>
<td>246</td>
<td>264</td>
<td>58</td>
<td>13</td>
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<td>143</td>
<td>57</td>
<td>57</td>
<td>40.5</td>
<td>19</td>
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</tbody>
</table>

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*Note: A_1 and E_T apply to urethane striker cap accessory.*
### OEMXT Mid-Bore Series

**Clevis Mount**

Adjustable Series Hydraulic Shock Absorbers

#### OEMXT 3/4 & (LR)OEMXT 1.5M Series

**Accessories**

- **Clevis Mount**
  - **Spring Optional**
  - **Lock Ring**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>(L) Stroke In. (mm)</th>
<th>L In. (mm)</th>
<th>N In. (mm)</th>
<th>P In. (mm)</th>
<th>Q In. (mm)</th>
<th>S In. (mm)</th>
<th>T In. (mm)</th>
<th>U In. (mm)</th>
<th>V In. (mm)</th>
<th>W In. (mm)</th>
<th>Z In. (mm)</th>
<th>CR In. (mm)</th>
<th>Weight/ (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(LR)OEMXT 3/4 x 1 CM(S)</td>
<td>1.00</td>
<td>7.84</td>
<td>0.376</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.87</td>
<td>0.505</td>
<td>0.56</td>
</tr>
<tr>
<td>(LR)OEMXT 1.5M x 1 CM(S)</td>
<td>1.50</td>
<td>11.84</td>
<td>0.376</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.87</td>
<td>0.505</td>
<td>0.30</td>
</tr>
<tr>
<td>(LR)OEMXT 3/4 x 2 CM(S)</td>
<td>2.00</td>
<td>9.84</td>
<td>0.376</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.87</td>
<td>0.505</td>
<td>0.56</td>
</tr>
<tr>
<td>(LR)OEMXT 1.5M x 2 CM(S)</td>
<td>2.50</td>
<td>13.84</td>
<td>0.376</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.87</td>
<td>0.505</td>
<td>0.40</td>
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<tr>
<td>(LR)OEMXT 3/4 x 3 CM(S)</td>
<td>3.00</td>
<td>11.84</td>
<td>0.376</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.87</td>
<td>0.505</td>
<td>0.48</td>
</tr>
<tr>
<td>(LR)OEMXT 1.5M x 3 CM(S)</td>
<td>3.50</td>
<td>13.84</td>
<td>0.376</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.87</td>
<td>0.505</td>
<td>0.38</td>
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</tbody>
</table>

Notes: 1. "S" designates model is supplied with spring. 2. Δ = Non-standard lead time items, contact ITT Enidine.

**Flange Foot Mount**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>Y in. (mm)</th>
<th>Z in. (mm)</th>
<th>FA In. (mm)</th>
<th>EB In. (mm)</th>
<th>EC In. (mm)</th>
<th>FD In. (mm)</th>
<th>FE In. (mm)</th>
<th>EG In. (mm)</th>
<th>EI In. (mm)</th>
<th>Bulk Size In. (mm)</th>
<th>Weight (lbs)</th>
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</thead>
<tbody>
<tr>
<td>FM 1 1/12</td>
<td>2892940</td>
<td>1.800641/4</td>
<td>2.75</td>
<td>3.00</td>
<td>3.75</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>2.75</td>
<td>3.00</td>
<td>2.75</td>
<td>1.52</td>
<td></td>
</tr>
<tr>
<td>FM M42 x 1.5</td>
<td>2892940</td>
<td>1.600641/8</td>
<td>2.50</td>
<td>3.00</td>
<td>3.75</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>2.75</td>
<td>3.00</td>
<td>2.75</td>
<td>1.37</td>
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www.enidine.com  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406
## Adjustable Series Hydraulic Shock Absorbers

### OEMXT Mid-Bore Series

### Standard

<table>
<thead>
<tr>
<th><strong>Imperial Catalog No./Model</strong></th>
<th><strong>LS</strong></th>
<th><strong>Optimal Velocity Range (in/sec.)</strong></th>
<th><strong>E (Max. RecoilForce) (lbs.)</strong></th>
<th><strong>E (Max. Reaction Force) lbs.</strong></th>
<th><strong>Nominal Coil Spring Force (lbs.)</strong></th>
<th><strong>Optimal (FP)(FD)</strong></th>
<th><strong>Max. Propelling Weight (lbs.)</strong></th>
<th><strong>Max. Propelling Force (lbs.)</strong></th>
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<tbody>
<tr>
<td>OEMXT 1 1/8 x 1</td>
<td>1</td>
<td>3-30</td>
<td>10,000</td>
<td>2,000,000</td>
<td>31,500</td>
<td>115</td>
<td>155</td>
<td>17,750</td>
</tr>
<tr>
<td>OEMXT 1 1/8 x 2</td>
<td>2</td>
<td>12-140</td>
<td>20,000</td>
<td>3,730,000</td>
<td>31,500</td>
<td>115</td>
<td>155</td>
<td>17,750</td>
</tr>
<tr>
<td>OEMXT 1 3/8 x 4</td>
<td>4</td>
<td>12-140</td>
<td>40,000</td>
<td>3,730,000</td>
<td>31,500</td>
<td>115</td>
<td>155</td>
<td>17,750</td>
</tr>
<tr>
<td>OEMXT 1 1/8 x 4</td>
<td>4</td>
<td>12-140</td>
<td>20,000</td>
<td>3,730,000</td>
<td>31,500</td>
<td>115</td>
<td>155</td>
<td>17,750</td>
</tr>
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<table>
<thead>
<tr>
<th><strong>Metric Catalog No./Model</strong></th>
<th><strong>CS</strong></th>
<th><strong>A</strong></th>
<th><strong>A1</strong></th>
<th><strong>B</strong></th>
<th><strong>D</strong></th>
<th><strong>E</strong></th>
<th><strong>E1</strong></th>
<th><strong>F</strong></th>
<th><strong>K</strong></th>
<th><strong>H</strong></th>
<th><strong>WF</strong></th>
<th><strong>WL</strong></th>
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</thead>
<tbody>
<tr>
<td>OEMXT 2.0M x 1</td>
<td>M64 x 2.0</td>
<td>371</td>
<td>475</td>
<td>77</td>
<td>50</td>
<td>57</td>
<td>140</td>
<td>50</td>
<td>61.5</td>
<td>25</td>
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<tr>
<td>OEMXT 2.0M x 2</td>
<td>M64 x 2.0</td>
<td>371</td>
<td>475</td>
<td>77</td>
<td>50</td>
<td>57</td>
<td>140</td>
<td>50</td>
<td>61.5</td>
<td>25</td>
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<tr>
<td>OEMXT 2.0M x 4</td>
<td>M64 x 2.0</td>
<td>371</td>
<td>475</td>
<td>77</td>
<td>50</td>
<td>57</td>
<td>140</td>
<td>50</td>
<td>61.5</td>
<td>25</td>
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</table>

**Note:** All standard lead times shown, contact ITT Enidine.
Adjustable Series Hydraulic Shock Absorbers
OEMXT Mid-Bore Series Accessories

OEMXT 1/8 & OEMXT 2.0M Series

Clevis Mount

Flange Foot Mount

---

**OEMXT Mid-Bore Series Accessories**

---

**Adjustable Series**

---

**Flange Foot Mount**

---

**Clevis Mount**

---

**Table:**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>Y (in.)</th>
<th>Z (in.)</th>
<th>FA (in.)</th>
<th>FB (in.)</th>
<th>FC (in.)</th>
<th>FD (in.)</th>
<th>FE (in.)</th>
<th>FG (in.)</th>
<th>FK (in.)</th>
<th>Bolt Size (Ref)</th>
<th>Weight (lbs.)</th>
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</thead>
<tbody>
<tr>
<td>FM 2 ½ - 12</td>
<td>2FE0310</td>
<td>LR/OEM 1 ½</td>
<td>3.00</td>
<td>1.56</td>
<td>5.63</td>
<td>4.88</td>
<td>41</td>
<td>3.38</td>
<td>0.63</td>
<td>1.75</td>
<td>0.44</td>
<td>M10</td>
<td>3.3</td>
</tr>
<tr>
<td>FM M64 x 2</td>
<td>2F3010</td>
<td>LR/OEM 2.0M</td>
<td>3.00</td>
<td>1.56</td>
<td>5.63</td>
<td>4.88</td>
<td>41</td>
<td>3.38</td>
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**Notes:**
1. "S" designates model is supplied with spring.
2. A = Non-standard lead time items, contact ITT Enidine.
3. OEM 1 ½ x 6 "Z" dimension is 2.69 in.
4. OEM 2.0M x 6 "Z" dimension is 68,3 mm
## Adjustable Series Hydraulic Shock Absorbers

### OEM 3.0M → OEM 4.0M Series

#### Technical Data

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<th>Catalog No./Model</th>
<th>Optional Velocity Range (in./sec.)</th>
<th>(E) Max. Striker Cap Compressibility (in./cycle)</th>
<th>(E) Max. Striker Cap Compressibility (in./hour)</th>
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### Catalog Data

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**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 32.
3. Rear flange mounting of OEM 3.0M x 6.5, OEM 4.0M x 8 and OEM 4.0M x 10 models not recommended when mounting horizontally.
4. Note: Δ indicates non-standard lead time items, contact ITT Enidine.
## Adjustable Series Hydraulic Shock Absorbers

**OEM Mid-Bore Series**

### Clevis Mount

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**Notes:**
1. “S” indicates model is supplied with spring.
2. Δ= Non-standard lead time items, contact ITT Enidine.

### Flange Foot Mount

![Flange Foot Mount Diagram](image)

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<td>OEM</td>
<td>3.82</td>
<td>7.68</td>
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**Notes:**
1. 1. OEM 3.82 ID x 7.68 OD x 2” long, diameter 1-1/2”.
2. 2. OEM 3.82 ID x 7.68 OD x 2” long, diameter 1-1/2”.
3. For rear foot mount, diameter is 2-1/2”.
Adjustable Series Hydraulic Shock Absorbers

**Stop Collar (SC)**

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<th>CB in. (mm)</th>
<th>CD in. (mm)</th>
<th>Length (mm)</th>
<th>Weight (oz) (g)</th>
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<td>OEMXT 1/4</td>
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**Lock Ring (LR)**

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<th>CD in. (mm)</th>
<th>Length (mm)</th>
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**Square Flange (SF)**

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<th>CD in. (mm)</th>
<th>Length (mm)</th>
<th>Weight (oz) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 1'' - 12</td>
<td>B00014022</td>
<td>OEMXT 1/2</td>
<td>3.00</td>
<td>3.00</td>
<td>2.22</td>
<td>12.0</td>
<td>53 (145)</td>
</tr>
<tr>
<td>SF 2'' - 12</td>
<td>B00014023</td>
<td>OEMXT 1</td>
<td>3.00</td>
<td>3.00</td>
<td>2.22</td>
<td>18.0</td>
<td>91 (256)</td>
</tr>
<tr>
<td>SF M42 x 1.5 x 1</td>
<td>B00014024</td>
<td>OEMXT 1.5M</td>
<td>3.00</td>
<td>3.00</td>
<td>2.22</td>
<td>18.0</td>
<td>91 (256)</td>
</tr>
<tr>
<td>SF M42 x 1.5 x 2</td>
<td>B00014025</td>
<td>OEMXT 1.5M</td>
<td>3.00</td>
<td>3.00</td>
<td>2.22</td>
<td>24.0</td>
<td>129 (365)</td>
</tr>
<tr>
<td>SF M42 x 1.5 x 3</td>
<td>B00014026</td>
<td>OEMXT 1.5M</td>
<td>3.00</td>
<td>3.00</td>
<td>2.22</td>
<td>30.0</td>
<td>167 (475)</td>
</tr>
<tr>
<td>SF M42 x 1.5 x 4</td>
<td>B00014027</td>
<td>OEMXT 1.5M</td>
<td>3.00</td>
<td>3.00</td>
<td>2.22</td>
<td>36.0</td>
<td>205 (581)</td>
</tr>
</tbody>
</table>

**Note:** 1. * Do not use with urethane striker cap. 2. Δ = Non-standard lead time items, contact ITT Enidine.
# Adjustable Series Hydraulic Shock Absorbers

## Accessories

### OEM Mid-Bore Accessories

#### Rectangular Flange (RF)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
<th>C in. (mm)</th>
<th>D in. (mm)</th>
<th>E in. (mm)</th>
<th>F in. (mm)</th>
<th>T in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF 1/4 x 12</td>
<td>M529410129</td>
<td>OEMXT</td>
<td>.34</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
<tr>
<td>RF 1/2 x 1.5</td>
<td>M529410129</td>
<td>OEMXT 1 SM</td>
<td>.34</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
<tr>
<td>RF 0.7 x 2</td>
<td>M533010129</td>
<td>OEM 1 SM</td>
<td>.34/4</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
</tbody>
</table>

#### Stop Bar Kit

<table>
<thead>
<tr>
<th>Kit Part Number</th>
<th>Model (Ref)</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
<th>C in. (mm)</th>
<th>D in. (mm)</th>
<th>E in. (mm)</th>
<th>F in. (mm)</th>
<th>T in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCF 1</td>
<td>M98630100</td>
<td>1.00</td>
<td>2.00</td>
<td>3.50</td>
<td>2.50</td>
<td>3.50</td>
<td>2.20</td>
<td>3.00</td>
<td>39.8 (1 100)</td>
</tr>
<tr>
<td>SCF 2</td>
<td>M98630100</td>
<td>1.00</td>
<td>2.00</td>
<td>3.50</td>
<td>2.50</td>
<td>3.50</td>
<td>2.20</td>
<td>3.00</td>
<td>39.8 (1 100)</td>
</tr>
</tbody>
</table>

#### Urethane Striker Cap (UC)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
<th>C in. (mm)</th>
<th>D in. (mm)</th>
<th>E in. (mm)</th>
<th>F in. (mm)</th>
<th>T in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC 2940</td>
<td>M52941100</td>
<td>OEMXT</td>
<td>.34</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
<tr>
<td>UC 3010</td>
<td>M53301100</td>
<td>OEM 1 SM</td>
<td>.34/4</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
</tbody>
</table>

#### Stop Collar With Flange (SCF)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
<th>C in. (mm)</th>
<th>D in. (mm)</th>
<th>E in. (mm)</th>
<th>F in. (mm)</th>
<th>T in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCF 1/4 x 12</td>
<td>M529410129</td>
<td>OEMXT</td>
<td>.34</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
<tr>
<td>SCF 1/2 x 1.5</td>
<td>M529410129</td>
<td>OEMXT 1 SM</td>
<td>.34</td>
<td>.63</td>
<td>1.94</td>
<td>.94</td>
<td>2.25</td>
<td>2.20</td>
<td>1.63</td>
<td>21.5 (605)</td>
</tr>
</tbody>
</table>

**Notes:**
1. Locking set screw feature provided as standard.
2. ± .002 = Non-standard lead time items, contact ITT Enidine.
3. Kit includes 2 Stop Bars, Rectangular Flange for 0.75 and 1.5, Square Flange for 1.25 and 2 and Lock Ring.
4. Kit includes 2 Stop Bars, Rectangular Flange for 0.75 and 1.5, Square Flange for 1.25 and 2 and Lock Ring.

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After properly sizing the shock absorber, the usable 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 usable 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: (LR)OEMXT 1 1/8 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.

Adjustment Techniques

Useable Adjustment Setting Range

Position 0 provides minimum damping force.
Position 8 provides maximum damping force.
Adjustable Series Hydraulic Shock Absorbers

Typical Applications

Automotive Manufacturing Applications

Bottling Applications

Automated Applications
Non-Adjustable Series Hydraulic Shock Absorbers
TK, STH Micro-Bore Series

Overview

ITT Enidine non-adjustable micro-bore 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.

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.

The ITT 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.

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°F to 180°F) to (–30°F 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.
Non-Adjustable Series Hydraulic Shock Absorbers

TK, STH Micro-Bore Series

Overview

ITT Enidine Non-Adjustable Single-Orifice Shock Absorbers

The internal structure of a single orifice shock absorber is shown above. When a force is applied to the piston rod, the check ball is seated and the valve remains closed. Oil is forced through the orifice, creating internal pressure allowing smooth, controlled deceleration of the moving load. When the load is removed, the compressed coil spring moves to reposition the piston head, the check ball unseats, opening the valve that permits rapid return of the piston head rod to the original extended position.

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 closed system would be hydraulically locked.

Single-orifice shock absorbers provide constant orifice area (dashpot) damping.
## TK Micro-Bore Series

### Technical Data

#### TK 6M, TK 8 Series

**Non-Adjustable Series Hydraulic Shock Absorbers**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Bore Size (in.)</th>
<th>Stroke (in.)</th>
<th>Force (lbs./cycle)</th>
<th>Impact Velocity (in/sec)</th>
<th>Total Energy (in-lbs/cycle)</th>
<th>Damping Constant (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK 6M</td>
<td>.28</td>
<td>9</td>
<td>31,863</td>
<td>1.1</td>
<td>(28,0)</td>
<td>-2, -3, -4</td>
</tr>
<tr>
<td>TK 8M</td>
<td>.16</td>
<td>9</td>
<td>42,480</td>
<td>1.1</td>
<td>(25,0)</td>
<td>-2, -3, -4</td>
</tr>
</tbody>
</table>

**Notes:**
1. Dash numbers are non-standard lead time items, contact ITT Enidine.
2. A positive stop is required to prevent the internal damage of the TK 6 and TK 8 shock absorbers.

### Diagram

![Diagram](image)

**TK 6M/TK 8M**

#### TOTAL ENERGY (in-lbs/cycle)

<table>
<thead>
<tr>
<th>IMPACT VELOCITY (in/sec)</th>
<th>TOTAL ENERGY (in-lbs/cycle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td>1.0</td>
<td>3.0</td>
</tr>
<tr>
<td>2.0</td>
<td>6.0</td>
</tr>
<tr>
<td>3.0</td>
<td>12.0</td>
</tr>
</tbody>
</table>

**IMPACT VELOCITY (m/sec)**

<table>
<thead>
<tr>
<th>TOTAL ENERGY (Nm/cycle)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>0.5</td>
</tr>
<tr>
<td>1.0</td>
</tr>
<tr>
<td>2.0</td>
</tr>
<tr>
<td>3.0</td>
</tr>
<tr>
<td>4.0</td>
</tr>
<tr>
<td>5.0</td>
</tr>
<tr>
<td>6.0</td>
</tr>
<tr>
<td>7.0</td>
</tr>
</tbody>
</table>

---

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Non-Adjustable Series Hydraulic Shock Absorbers

TK Micro-Bore Series

TK 10M Series

Technical Data

CATALOG NO./
MODEL

<table>
<thead>
<tr>
<th>Catalog No. /</th>
<th>Model</th>
<th>Stroke [in.]</th>
<th>Force [lbs]</th>
<th>Weight [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK 21</td>
<td>-1, -2, -3</td>
<td>.25</td>
<td>50</td>
<td>115,000</td>
</tr>
<tr>
<td>TK 21M</td>
<td></td>
<td>.25</td>
<td>20</td>
<td>36,000</td>
</tr>
</tbody>
</table>

Note: A1 and E apply to button models and urethane striker cap accessory.

TK 21M Series

Standard

CATALOG NO./
MODEL

<table>
<thead>
<tr>
<th>Catalog No. /</th>
<th>Model</th>
<th>Stroke [in.]</th>
<th>Force [lbs]</th>
<th>Weight [lbs]</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK 10M (B)</td>
<td></td>
<td>.12</td>
<td>.3</td>
<td>2.2</td>
</tr>
<tr>
<td>TK 21M</td>
<td></td>
<td>.12</td>
<td>.3</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Note: Dash numbers in page color are non-standard lead time items, contact ITT Enidine.
### Non-Adjustable Series Hydraulic Shock Absorbers

#### STH Small-Bore Series

#### Technical Data

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>D</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>WF</th>
</tr>
</thead>
<tbody>
<tr>
<td>STH .25M</td>
<td>0.39</td>
<td>1.00</td>
<td>37,000</td>
<td>6.15</td>
<td>2.5</td>
</tr>
<tr>
<td>STH .5M</td>
<td>0.58</td>
<td>0.53</td>
<td>3900</td>
<td>9.06</td>
<td>5.0</td>
</tr>
<tr>
<td>STH .75M</td>
<td>0.75</td>
<td>0.49</td>
<td>2,180</td>
<td>6.04</td>
<td>8.0</td>
</tr>
<tr>
<td>STH 1.0M</td>
<td>1.00</td>
<td>0.84</td>
<td>4,400</td>
<td>3.70</td>
<td>11.0</td>
</tr>
<tr>
<td>STH 1.0M x 2</td>
<td>1.00</td>
<td>1.20</td>
<td>7,000</td>
<td>3.00</td>
<td>15.0</td>
</tr>
<tr>
<td>STH 1.5M x 1</td>
<td>0.70</td>
<td>1.63</td>
<td>10,200</td>
<td>6.09</td>
<td>12.5</td>
</tr>
<tr>
<td>STH 1.5M x 2</td>
<td>1.00</td>
<td>2.00</td>
<td>20,400</td>
<td>12.0</td>
<td>25.0</td>
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</table>

#### Custom Orificed Products

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>D</th>
<th>C</th>
<th>E</th>
<th>F</th>
<th>WF</th>
</tr>
</thead>
<tbody>
<tr>
<td>STH .25M</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>STH .5M</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>STH .75M</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>STH 1.0M</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>STH 1.0M x 2</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>STH 1.5M x 1</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>STH 1.5M x 2</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

#### 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.
4. Δ = Non-standard lead time items, contact ITT Enidine.

---

**Catalog No./Model**
- **STH .25M**: 0.39
- **STH .5M**: 0.58
- **STH .75M**: 0.75
- **STH 1.0M**: 1.00
- **STH 1.0M x 2**: 1.00
- **STH 1.5M x 1**: 0.70
- **STH 1.5M x 2**: 1.00

**Dimensions (in.):**
- **D**: 0.39
- **C**: 1.00
- **E**: 6.15
- **F**: 2.5
- **WF**: 4.9

**Catalog No./Model**
- **STH .25M**: 0.39
- **STH .5M**: 0.58
- **STH .75M**: 0.75
- **STH 1.0M**: 1.00
- **STH 1.0M x 2**: 1.00
- **STH 1.5M x 1**: 0.70
- **STH 1.5M x 2**: 1.00

**Dimensions (in.):**
- **D**: 0.39
- **C**: 1.00
- **E**: 6.15
- **F**: 2.5
- **WF**: 4.9
Non-Adjustable Series Hydraulic Shock Absorbers

TK, STH Micro-Bore Series

**Jam Nut (JN)**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>ØB (mm)</th>
<th>ØL (mm)</th>
<th>ØJ (mm)</th>
<th>ØD (mm)</th>
<th>Weight (mass) (oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JN M10 x 1</td>
<td>J24023135</td>
<td>TM10/TM21M</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>1.1</td>
</tr>
<tr>
<td>JN M14 X 1.5</td>
<td>J22153121</td>
<td>STH 2SM</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>2.2</td>
</tr>
<tr>
<td>JN M22 X 1.5</td>
<td>J24032121</td>
<td>STH 5W</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>5.5</td>
</tr>
<tr>
<td>JN M36 X 1.5</td>
<td>J23164035</td>
<td>STH 8X8M</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>16.9</td>
</tr>
</tbody>
</table>

**Lock Ring (LR)**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>ØB (mm)</th>
<th>ØL (mm)</th>
<th>ØD (mm)</th>
<th>Weight (mass) (oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR M65 x 1.5</td>
<td>F28637049</td>
<td>STH 1.5 Series</td>
<td>64.5</td>
<td>53.5</td>
<td>13.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Square Flange (SF)**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>ØB (mm)</th>
<th>ØL (mm)</th>
<th>ØD (mm)</th>
<th>Weight (mass) (oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF M45 X 1.5</td>
<td>M48637129</td>
<td>STH 1.5 Series</td>
<td>34.5</td>
<td>27.5</td>
<td>7.5</td>
<td>3.0</td>
</tr>
</tbody>
</table>

**Side Load Adapter (SLA)**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>ØB (mm)</th>
<th>ØL (mm)</th>
<th>ØD (mm)</th>
<th>Weight (mass) (oz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLA 3/8 - 32 x 25</td>
<td>S230843</td>
<td>TK 21</td>
<td>6/9</td>
<td>6/9</td>
<td>6/9</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Notes: 1. Maximum sideload angle is 30°.
2. Dash number in page color are non-standard lead time items, contact ITT Enidine.
Non-Adjustable Series

Hydraulic Shock Absorbers

TK Micro-Bore Series, STH Series

Accessories

Rectangular Flange (RF)

<table>
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<th>Part Number</th>
<th>Model (Ref)</th>
<th>A (in.)</th>
<th>FC (in.)</th>
<th>FR (in.)</th>
<th>BE (in.)</th>
<th>SA (in.)</th>
<th>SB (in.)</th>
<th>BOLT (Ref)</th>
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Universal Retaining Flange (UF)

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<th>B (in.)</th>
<th>C (in.)</th>
<th>D (in.)</th>
<th>E (in.)</th>
<th>F (in.)</th>
<th>G (in.)</th>
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Non-Adjustable Series Hydraulic Shock Absorbers

Typical Applications

Packaging

Medical Devices

High Speed Automation
ITT Enidine’s New ECO Series 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.

The ECO Series was designed using materials and fluids that are safe for our environment. Models can accommodate a wide range of operating conditions with varying masses or propelling forces. The ECO Series offers a flexible design to accommodate a wide variety of application parameters. Whether your application has a low velocity/high drive force or high velocity/low drive force condition, the New ECO Series will deliver the performance that you have come to expect.

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.

- Environmentally friendly materials:
  - RoHS Compliant materials
  - Bio-degradable hydraulic oil
  - Copper-Free design
  - Recyclable packaging materials

- Introducing our new Enicote II surface finish:
  - RoHS Compliant
  - Rated at 350 hours salt spray corrosion protection

- Jam Nut included with every shock absorber.

- ISO quality standards result in reliable, long-life operation.

- Tamperproof design ensures repeatable performance.

- Threaded cylinders provide mounting flexibility and increase surface area for improved heat dissipation.

- Wrench flats promote ease of mounting

- Capability to mount into pressure chambers

- Integrated positive stopping capabilities up to 100 psi (7 bar).

- Special materials and finishes can be designed to meet specific customer requirements
  - Optional fluids and seal packages can expand the standard operating temperature range from (15°F to 180°F) to (–30°F to 210°F)
  - Food grade options available

- Custom orificed (CBECO) can be engineered to meet specific application requirements or emergency impact only requirements.
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. As the piston head moves it closes off orifice holes, thus reducing the available orifice area in proportion to the velocity. After the load is removed 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. This allows quick repositioning for the next impact.

Low Pressure multiple orifice shock absorbers can provide progressive or self-compensating damping, depending on the impact conditions.
# Non-Adjustable Series

## ECO Series

### Technical Data

<table>
<thead>
<tr>
<th></th>
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<td></td>
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<td>(6 215)</td>
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<td>1.6</td>
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*Notes: Maximum energy rating for emergency use only. Estimated cycle life of 1-5 cycles if used at maximum emergency rating.*

---

**Non-Adjustable Series Hydrauluic Shock Absorbers**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Standard</th>
<th>ECO 8 — ECO 100 Series</th>
<th>Notes</th>
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**Notes: A1 and E1 apply to button models and urethane striker cap accessory. One Hex Jam Nut included with every shock absorber.**

---

**Catalog No./ Model**

- ECO 8 IF (B)
- ECO 8 MF (B)
- ECO 8 MC (B)
- ECO 10 IF (B)
- ECO 10 MF (B)
- ECO 15 IF (B)
- ECO 15 MF (B)
- ECO 15 MC (B)
- ECO S 25 MF (B)
- ECO S 25 IC (B)
- ECO S 25 MC (B)
- ECO 25 IF (B)
- ECO 25 MF (B)
- ECO 25 IC (B)
- ECO 25 MC (B)
- ECO S 50 IF (B)
- ECO S 50 IC (B)
- ECO S 50 MC (B)
- ECO 50 IF (B)
- ECO 50 MF (B)
- ECO 50 IC (B)
- ECO 50 MC (B)
- ECO 100 IF (B)
- ECO 100 MF (B)
- ECO 100 IC (B)
- ECO 100 MC (B)

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**Technical Data**

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<th>Standard</th>
<th>ECO 8 — ECO 100 Series</th>
<th>Notes</th>
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**Notes: A1 and E1 apply to button models and urethane striker cap accessory. One Hex Jam Nut included with every shock absorber.**

---

**Catalog No./ Model**

- ECO 8 IF (B)
- ECO 8 MF (B)
- ECO 8 MC (B)
- ECO 10 IF (B)
- ECO 10 MF (B)
- ECO 15 IF (B)
- ECO 15 MF (B)
- ECO 15 MC (B)
- ECO S 25 MF (B)
- ECO S 25 IC (B)
- ECO S 25 MC (B)
- ECO 25 IF (B)
- ECO 25 MF (B)
- ECO 25 IC (B)
- ECO 25 MC (B)
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- ECO 50 IC (B)
- ECO 50 MC (B)
- ECO 100 IF (B)
- ECO 100 MF (B)
- ECO 100 IC (B)
- ECO 100 MC (B)
**Non-Adjustable Series Hydraulic Shock Absorbers**

**ECO Series**

**Accessories**

*Note: One Hex Jam Nut included with every shock absorber.*

### Stop Collar (SC)

**ECO8 ➞ ECO100**

#### Catalog No./ Part Number | ECO Series Part Number | Model (Ref) | CA (in.) | CB (in.) | CD (in.) | WF (Metric Only) | WL (Metric Only) | Weight (oz.) | Metric Only
--- | --- | --- | --- | --- | --- | --- | --- | --- | ---
SC J/ 3/32 | M92439057 | ECO 8 (B) | 0.75 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 1/8 | M92439157 | ECO 8 IF (B) | 0.75 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 5/32 | M9241057 | ECO 10 IF (B) | 0.75 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 3/16 | M9241157 | ECO 10 MF (B) | 1.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 1/4 | M9241058 | ECO 15 IF (B) | 1.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 5/32 | M9241158 | ECO 15 MF (B) | 1.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 3/16 | M9240058 | ECO 25 IF (B) | 1.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 1/4 | M9240158 | ECO 25 MF (B) | 1.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 3/8 | M9240059 | ECO 50 IF (B) | 2.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 1/2 | M9240159 | ECO 50 MF (B) | 2.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 1 | M9240060 | ECO 100 IF (B) | 2.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3
SC J/ 1/2 | M9240160 | ECO 100 MF (B) | 2.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3

**HEX JAM NUT INCLUDED WITH SHOCK ABSORBER**
## Non-Adjustable Series

### Side Load Adaptor (SLA)

<table>
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<tr>
<th>Catalog No./Part Number</th>
<th>ECO Series (Ref)</th>
<th>Model (mm)</th>
<th>(mm)</th>
<th>in.</th>
<th>in.</th>
<th>in.</th>
<th>in.</th>
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<td>SLA 33974 ECO 10</td>
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<td>0.47</td>
<td>0.38</td>
<td>0.20</td>
<td>0.87</td>
<td>0.63</td>
<td>0.56</td>
<td>0.16</td>
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<td>SLA 10 MF</td>
<td>SLA 33457 ECO 10</td>
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<td>(11.7)</td>
<td>(3.8)</td>
<td>(0.20)</td>
<td>(3.4)</td>
<td>(2.63)</td>
<td>(2.22)</td>
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<td>0.55</td>
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<td>0.63</td>
<td>0.56</td>
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<td>SLA 33299 ECO 10</td>
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<td>(11.7)</td>
<td>(3.8)</td>
<td>(0.20)</td>
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<td>(2.22)</td>
<td>(0.06)</td>
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<td>0.71</td>
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<td>0.20</td>
<td>0.87</td>
<td>0.63</td>
<td>0.56</td>
<td>0.28</td>
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<tr>
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<td>SLA 33299 ECO 15</td>
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<td>(22)</td>
<td>(11)</td>
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<td>(32.4)</td>
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### Notes:
1. Maximum sideload angle is 30°.
2. Part numbers in page color are non-standard lead time items, contact Enidine.

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### Universal Retaining Flange (UF)

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<th>ECO Series (Ref)</th>
<th>Model (mm)</th>
<th>(mm)</th>
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<td>0.00</td>
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<td>0.28</td>
<td>0.25</td>
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<tr>
<td>UF M20 x 1.5</td>
<td>UF M20 x 1.5 UNF</td>
<td>1.00</td>
<td>0.62</td>
<td>0.31</td>
<td>0.32</td>
<td>1.98</td>
<td>0.71</td>
<td>0.63</td>
<td>0.28</td>
</tr>
<tr>
<td>UF 3/4 - 18</td>
<td>UF 3/4 - 18 UNF</td>
<td>0.79</td>
<td>0.56</td>
<td>0.28</td>
<td>0.25</td>
<td>1.00</td>
<td>0.50</td>
<td>0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>UF M20 x 1.5</td>
<td>UF M20 x 1.5 UNF</td>
<td>1.00</td>
<td>0.62</td>
<td>0.31</td>
<td>0.32</td>
<td>1.98</td>
<td>0.71</td>
<td>0.63</td>
<td>0.28</td>
</tr>
<tr>
<td>UF 1-12</td>
<td>UF 1-12 UNF</td>
<td>0.79</td>
<td>0.56</td>
<td>0.28</td>
<td>0.25</td>
<td>1.00</td>
<td>0.50</td>
<td>0.20</td>
<td>0.00</td>
</tr>
<tr>
<td>UF M20 x 1.5</td>
<td>UF M20 x 1.5 UNF</td>
<td>1.00</td>
<td>0.62</td>
<td>0.31</td>
<td>0.32</td>
<td>1.98</td>
<td>0.71</td>
<td>0.63</td>
<td>0.28</td>
</tr>
</tbody>
</table>

### Notes:
1. Part numbers in page color are non-standard lead time items, contact ITT Enidine.
### Non-Adjustable Series Hydraulic Shock Absorbers

#### ECO Series

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke (in)</th>
<th>A (in)</th>
<th>D (in)</th>
<th>E (in)</th>
<th>L (in)</th>
<th>J (in)</th>
<th>WL (in)</th>
<th>WT (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRO 110 IF (B)**</td>
<td>1.56</td>
<td>7.96</td>
<td>1.12</td>
<td>0.88</td>
<td>6.88</td>
<td>2.60</td>
<td>560</td>
<td></td>
</tr>
<tr>
<td>PRO 110 MF (B)**</td>
<td>1.56</td>
<td>7.96</td>
<td>1.12</td>
<td>0.88</td>
<td>6.88</td>
<td>2.60</td>
<td>560</td>
<td></td>
</tr>
<tr>
<td>PRO 110 MC (B)**</td>
<td>1.56</td>
<td>7.96</td>
<td>1.12</td>
<td>0.88</td>
<td>6.88</td>
<td>2.60</td>
<td>560</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- *A* and *E* apply to button models and urethane striker cap accessory.
- The PRO 110 Model is a Nickel Plated Shock Absorber.
- *Maximum emergency rating for emergency use only. Estimated cycle life of 1-5 cycles if used at maximum emergency rating."

---

**Non-Adjustable Series**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke (mm)</th>
<th>A (mm)</th>
<th>D (mm)</th>
<th>E (mm)</th>
<th>L (mm)</th>
<th>J (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRO 110 IF (B)**</td>
<td>39.0</td>
<td>20.4</td>
<td>28.7</td>
<td>6.37</td>
<td>23.2</td>
<td>8.07</td>
</tr>
<tr>
<td>PRO 110 MF (B)**</td>
<td>39.0</td>
<td>20.4</td>
<td>28.7</td>
<td>6.37</td>
<td>23.2</td>
<td>8.07</td>
</tr>
<tr>
<td>PRO 110 MC (B)**</td>
<td>39.0</td>
<td>20.4</td>
<td>28.7</td>
<td>6.37</td>
<td>23.2</td>
<td>8.07</td>
</tr>
</tbody>
</table>

### Notes:
- See page 55 for constant damping curves.
- The PRO 110 Model is a Nickel Plated Shock Absorber.
Non-Adjustable Series Hydraulic Shock Absorbers

### ECO Series

#### Non-Adjustable Series

Accessories

**Clevis Mount**

- **Catalog No./ Model**: ECO 120, ECO 125, ECO 220, ECO 225
- **Dimensions**:
  - **L**: 6.59 in (167 mm)
  - **W**: 0.88 in (23 mm)
  - **CR**: 1.3 in (33 mm)

**Notes**:
1. Shock absorber must be ordered separately from foot mount kit.
2. All foot mount kits include two foot mounts.
3. (S) indicates model comes with spring.

**Catalog No./ M N P Q Weight**

<table>
<thead>
<tr>
<th>Model</th>
<th>L (in)</th>
<th>W (in)</th>
<th>CR (in)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECO 120</td>
<td>6.59</td>
<td>0.88</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>ECO 220</td>
<td>9.22</td>
<td>0.88</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>ECO 125</td>
<td>6.59</td>
<td>0.88</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>ECO 225</td>
<td>9.22</td>
<td>0.88</td>
<td>1.9</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Flange Foot Mount**

- **Catalog No./ Model**: FM 1 1/4 - 12, FM 1 3/8 - 12
- **Dimensions**:
  - **Y + STROKE**: 2.25 in (57.2 mm)
  - **Z + STROKE**: 2.38 in (60.3 mm)

**Catalog No./ Part Number**

<table>
<thead>
<tr>
<th>Model (Ref)</th>
<th>L (in)</th>
<th>W (in)</th>
<th>CR (in)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2F21049305</td>
<td>2.25</td>
<td>2.38</td>
<td>2.38</td>
<td>2.25</td>
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<td>2F21049306</td>
<td>2.25</td>
<td>2.38</td>
<td>2.38</td>
<td>2.25</td>
</tr>
</tbody>
</table>

**Notes**:
1. All foot mount kits include two foot mounts.
2. Catalog No. includes styled series with springs.

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ENIDINE
www.enidine.com Email: industrialsales@enidine.com Tel.: 1-800-852-8508 Fax: 1-716-662-0406
Non-Adjustable Series Hydraulic Shock Absorbers
ECO Series

Stop Collar (SC)

Imperial

Metric

### Accessories

#### ECO 120 → ECO 225 Series

**Stop Collar (SC)**

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Roll)</th>
<th>Model (Ref)</th>
<th>CA Ax. (mm)</th>
<th>CD Ax. (mm)</th>
<th>WF Ax. (mm)</th>
<th>WL Ax. (mm)</th>
<th>Weight (mass)</th>
<th>Weight (mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC 1 1/2-12</td>
<td>M921049057</td>
<td>ECO 120/220</td>
<td>2.50</td>
<td>1.50</td>
<td>–</td>
<td>–</td>
<td>7.0</td>
<td>210</td>
</tr>
<tr>
<td>SC M33 x 1,5</td>
<td>M921293057</td>
<td>ECO 120/220</td>
<td>2.50</td>
<td>1.50</td>
<td>–</td>
<td>–</td>
<td>7.0</td>
<td>210</td>
</tr>
<tr>
<td>SC 1 3/8-12</td>
<td>M930290171</td>
<td>ECO 120/220</td>
<td>2.50</td>
<td>1.50</td>
<td>–</td>
<td>–</td>
<td>7.0</td>
<td>210</td>
</tr>
<tr>
<td>SC M36 x 1,5</td>
<td>M930285058</td>
<td>ECO 120/220</td>
<td>2.50</td>
<td>1.50</td>
<td>–</td>
<td>–</td>
<td>7.0</td>
<td>210</td>
</tr>
</tbody>
</table>

**Jam Nut (JN)**

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Roll)</th>
<th>Model (Ref)</th>
<th>JA Ax. (mm)</th>
<th>JB Ax. (mm)</th>
<th>JD Ax. (mm)</th>
<th>JD Ax. (mm)</th>
<th>Weight (mass)</th>
<th>Weight (mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JN 1 1/2-12</td>
<td>J118090504</td>
<td>ECO 120/220</td>
<td>1.73</td>
<td>1.00</td>
<td>23</td>
<td>23</td>
<td>0.9</td>
<td>37</td>
</tr>
<tr>
<td>JN M33 x 1,5</td>
<td>J118090535</td>
<td>ECO 120/220 W</td>
<td>1.73</td>
<td>1.00</td>
<td>23</td>
<td>23</td>
<td>0.9</td>
<td>37</td>
</tr>
<tr>
<td>JN 1 3/8-12</td>
<td>J211640304</td>
<td>ECO 120/220</td>
<td>1.73</td>
<td>1.00</td>
<td>23</td>
<td>23</td>
<td>0.9</td>
<td>37</td>
</tr>
<tr>
<td>JN M36 x 1,5</td>
<td>J211640304</td>
<td>ECO 120/220</td>
<td>1.73</td>
<td>1.00</td>
<td>23</td>
<td>23</td>
<td>0.9</td>
<td>37</td>
</tr>
</tbody>
</table>
Non-Adjustable Series Hydraulic Shock Absorbers
ECO Series

Overview

Urethane Striker Cap (USC)

Rectangular Flange (RF)

| ECO 120 → ECO 225 Series |

| ECO 120/220 & 225 | ECO 125/225 & 225 | ECO 125/225M & 225 |

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A in. (mm)</th>
<th>E2 in. (mm)</th>
<th>Weight (oz.)(g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC 8693</td>
<td>C94609799</td>
<td>ECO 120, 125, 220 &amp; 225</td>
<td>.22</td>
<td>.38</td>
<td>1.63</td>
</tr>
<tr>
<td>RF M33 x 1.5</td>
<td>N121049141</td>
<td>ECO 120/ 220M</td>
<td>(5.5)</td>
<td>(9.5)</td>
<td>(41.3)</td>
</tr>
<tr>
<td>RF M36 x 1.5</td>
<td>N121293129</td>
<td>ECO 125/225M</td>
<td>(5.5)</td>
<td>(9.5)</td>
<td>(41.3)</td>
</tr>
<tr>
<td>RF M36 x 1.5</td>
<td>N121293129</td>
<td>ECO 125/225M</td>
<td>(5.5)</td>
<td>(9.5)</td>
<td>(41.3)</td>
</tr>
</tbody>
</table>

| RF 1 1/2 - 1.22 | N121049129 | ECO 120/220 | .22 | .38 | 1.63 | 2.00 | 1.75 | 1.13 |
| RF M32 x 1.5 | N121293129 | ECO 125/225 | (5.5) | (9.5) | (41.3) | (50.8) | (44.5) | (28.6) |
| RF 1 1/2 - 1.22 | N121049129 | ECO 120/220 | .22 | .38 | 1.63 | 2.00 | 1.75 | 1.13 |
| RF M36 x 1.5 | N121293129 | ECO 125/225M | (5.5) | (9.5) | (41.3) | (50.8) | (44.5) | (28.6) |
Non-Adjustable Series Hydraulic Shock Absorbers
ECO Series

Note: Minimum impact velocity for ECO models is 4 in./sec. (0.1 m/sec).
Note: Minimum impact velocity for PRO and ECO models is 4 in./sec. (0.1 m/sec).
Non-Adjustable Series Hydraulic Shock Absorbers
ECO Series

Typical Applications

Factory Automation

Medical Laboratory Equipment

Food Processing
Non-Adjustable Series Hydraulic Shock Absorbers

PMXT Mid-Bore Series

Overview

ITT 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.

The PM Series uses a self-compensating design to provide energy absorption in low velocity and high drive force applications. The 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.

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°F to 180°F) to (-30°F 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.
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.

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.

As the piston head moves it closes off orifice holes, thus reducing the available orifice area in proportion to the velocity. After the load is removed 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. This allows quick repositioning for the next impact.

Low Pressure multiple orifice shock absorbers can provide progressive or self-compensating damping, depending on the impact conditions.
<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Threads</th>
<th>Damping Coefficient</th>
<th>A in. (mm)</th>
<th>A2 in. (mm)</th>
<th>C in. (mm)</th>
<th>D in. (mm)</th>
<th>El in. (mm)</th>
<th>E2 in. (mm)</th>
<th>F in. (mm)</th>
<th>WF in. (mm)</th>
<th>Wl in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 1525 SF</td>
<td>-1, -2, -3</td>
<td>5.68</td>
<td>6.37</td>
<td>(IF) 1 3/4-12 UN</td>
<td>.50</td>
<td>1.75</td>
<td>1.75</td>
<td>3.62</td>
<td>1.70</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>PMXT 1525 MF</td>
<td>-1, -2, -3</td>
<td>5.68</td>
<td>6.37</td>
<td>(MF) M45 x 1.5</td>
<td>1.00</td>
<td>1.19</td>
<td>1.19</td>
<td>3.80</td>
<td>1.95</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>PMXT 1550 SF</td>
<td>-1, -2, -3</td>
<td>7.68</td>
<td>8.37</td>
<td>(IF) 1 3/4-12 UN</td>
<td>.75</td>
<td>2.25</td>
<td>2.25</td>
<td>4.33</td>
<td>2.12</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>PMXT 1550 MF</td>
<td>-1, -2, -3</td>
<td>7.68</td>
<td>8.37</td>
<td>(MF) M45 x 1.5</td>
<td>1.00</td>
<td>1.19</td>
<td>1.19</td>
<td>4.50</td>
<td>1.95</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>PMXT 1575 SF</td>
<td>-1, -2, -3</td>
<td>9.68</td>
<td>10.37</td>
<td>(IF) 1 3/4-12 UN</td>
<td>.75</td>
<td>2.25</td>
<td>2.25</td>
<td>5.63</td>
<td>2.25</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PMXT 1575 MF</td>
<td>-1, -2, -3</td>
<td>9.68</td>
<td>10.37</td>
<td>(MF) M45 x 1.5</td>
<td>1.00</td>
<td>1.19</td>
<td>1.19</td>
<td>5.80</td>
<td>1.95</td>
<td>0.95</td>
<td></td>
</tr>
<tr>
<td>PMXT 2050 SF</td>
<td>-1, -2, -3</td>
<td>12.90</td>
<td>13.55</td>
<td>(IF) 2 1/2-12 UN</td>
<td>.75</td>
<td>2.25</td>
<td>2.25</td>
<td>7.50</td>
<td>2.42</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PMXT 2050 MF</td>
<td>-1, -2, -3</td>
<td>12.90</td>
<td>13.55</td>
<td>(MF) M64 x 2.0</td>
<td>1.00</td>
<td>1.19</td>
<td>1.19</td>
<td>9.50</td>
<td>2.42</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PMXT 2100 SF</td>
<td>-1, -2, -3</td>
<td>17.97</td>
<td>18.62</td>
<td>(IF) 2 1/2-12 UN</td>
<td>.75</td>
<td>2.25</td>
<td>2.25</td>
<td>9.50</td>
<td>2.42</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PMXT 2100 MF</td>
<td>-1, -2, -3</td>
<td>17.97</td>
<td>18.62</td>
<td>(MF) M64 x 2.0</td>
<td>1.00</td>
<td>1.19</td>
<td>1.19</td>
<td>11.50</td>
<td>2.42</td>
<td>1.00</td>
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</tr>
<tr>
<td>PMXT 2150 SF</td>
<td>-1, -2, -3</td>
<td>22.85</td>
<td>23.50</td>
<td>(IF) 2 1/2-12 UN</td>
<td>.75</td>
<td>2.25</td>
<td>2.25</td>
<td>9.50</td>
<td>2.42</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>PMXT 2150 MF</td>
<td>-1, -2, -3</td>
<td>22.85</td>
<td>23.50</td>
<td>(MF) M64 x 2.0</td>
<td>1.00</td>
<td>1.19</td>
<td>1.19</td>
<td>11.50</td>
<td>2.42</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Note: 1. Dash numbers in page color are non-standard lead time items, contact ITT Enidine.
2. See page 59 for constant damping curves.
3. Urethane striker caps are available as accessories for models PM 1525 to PM 2150.
## Non-Adjustable Series Hydraulic Shock Absorbers

### PMXT Mid-Bore Series

#### Clevis Mount

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>L (in.)</th>
<th>N (0.0005/0.001 in.)</th>
<th>F (0.0005/0.001 in.)</th>
<th>G (0.0005/0.001 in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (0.0005/0.001 in.)</th>
<th>CR (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM 1 3/4 - 12</td>
<td>7.86</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.75</td>
<td>1500</td>
</tr>
<tr>
<td>FM M45 x 1,5</td>
<td>12.64</td>
<td>0.750</td>
<td>1.50</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.75</td>
<td>1500</td>
</tr>
<tr>
<td>FM 2 1/2 - 12</td>
<td>11.84</td>
<td>0.501</td>
<td>0.750</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.75</td>
<td>2500</td>
</tr>
<tr>
<td>FM M64 x 2</td>
<td>21.13</td>
<td>0.750</td>
<td>1.50</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.75</td>
<td>5000</td>
</tr>
</tbody>
</table>

#### Flange Foot Mount

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
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<th>Z (in.)</th>
<th>FA (in.)</th>
<th>FB (in.)</th>
<th>FC (in.)</th>
<th>FD (in.)</th>
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<th>RJ (in.)</th>
<th>H (in.)</th>
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**Notes:**
1. ΔPMXT 1525 CM (S) 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 and lock ring.

---

**Non-Adjustable Series**

[www.enidine.com](http://www.enidine.com)  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406
**Non-Adjustable Series**

**Hydraulic Shock Absorbers**

**PMXT Mid-Bore Series**

### Accessories

**Lock Ring (LR)**

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<th>Model (Ref)</th>
<th>CA in. (mm)</th>
<th>OD in. (mm)</th>
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**Urethane Striker Cap (USC)**

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<th>L in. (mm)</th>
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**Note:**
1. Part numbers in page color are non-standard lead time items, contact ITT Enidine.

---

**Non-Adjustable Series**

**PMXT 1525 → PMXT 2150 Series**

---

**Non-Adjustable Series**

---

**Stop Collar (SC)**

![Stop Collar (SC)](image)

**Urethane Striker Cap (USC)**

![Urethane Striker Cap (USC)](image)

**Lock Ring (LR)**

![Lock Ring (LR)](image)
Non-Adjustable Series Hydraulic Shock Absorbers
PMXT Mid-Bore Series

Square Flange (SF)

Non-Adjustable Series

<table>
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<th>FC in. (mm)</th>
<th>FH in. (mm)</th>
<th>SA in. (mm)</th>
<th>SB in. (mm)</th>
<th>Bolt Size</th>
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Non-Adjustable Series Hydraulic Shock Absorbers
PMXT Mid-Bore Series

Sizing Curves

PM 120/125 → PMXT 2150 Series

Note: Minimum impact velocity for PM models is 4 in./sec. (0.1 m/sec).
Non-Adjustable Series Hydraulic Shock Absorbers
PMXT Mid-Bore Series

Typical Applications

Automated Handling

Conveyor Systems

Robotics
ITT Enidine Heavy Duty Series 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.

**HDN 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 4 in. (100mm) and strokes over 60 in. (1524mm).

**HDA Series**
Adjustable units enable the user to modify shock absorber resistance to accommodate load velocity variations, with strokes up to 12 in. (305mm). Standard adjustable configurations available.

**Features and Benefits HDN, HDA**
- Designed with Environmentally friendly materials and fluids
- Compact design smoothly and safely decelerates large energy capacity loads up to 3,000,000 in-lbs. per cycle (330,000 Nm)
- Internal charged air/oil accumulator replaces mechanical return springs, providing shorter overall length and reduced weight. Optional Bladder Accumulator (BA) for higher cycle rates also available.
- Engineered to meet OSHA, AISE, CMAA and other safety specifications such as DIN and FEM.
- Wide variety of optional configurations including bellows, clevis mounts and safety cables.
- Painted external components provide excellent corrosion protection.
- Epoxy painting and special rod materials are available for use in highly corrosive environments.
- All sizes are fully field repairable.
- Piston rod extension sensor systems available for re-use safety requirements.
- Incorporating optional fluids and seal packages can expand standard operating temperature range from 15°F to 140°F (-10°C to 60°C) to -30°F to 210°F (-35°C to 100°C)
Heavy Duty Shock Absorbers

**HDN 1.5 x 2 → HDN 1.5 x 32 Series**

### Technical Data

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Notes:
1. HDN 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. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact ITT Enidine for sizing assistance.
3. Rear flange mounting of 12 inch (300 mm) strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
4. Maximum cycle rate is 60 cycles/hr. for HDN with BA (Bladder Accumulator) option and 30 cycles/hr. without BA option.
5. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.

**HDN w/o BA option contains only a single charge/fill port.**

* Denotes Shock Absorber Bladder Accumulator Option.
Notes:
1. HDN 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 ITT 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 ITT Enidine for sizing assistance.
4. Rear flange mounting of 12 inch (300 mm) strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr. for HDN with BA (Bladder Accumulator) option and 30 cycles/hr. without BA option.
6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.
7. ** HDN 2.0 x 56 has two charge ports.

[Table]

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<tr>
<th>Catalog No./ Model</th>
<th>(S) Stroke Max. Return Force BA* (in.)</th>
<th>(E) Max. Shock Force BA* (lbs.)</th>
<th>(C) Max. Cycle Rate (in./hour)</th>
<th>(T) Return Force BA* (lbs.)</th>
<th>A (in.)</th>
<th>T (in.)</th>
<th>Z (in.)</th>
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* Denotes Shock Absorber Bladder Accumulator Option. Note: For TF and FF mounting, delete front foot and dimensions.
** HDN w/o BA option contains only a single charge/fill port.
---

Heavy Duty Series

HDN 2.0 Series

HDN 2.0 x 6 → HDN 2.0 x 56 Series

Technical Data

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3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact ITT Enidine for sizing assistance.
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5. Maximum cycle rate is 60 cycles/hr. for HDN with BA (Bladder Accumulator) option and 30 cycles/hr. without BA option.
6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.
7. ** HDN 2.0 x 56 has two charge ports.
HDN 3.0 Series

Dimensions are in inches (millimeters).

www.enidine.com  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406

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Heavy Duty Series Shock Absorber

HDN 3.0 Series

Technical Data

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<th>(F2) Max. Stroke (in.)</th>
<th>(E2) Stroke Max. Shock Force (lbs.)</th>
<th>(F2) Stroke Max. Shock Force (lbs.)</th>
<th>(F2) Nominal Return Force w/o BA (lbs.)</th>
<th>(E2) Nominal Return Force w/o BA (lbs.)</th>
<th>(F2) Max. Acceleration (ft/sec^2)</th>
<th>(E2) Max. Acceleration (ft/sec^2)</th>
<th>(F2) Max. Velocity (ft/sec)</th>
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<th>(E2) BA* Max. Velocity (ft/sec)</th>
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### Technical Data

**HDN Heavy Duty Series Shock Absorber**

#### Model HDN 3.5 Series

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<th>(E) Max.</th>
<th>(E) Max.</th>
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<th>CP</th>
<th>Nominal Return Force</th>
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Note: 1. HDN 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. HDN w/o BA option contains only a single charge/fill port.

3. It is recommended that the customer consult ITT Enidine for safety-related overhead crane applications.

4. Rear flange mounting of 12-inch (300 mm) strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.

5. Maximum cycle rate is 60 cycles/hr. for HDN with BA option and 30 cycles/hr. without BA option.

6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.

7. ** HDN w/o BA option contains only a single charge/fill port.

---

**Notes:**

1. HDN 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.

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6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.

7. ** HDN w/o BA option contains only a single charge/fill port.

---

**Dimensions are in inches (millimeters).**

**HDN** 3.5 x 56 Series

- **HDN 3.5 x 2 → HDN 3.5 x 56 Series**
### Heavy Duty Series

**HDN Series**

#### HDN 4.0 Series

**Technical Data**

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal</th>
<th>CP</th>
<th>Model</th>
<th>FP</th>
<th>w/o Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDN 4.0 x 2</td>
<td>2 in.</td>
<td>139,200</td>
<td>80,000</td>
<td>250</td>
<td>425 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 4</td>
<td>4 in.</td>
<td>275,700</td>
<td>80,000</td>
<td>270</td>
<td>485 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 6</td>
<td>6 in.</td>
<td>409,606</td>
<td>80,000</td>
<td>270</td>
<td>690 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 8</td>
<td>8 in.</td>
<td>548,800</td>
<td>80,000</td>
<td>270</td>
<td>980 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 10</td>
<td>10 in.</td>
<td>682,700</td>
<td>80,000</td>
<td>275</td>
<td>1,230 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 12</td>
<td>12 in.</td>
<td>819,200</td>
<td>80,000</td>
<td>275</td>
<td>1,270 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 16</td>
<td>16 in.</td>
<td>1,089,600</td>
<td>80,000</td>
<td>275</td>
<td>1,270 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 20</td>
<td>20 in.</td>
<td>1,362,700</td>
<td>80,000</td>
<td>280</td>
<td>1,155 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 24</td>
<td>24 in.</td>
<td>1,635,700</td>
<td>80,000</td>
<td>280</td>
<td>1,275 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 28</td>
<td>28 in.</td>
<td>1,904,200</td>
<td>80,000</td>
<td>280</td>
<td>1,275 lbs.</td>
</tr>
<tr>
<td>HDN 4.0 x 32</td>
<td>32 in.</td>
<td>2,128,700</td>
<td>80,000</td>
<td>280</td>
<td>1,275 lbs.</td>
</tr>
</tbody>
</table>

**Notes:**

1. HDN 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 ITT Enidine for safety-related overhead crane applications.
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5. Maximum cycle rate is 60 cycles/hr. for HDN with BA option and 30 cycles/hr. without BA option.
6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.

**Dimensions:**

- **HDN 4.0 x 2:**
  - w/o BA option contains only a single charge/fill port.
  - * Denotes Shock Absorber Bladder Accumulator Option.
  - Dimensions are in inches (millimeters).

---

**E-mail:** industrialsales@enidine.com  
**Tel.:** 1-800-852-8508  
**Fax:** 1-716-662-0406  
**www.enidine.com**
Heavy Duty Adjustable Series Shock Absorber
HDA 3.0 Series

HDA 3.0 x 2 -> HDA 3.0 x 12 Series

Catalog No./ Stroke Max. Max. Shock Force BA* in. in.-lbs./cycle in.-lbs./hour lbs. lbs. (mm) (mm) (mm) (mm) (mm) (mm) (Kg)

<table>
<thead>
<tr>
<th>Model</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
<th>C in. (mm)</th>
<th>Y in. (mm)</th>
<th>Z in. (mm)</th>
<th>CP* lbs. (Kg)</th>
<th>FP* lbs. (Kg)</th>
<th>With BA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDA 3.0 x 2</td>
<td>2</td>
<td>0.030</td>
<td>2,400,000</td>
<td>20,000</td>
<td>50,000</td>
<td>13.2</td>
<td>8.4</td>
<td>10.4</td>
</tr>
<tr>
<td>HDA 3.0 x 3</td>
<td>3</td>
<td>0.030</td>
<td>3,600,000</td>
<td>20,000</td>
<td>50,000</td>
<td>15.2</td>
<td>9.4</td>
<td>11.4</td>
</tr>
<tr>
<td>HDA 3.0 x 5</td>
<td>5</td>
<td>0.060</td>
<td>4,800,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
<td>13.4</td>
</tr>
<tr>
<td>HDA 3.0 x 8</td>
<td>8</td>
<td>0.080</td>
<td>7,200,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
<td>13.4</td>
</tr>
<tr>
<td>HDA 3.0 x 10</td>
<td>10</td>
<td>0.100</td>
<td>9,600,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
<td>13.4</td>
</tr>
<tr>
<td>HDA 3.0 x 12</td>
<td>12</td>
<td>0.100</td>
<td>12,000,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
<td>13.4</td>
</tr>
</tbody>
</table>

Notes:
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2. It is recommended that the customer consult ITT 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 ITT Enidine for sizing assistance.
4. Rear flange mounting of 12 inch (300 mm) strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.
6. HDA models which have an impact velocity below 30 in./sec (.8 m/sec.), please contact ITT Enidine for assistance.
7. Maximum allowable applied propelling force: 25,000 lbs. (111,200 N)

Adjustment Techniques

After properly sizing an HDA shock absorber, the usable 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 usable 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 m/s)
2. Intersection Point: Setting 3
3. Usable Adjustment Setting Range: 1 to 3

Heavy Duty Series

Technical Data

Dimensions are in inches (millimeters).

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

Catalog No./ Model | (S) Shock in. (mm) | (E) Max. in./sec. (m/sec.) | (E)(C) Max. min. in./sec. (m/sec.) | (FP) Nominal Model | Commercial Rate Force | R* lbs. (Kgs) | Weight |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
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<td>2</td>
<td>0.030</td>
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<td>20,000</td>
<td>50,000</td>
<td>13.2</td>
<td>8.4</td>
</tr>
<tr>
<td>HDA 3.0 x 3</td>
<td>3</td>
<td>0.030</td>
<td>3,600,000</td>
<td>20,000</td>
<td>50,000</td>
<td>15.2</td>
<td>9.4</td>
</tr>
<tr>
<td>HDA 3.0 x 5</td>
<td>5</td>
<td>0.060</td>
<td>4,800,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
</tr>
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<td>0.080</td>
<td>7,200,000</td>
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<td>19.3</td>
<td>11.4</td>
</tr>
<tr>
<td>HDA 3.0 x 10</td>
<td>10</td>
<td>0.100</td>
<td>9,600,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
</tr>
<tr>
<td>HDA 3.0 x 12</td>
<td>12</td>
<td>0.100</td>
<td>12,000,000</td>
<td>50,000</td>
<td>165</td>
<td>19.3</td>
<td>11.4</td>
</tr>
</tbody>
</table>
### Heavy Duty Adjustable Series Shock Absorber

**HDA 4.0 Series**

<table>
<thead>
<tr>
<th>Citation No./Model</th>
<th>(S) Sticks</th>
<th>(F) Max. (F_m) in.-lbs./cycle (Nm/cycle)</th>
<th>(E(C) Max. (E_m) J, (E_t) in.-lbs./hour (Nm/hr)</th>
<th>(F) Max. End Stroke Force (F_p) in.-lbs./cycle (Nm/cycle)</th>
<th>Nominal Return Force (R_m) in.-lbs./cycle (Nm/cycle)</th>
<th>A</th>
<th>Y</th>
<th>Z</th>
<th>CP*</th>
<th>FP*</th>
<th>Weights</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDA 4.0 x 2</td>
<td>2</td>
<td>125,600 (13,600)</td>
<td>2,306,000 (255,900)</td>
<td>159 (1,125)</td>
<td>18.9</td>
<td>13.0</td>
<td>13.9</td>
<td>4.0</td>
<td>7.1</td>
<td>6.3</td>
<td>441</td>
</tr>
<tr>
<td></td>
<td>(50)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDA 4.0 x 4</td>
<td>4</td>
<td>249,000 (27,100)</td>
<td>3,972,000 (355,900)</td>
<td>209 (1,135)</td>
<td>20.9</td>
<td>18.0</td>
<td>19.5</td>
<td>6.0</td>
<td>7.1</td>
<td>6.3</td>
<td>554</td>
</tr>
<tr>
<td></td>
<td>(100)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDA 4.0 x 6</td>
<td>6</td>
<td>369,000 (40,700)</td>
<td>5,941,000 (355,900)</td>
<td>259 (1,135)</td>
<td>24.9</td>
<td>18.0</td>
<td>19.5</td>
<td>8.0</td>
<td>7.1</td>
<td>6.3</td>
<td>661</td>
</tr>
<tr>
<td></td>
<td>(150)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDA 4.0 x 8</td>
<td>8</td>
<td>489,000 (54,200)</td>
<td>7,986,000 (355,900)</td>
<td>289 (1,135)</td>
<td>28.9</td>
<td>20.0</td>
<td>21.5</td>
<td>10.0</td>
<td>7.1</td>
<td>6.3</td>
<td>764</td>
</tr>
<tr>
<td></td>
<td>(200)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDA 4.0 x 10</td>
<td>10</td>
<td>609,000 (67,900)</td>
<td>9,954,000 (355,900)</td>
<td>319 (1,135)</td>
<td>32.9</td>
<td>22.0</td>
<td>23.5</td>
<td>12.0</td>
<td>7.1</td>
<td>6.3</td>
<td>857</td>
</tr>
</tbody>
</table>

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

#### Technical Data

**Adjustment Technique**

1. Loosen button head lock screw.
2. Set adjustment screw to desired setting.
3. Tighten button head lock screw on shoulder of adjustment screw.

---

**Notes:**
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3. The energy data listed is for ideal linear impacts only. If side load conditions exist in the application, contact ITT Enidine for sizing assistance.
4. Rear flange mounting of 12 inch (300 mm) strokes and longer not recommended. Front and rear flange or foot mount configurations are recommended.
5. Maximum cycle rate is 60 cycles/hr.
6. HDA models which have an impact velocity below 30 in./sec. (.8 m/sec.), please contact ITT Enidine for assistance.
7. Maximum allowable applied propelling force: 40,000 (177 900 N)

**Dimensions:**
- Dimensions are in inches (millimeters).
- Note: For TF, FF and FR mounting, delete front foot and dimension.

---

**Contact Information:**

- www.enidine.com
- Email: industrialsales@enidine.com
- Tel.: 1-800-852-8508
- Fax: 1-716-662-0406

---

**HDA 4.0 x 2 ➞ HDA 4.0 x 10 Series**

**HDA 4.0 Series**

**Damping Force**

Position 1 provides minimum damping force.

Position 5 provides maximum damping force.

---

**Locking Screw**

**Adjustment Screw**

( metering pin)
Heavy Duty Series Shock Absorber

Overview

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 5 in. (125mm) and 6 in. (156mm) with strokes over 60 in. (1525mm).

Features and Benefits HD

- Compact design smoothly and safely decelerates large energy capacity loads up to 8,000,000 in-lbs. per cycle (900,000 Nm)
- Engineered to meet OSHA, AISE, CMAA 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.
- Zinc plated external components provide enhanced corrosion protection.
- Epoxy painting and special rod materials are available for use in highly corrosive environments.
- All sizes are fully field repairable.
- Piston rod extension sensor systems available for reuse safety requirements.
- Incorporating optional fluids and seal packages can expand standard operating temperature range from 15°F to 140°F to -30°F to 210°F (-10°C to 60°C) to (-35°C to 100°C)
Heavy Duty Series Shock Absorber

HD 5.0 Series

HD 5.0 x 4 → HD 5.0 x 48 Series

Notes:
1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. 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.
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6. Maximum cycle rate is 60 cycles/hr.
7. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.
8. For TF, FF and FR mounting, delete front foot and dimensions.

<table>
<thead>
<tr>
<th>Catalog No./ Stroke</th>
<th>Max. Return Force A F Y Z CA Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD 5.0 x 4</td>
<td>414,000 16,000,000 124,000 400 23.3 14.8 17.1 7.4 9.1 192</td>
</tr>
<tr>
<td>HD 5.0 x 6</td>
<td>620,000 17,203,000 133,000 400 27.3 16.8 19.1 9.4 9.1 257</td>
</tr>
<tr>
<td>HD 5.0 x 8</td>
<td>838,000 18,414,000 144,000 400 31.3 18.6 21.4 11.4 9.1 323</td>
</tr>
<tr>
<td>HD 5.0 x 10</td>
<td>1,036,000 21,911,000 155,000 400 35.3 20.8 23.1 13.4 9.1 398</td>
</tr>
<tr>
<td>HD 5.0 x 12</td>
<td>1,239,000 24,462,000 165,000 400 39.3 22.8 25.1 15.4 9.1 468</td>
</tr>
<tr>
<td>HD 5.0 x 16</td>
<td>1,655,000 28,385,000 175,000 400 47.3 26.8 29.1 19.4 9.1 592</td>
</tr>
<tr>
<td>HD 5.0 x 20</td>
<td>2,071,000 36,889,000 185,000 400 55.3 30.7 32.7 23.3 13.4 748</td>
</tr>
<tr>
<td>HD 5.0 x 24</td>
<td>2,478,000 45,937,000 195,000 400 63.2 34.7 36.7 27.3 13.4 897</td>
</tr>
<tr>
<td>HD 5.0 x 28</td>
<td>2,994,000 54,132,000 205,000 400 71.2 38.7 40.4 31.3 13.4 1,067</td>
</tr>
<tr>
<td>HD 5.0 x 32</td>
<td>3,510,000 62,196,000 215,000 400 79.2 42.7 44.4 35.3 13.4 1,268</td>
</tr>
<tr>
<td>HD 5.0 x 40</td>
<td>4,123,000 72,687,000 225,000 400 88.2 47.6 50.6 39.3 13.4 1,608</td>
</tr>
<tr>
<td>HD 5.0 x 48</td>
<td>4,758,000 84,230,000 235,000 400 97.2 52.5 54.7 43.3 13.4 2,122</td>
</tr>
</tbody>
</table>

Dimensions are in inches (millimeters).

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

<table>
<thead>
<tr>
<th>HDN</th>
<th>HDA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

www.enidine.com Email: industrialsales@enidine.com Tel.: 1-800-852-8508 Fax: 1-716-662-0406

Heavy Duty Series

HDN

HDA

Technical Data

HD 5.0 Series

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<tr>
<td>HD 5.0 x 40</td>
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<tr>
<td>HD 5.0 x 48</td>
<td>4,758,000 84,230,000 235,000 400 97.2 52.5 54.7 43.3 13.4 2,122</td>
</tr>
</tbody>
</table>
### Heavy Duty Series Shock Absorber

#### HD 6.0 Series

#### Technical Data

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Nominal Return Force BA* in.-lbs./cycle</th>
<th>Max. Return Force in.-lbs./hour</th>
<th>R, lbs.</th>
<th>A in. (mm)</th>
<th>f in. (mm)</th>
<th>Y in. (mm)</th>
<th>Z in. (mm)</th>
<th>CA in. (mm)</th>
<th>Weight (lbs.)</th>
<th>Weight (Kg)</th>
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<tbody>
<tr>
<td><strong>HD(A) 6.0 x 4</strong></td>
<td>677,000</td>
<td>21,280,000</td>
<td>202,250</td>
<td>625</td>
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<td>15.6</td>
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<td>8.3</td>
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</tbody>
</table>

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

*Dimensions are in inches (millimeters)*

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**HDN, HDA Series**

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

TM: Rear Flange Front Foot Mount

TF: Front and Rear Flanges

CM: Clevis Mount

FM: Front and Rear Foot Mount

Also shown is optional safety cable, typically used in overhead applications.

FR: Rear Foot

Note: Rear flange mounting not recommended for stroke lengths above 12 inches (300 mm).

Cylindrical Clevis Dimensions

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
<th>D in. (mm)</th>
<th>E in. (mm)</th>
<th>HD/HDN F in. (mm)</th>
<th>HDA F in. (mm)</th>
<th>CA in. (mm)</th>
<th>CC in. (mm)</th>
<th>CD in. (mm)</th>
<th>CE in. (mm)</th>
<th>CF in. (mm)</th>
<th>FA in. (mm)</th>
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<th>FC in. (mm)</th>
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<td>8.0</td>
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<td>1.5</td>
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<td>3.7</td>
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<td>3.7</td>
<td>1.3</td>
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<td>15.6</td>
<td>17.0</td>
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<td>1.0</td>
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<td>1.0</td>
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<td>3.7</td>
<td>1.3</td>
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<td>3.7</td>
<td>1.3</td>
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<td>3.7</td>
<td>1.3</td>
<td>1.0</td>
<td>3.9</td>
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</tbody>
</table>

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

Dimensions are in inches (millimeters).
HDN 1.5, 2.0 and 4.0

Optional Piston Rod Return Sensor

- Magnetic proximity sensor indicates complete piston rod return with 10-foot (3 m) long cable.
- If complete piston rod does not return the circuit remains open. This can be used to trigger a system shut-off.
- Contact ITT Enidine for other available sensor types.
- Sensor port in line with charge port on models HDN 1.5, 2.0 and 4.0. Location offset 90° for models HDN 3.0 and 3.5.

Sensor Specifications

- Voltage 10 - 30V
- Load Current ≤ 200 mA
- Leakage Current ≤ 80 mA
- Load Capacitance ≤ 1.0 mF
- Ambient Temperature: -15° to 160°F (-26° to 71°C)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensor Dia. (in.)</th>
<th>Height Dia. (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDN 1.5</td>
<td>3.4 (86)</td>
<td>0.79 (20)</td>
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<tr>
<td>HDN 2.0 x 6-28</td>
<td>3.0 (76)</td>
<td>0.63 (16)</td>
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<tr>
<td>HDN 2.0 x 22-56</td>
<td>4.8 (122)</td>
<td>0.35 (9)</td>
</tr>
<tr>
<td>HDN 4.0 x 2-10</td>
<td>6.3 (161)</td>
<td>0.25 (6)</td>
</tr>
<tr>
<td>HDN 4.0 x 12-48</td>
<td>8.0 (203)</td>
<td>0.18 (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Sensor Dia. (in.)</th>
<th>Height Dia. (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDN 3.0 x 2-12</td>
<td>2.0 (51)</td>
<td>0.39 (10)</td>
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<tr>
<td>HDN 3.0 x 15-22</td>
<td>4.6 (117)</td>
<td>0.59 (15)</td>
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<tr>
<td>HDN 3.0 x 16-60</td>
<td>6.3 (161)</td>
<td>0.35 (9)</td>
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<td>HDN 3.5 x 2-16</td>
<td>3.0 (76)</td>
<td>0.25 (6)</td>
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<tr>
<td>HDN 3.5 x 20-56</td>
<td>5.2 (132)</td>
<td>0.18 (4)</td>
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<td>HDN 4.0 x 2-10</td>
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<tr>
<td>HDN 4.0 x 12-48</td>
<td>8.0 (203)</td>
<td>0.16 (4)</td>
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HDN 3.0 and 3.5

Urethane Cap
Heavy Industry Products
Configuration Worksheet

Ordering Example

Note: HDN/HD/HDA models are custom-ordinated, therefore all information must be provided to ITT Enidine for unique part number assignment.

Ordering Code Example for Heavy Duty Shock Absorbers

1. Quantity
2. Model Selection
   HDN (Non-Adjustable)
   HD (Non-Adjustable)
   HDA (Adjustable)
3. Model Size
   Select Size from Engineering Data Chart
   HDN - 1.5, 2.0, 3.0, 3.5, 4.0 Bore Sizes (pages 8-12)
   HDA - 3.0, 4.0 Bore Sizes (pages 13-14)
   HD - 5.0, 6.0 Bore Sizes (pages 16-17)
4. Mounting Method
   TM (Rear flange front foot mount)
   TFR (Front and rear flange)
   TR (Rear flange)
   CM (Metric clevis mount)
5. Options
   C (Sensor cable)
   P (Sensor plug) - See Page 18
   UC (Urethane Cap)
   BA (Bladder Accumulator)

Application Data (Required for HDN/HD Models)
See Worksheet page 20
Vertical or horizontal motion
Weight
Impact velocity
Propelling force (if any)
Cycles/hr
Other (temperature or other environmental conditions, safety standards, etc.)

Notes
Overview

ITT 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 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.

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.
- Special epoxy painting and rod materials are available for use in highly corrosive environments.
- Surface treatment (Sea water resistant)
  - Housing: gray color, three-part epoxy
  - Piston Rod: hard-chrome plated steel
- Incorporating optional fluids and seal packages available to expand standard operating temperature range from (0°F to 175°F) to (-30°F to 250°F) (-10°C to 60°C) to (-35°C to 100°C)
ITT 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.

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**Ordering Example**

Example:

- **Select quantity:** 4
- **HI 120 x 100 FR**
- **Select HI Series model from Engineering Data Chart**
- **Select mounting method:**
  - BF (Flange Front)
  - BR (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

www.enidine.com  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406
## Heavy Industry Shock Absorbers

**HI Series**

### Technical Data

<table>
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<td>3</td>
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<td>HI 80 x 100</td>
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Heavy Industry Shock Absorbers
HI Series

HI 130 x 250 ↔ HI 150 x 1000 Series

**Technical Data**

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The design of Jarret Series Industrial Shock Absorber utilizes the unique compression and shear characteristics of specially formulated silicone elastomers.

These characteristics allow the energy absorption and return spring functions to be combined into a single unit without the need for an additional gas or mechanical spring stroke return mechanism.

**Applications**
Shock protection for all types of industries including:
- Defense
- Automotive
- Railroad
- Materials Handling
- Marine
- Pulp/Paper
- Metal Production and Processing

**Advantages:**
- Simple design
- High reliability
- High damping coefficient
- Low sensitivity to temperature variances
Jarret Series
BC1N, BC5, LR Series

Visco-elastic Technology

Visco-elastic technology makes use of the fundamental properties of specially formulated Jarret visco-elastic medium.

Compressibility:
Preloaded spring function
\[ F = F_0 + Kx \]

Viscosity:
Shock absorber function
\[ F = F_0 + Kx + CV^{\alpha} \]
with \( \alpha \) between 0.1 and 0.4

The two functions can be used separately or in combination, in the same product:

Preloaded Spring: Spring Function Only
- Hysteresis of between 5% and 10%
- Reduced weight and space requirement
- Force/stroke characteristic is independent of actuation speed

Shock Absorber Without Spring Return: Shock Absorbing Function Only
- Dampening devices
- Blocking devices

Preloaded Spring Shock Absorbers: Combine Spring and Shock Absorber Functions
- Dissipate between 30% and 100% of energy
- Force/stroke characteristics remain relatively unchanged between 15°F and 160°F (-10°C and +70°C)

* Spring and shock absorber products are capable of functioning between 15°F and 160°F (-10°C and +70°C). However, standard products are not intended for use over the full rated temperature range. Consult factory for special product considerations required to accommodate operation over a wide temperature range.
### Jarret Shock Absorbers

**BC1N Series**

**Catalog No./ L1 L2 L3 L4 L5 L6 R1 D1 D2 D3 D4 D5 D6 D7 Weight**

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**Notes:**
- Spring and shock absorber products are capable of functioning between 15°F and 160°F (-10°C and + 70°C). However, standard products are not intended for use over the full rated temperature range.
- Consult factory for special product considerations required to accommodate operation over a wide temperature range.

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www.enidine.com Email: industrialsales@enidine.com Tel.: 1-800-852-8508 Fax: 1-716-662-0406
Jarret Shock Absorbers
BC1N Series

Sizing Example

1. Energy dissipated per impact: 
   \[ E = \frac{1}{2} M_e V_e^2 \]

2. Energy Calculation
   
3. Allowable Impact Velocity
   \[ IF < 20 \times \frac{E}{En} \text{ Impacts/hour} \]

4. Effective (Actual) Stroke Calculation
   
5. Calculation of Effective Reaction Force \( Rdy_e \)
   \[ Rdy_e = \left( \frac{Rdymax - Rdy_0}{C} \right) \times Ce + Rdy_0 \]
   \[ (0.1 V + 0.8) \]

6. Application Example
   Given data: Effective mass = 15 t
   Effective velocity = 0.8 m/s
   Impact frequency = 25 impacts/hour
   1. Energy dissipated per impact: 
      \[ E = \frac{1}{2} (15)(0.8) = 4.8 \text{ kJ} \]
   2. BC1FN Selected
   3. Allowable impact frequency IF < 20 x 7/4.8 = 29
      25 = 29
   4. Effective (Actual) Stroke:
      \[ Ce = 60 \left( \frac{4.8}{7(0.03 x 0.8 + 0.24) + 1.36} - 1.17 \right) \]
      \[ Ce = 49 \text{ mm} \]
   5. Effective Reaction Force:
      \[ Rdy_e = [ (150 - 90) \times 49 + 90] \times (0.1 x 0.8 + 0.8) \]
      \[ 60 \]
      \[ Rdy_e = 122 \text{ kN} \]
   6. Compare standards to results:
   \[ \begin{array}{c|c|c|c|c|c|}
   & \text{BC1FN} & \text{APPLICATION} \\
   \hline
   E (kJ) & 7 & > & 4.8 \\
   C (mm) & 60 & > & 49 \\
   Rdymax (kN) & 150 & > & 122 \\
   \end{array} \]
   All performance characteristics can be modified.
   Please advise us of your specific requirements.
### Technical Data

#### Jarret Shock Absorbers

**BCS Series**

**BCSR Series**

#### BC5 Series

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<th>L8 (mm)</th>
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**Impact Speed:** BC5 Series shock absorbers are designed for impact velocities of up to 4 m/sec. Higher impact velocities require custom modification.

**Spring and shock absorber products are capable of functioning between 15°F and 160°F (-10°C and +70°C). However, standard products are not intended for use over the full rated temperature range. Consult factory for special product considerations required to accommodate operation over a wide temperature range.**
Jarret Shock Absorbers
BC5 Series

Based On
☐ Impact velocity (V) : 2 m/s
☐ Operating temperature : 20° to +40°C
☐ Surface protection : Electrolytic zinc
☐ Dynamic performance diagram

Symbols:
En = Energy Capacity (kJ)
C = Maximum Stroke (mm)
Rdy = Dynamic Reaction Force (kN)

1 - Energy Calculation
\[ E = \frac{1}{2} M g V_e^2 \]

2 - Allowable Impact Frequency (IF)
\[ IF < 15 \times \frac{E}{En} \text{ Impacts/hour} \]

3 - Effective Stroke Calculation
\[ C_e = C \left( \frac{E}{En [0.03 \times 0.6 + 0.24]} + 1.36 - 1.17 \right) \]

4 - Calculation of Effective Reaction \( R_{dy_e} \)
\[ R_{dy_e} = \left( \frac{R_{dymax} - R_{dy0}}{C} \right) \times C_e + R_{dy0} (0.1V + 0.8) \]

5 - Application Example
\[ \text{Data: Two shock absorbers in series, Effective mass } m=300 \text{ t, Impact speed } v = 1.2 \text{ m/s (which is an impact of 0.6 m/s on each shock absorber), Impact frequency = 15 impacts/hour, Maximum allowable structural load 1000 kN} \]

1. \[ E = \frac{1}{2} \left( \frac{1}{2} m v^2 \right) \]
\[ E = \frac{1}{2} \left( \frac{1}{2} \times 300 \times 1.2^2 \right) = 108 \text{ kJ} \]

2. Selection BC5E-180

3. Maximum allowable impact frequency is 15 x \( \frac{150}{108} \)\n\[ 15 < 15 \times 21 \text{ impacts/hour. Therefore 15 impacts/hour is acceptable.} \]

4. Effective (actual) stroke is 167 mm
\[ C_e = 180 \times \left( \frac{150}{150 [0.03 \times 0.6 + 0.24]} + 1.36 - 1.17 \right) = 156 \text{ mm} \]

5. \[ R_{dy_e} = \left( \frac{1100 - 640}{180} \right) \times \left( \frac{156}{840} \right) \times (0.1 \times 0.6 + 0.8) \]
\[ R_{dy_e} = 893 \text{ kN} < 1000 \text{ kN} \]

6. Compare standards to results:
\[ \begin{array}{ccc}
\text{BC5E-180} & \text{APPLICATION} \\
E (kJ) & 150 & > 108 \\
IF & 21 & > 15 \\
C (mm) & 180 & > 156 \\
Rdymax (kN) & 1100 & > 893 \\
\end{array} \]

Note: maximum allowed structural load is 1 000 kN > 893 kN

All performance characteristics can be modified.
Please advise us of your specific requirements.
### Jarret Shock Absorbers
#### XLR Series

**XLR6-150 ⇒ XLR-800 Series**

**Rear Flange Mounting** - Fa on Request.

Spring and shock absorber products are capable of functioning between 15°F and 160°F (-10°C and + 70°C). However, standard products are not intended for use over the full rated temperature range. Consult factory for special product considerations required to accommodate operation over a wide temperature range.

---

#### Technical Data

**XLR Series - Front Flange Mount- Fc**

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</table>
Jarret Shock Absorbers
LR Series

Sizing Example

Based On
- Impact velocity (V) : 2 m/s
- Operating temperature : 20° to + 40°C
- Surface protection : Electrolytic zinc & Painting
- Dynamic performance diagram

All performance characteristics can be modified. Please advise us of your specific requirements.

XLR6-150 ➞ XLR-800 Series

1 - Energy Calculation

\[ E = \frac{1}{2} M_e V_e^2 \]

2 - Allowable Impact Frequency (IF)

\[ IF < \frac{8 \times E_{n}}{E} \text{ Impacts/hour} \]

3 - Required Stroke Calculation

\[ C_e = C + 1.83 - 1.35 \]

4 - Calculation of Effective Reaction \( R_{dy_e} \)

\[ R_{dy_e} = \left( \frac{R_{dymax} - R_{dy_0}}{C} \right) \times C_e + R_{dy_0} \]

\( (0.1V + 0.8) \]

5 - Application Example Data:

- Effective mass = 30 t
- Effective impact speed = 2.2 m/s
- Maximum allowable structural force = 350 kN
- Impact frequency = 10/hr

1: Energy dissipated/impact is 72.6 kJ

\[ E = \frac{1}{2} \times 15 \times (2.2)^2 \]

\[ E = 72.6 \text{ kJ} \]

2: XLR100-400 selected

3: Maximum allowable impact frequency

\[ IF < \frac{8 \times 100}{72.6} = 11 \]

(10<11 impacts/hour is acceptable)

4: Effective (actual) stroke:

\[ C_e = 400 \times \left( \frac{\sqrt[3]{72.6}}{100 (0.027 \times 2.7 + 0.22) + 1.83 - 1.35} \right) \]

\[ C_e = 290.3 \text{ mm} \]

5: \( R_{dy_e} = \frac{320 - 175}{400} 290.3 + 175 \)

\[ (0.1 \times 2.2 + 0.8) \]

\[ R_{dy_e} = 285.8 \text{ kN} \]

(which is less than maximum allowable reaction force of 350 kN)

6. Compare standards to results:

<table>
<thead>
<tr>
<th>XLR100-400</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (kJ)</td>
<td>&gt; 72.6</td>
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<tr>
<td>IF</td>
<td>&gt; 11</td>
</tr>
<tr>
<td>C (mm)</td>
<td>&gt; 301.8</td>
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<tr>
<td>Rdymax (kN)</td>
<td>&gt; 290.1</td>
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Note: maximum allowed structural load is 350 kN > 290.1 kN
**Impact Speed**

Types XLR and BCLR Series shock absorbers are designed for impact velocities of up to 2 m/sec. Higher impact velocities require custom modification.

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Stroke Extension Rdy 0</th>
<th>Max Force Capacity in lbs.</th>
<th>Stroke (in.)</th>
<th>Extension (in.)</th>
<th>Compression (kN)</th>
<th>Rdy. Max. Shock Force (kN)</th>
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<tbody>
<tr>
<td>BCLR-100</td>
<td>885,075</td>
<td>15.7</td>
<td>6,744</td>
<td>36,403</td>
<td>42,714</td>
<td>69,691</td>
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<td>BCLR-150</td>
<td>1,327,612</td>
<td>19.7</td>
<td>9,330</td>
<td>47,300</td>
<td>44,962</td>
<td>85,427</td>
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<td>BCLR-220S</td>
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<td>10,116</td>
<td>56,877</td>
<td>51,977</td>
<td>110,156</td>
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<td>3,540,385</td>
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<td>69,214</td>
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<td>BCLR-800</td>
<td>8,850,746</td>
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<td>112,405</td>
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</table>

**Technical Data**

BCLR Series - Front Flange Mount - Fc

- Rear Flange Mounting - Fa on Request.
- Spring and shock absorber products are capable of functioning between 15°F and 160°F (-10°C and + 70°C). However, standard products are not intended for use over the full rated temperature range.
- Consult factory for special product considerations required to accommodate operation over a wide temperature range.

**BCLR Series**

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>L1 (mm)</th>
<th>L2 (mm)</th>
<th>L3 (mm)</th>
<th>L4 (mm)</th>
<th>L5 (mm)</th>
<th>L6 (mm)</th>
<th>L7 (mm)</th>
<th>L8 (mm)</th>
<th>D1 (mm)</th>
<th>D2 (mm)</th>
<th>D3 (mm)</th>
<th>D4 (mm)</th>
<th>D5 (mm)</th>
<th>Weight (lbs.)</th>
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<td>BCLR-100</td>
<td>(1120)</td>
<td>(660)</td>
<td>(460)</td>
<td>(250)</td>
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<td>BCLR-150</td>
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<td>(575)</td>
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<td>BCLR-600</td>
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</table>

**Technical Data**

Spring and shock absorber products are capable of functioning between 15°F and 160°F (-10°C and + 70°C). However, standard products are not intended for use over the full rated temperature range.

**Catalog No.**

- 100: 1.25 in. (32 mm)
- 150: 1.5 in. (38 mm)
- 220S: 1.5 in. (38 mm)
- 250: 1.5 in. (38 mm)
- 400: 1.5 in. (38 mm)
- 600: 1.5 in. (38 mm)
- 800: 1.5 in. (38 mm)
- 1000: 1.5 in. (38 mm)
Jarret Shock Absorbers
BCLR Series

Based On
- Impact velocity (V): 2 m/s
- Operating temperature: 20° to + 40°C
- Surface protection: Electrolytic zinc & Painting
- Dynamic performance diagram

Symbols:
En = Energy Capacity (kJ)
C = Maximum Stroke (mm)
Rdy = Dynamic Reaction Force (kN)

1 - Energy Calculation

\[ E = \frac{1}{2} M_e V_e^2 \]

2 - Allowable Impact Frequency (IF)

\[ IF < 8 \times \frac{E}{En} \text{ Impacts/hour} \]

3 - Required Stroke Calculation

\[ Ce = C + 1.83 - 1.35 \]

4 - Calculation of Effective Reaction \( \text{Rdy}_e \)

\[ \text{Rdy}_e = \left( \frac{\text{Rdymax} - \text{Rdy}_0}{C} \times \text{Ce} + \text{Rdy}_0 \right) (0.1V + 0.8) \]

5 - Application Example:
- Effective mass = 75 t
- Maximum impact speed = 2.7 m/s
- Maximum allowable structural force: 650 kN
- Impact frequency = 10/hr

1: Energy dissipated/impact is 274 kJ
2: BCLR-400 selected
3: Maximum allowable impact frequency
- IF < 8 x 400 / 274 = 12 (10 impacts/hour is acceptable)
- 10 < 12
4: Effective (actual) stroke:
\[ Ce = 850 \times \left( \frac{274}{400 (0.027 \times 2.7 + 0.22)} + 1.83 - 1.35 \right) \]
\[ Ce = 587 \text{ mm} \]
5: \( \text{Rdy}_e = 520 (0.1 \times 2.7 + 0.8) = 556 \text{ kN} \)

6. Compare standards to results:

<table>
<thead>
<tr>
<th>BCLR-400</th>
<th>APPLICATION</th>
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</thead>
<tbody>
<tr>
<td>E (kJ)</td>
<td>400 &gt; 274</td>
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<tr>
<td>IF</td>
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<tr>
<td>C (mm)</td>
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<tr>
<td>Rdymax (kN)</td>
<td>600 &gt; 556</td>
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</tbody>
</table>

Note: maximum allowed structural load is 650 kN > 556 kN

All performance characteristics can be modified. Please advise us of your specific requirements.
Heavy Duty and Heavy Industry Applications

Typical Applications

Construction Elevator Emergency Stops

Mining Applications

Refinery Material Handling Applications

HD
HI

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Heavy Duty and Heavy Industry Applications

Typical Applications

High Speed Elevator Applications

Material Transport Crane Applications

Amusement Ride Emergency Stops
ADA/DA Series

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.

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.

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.

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.
ADA 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.

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.
ITT 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.

ITT 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 ITT 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 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.

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

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

3. Compare the damping direction (T, C, or T and C), stroke (in. or mm) required, propelling force (lbs. or N) and total energy per hour (in-lbs./hr or Nm/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 Setting Instructions 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. (102 mm)
   Propelling Force (Pd): 200 lbs. (890 N) (T and C)
   Velocity (V): 8 in./sec. (0.2 m/s)
   Cycles/Hour (C): 20

2. Total Energy/Hour: 16,000 in-lbs./hr (1808 Nm/hr) compression
   16,000 in-lbs./hr (1808 Nm/hr) tension
   32,000 in-lbs./hr (3616 Nm/hr) Total

3. Compare damping direction (T and C), stroke, propelling force and total energy per hour, to the values listed in the rate controls engineering data charts.

4. An adjustable model is desired.

5. Selection: ADA 510 (T and C). The proper adjustment is two (2) in tension and compression per the ADA 500 Series Useable Adjustment Setting Ranges Curves.
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. (152 mm)
Control direction: Tension and Compression
Propelling force: 1,000 lbs. (4444.8 N) (tension), 1,625 lbs. (7228 N) (compression)
Selection: ADA 715
1. Velocity: 25 in./sec. (0.635 m/s) (tension), 4 in./sec. (0.1 m/s) (compression)
Intersection point: Adjustment setting 1 1/4 (tension), 1/4 (compression)
2. Adjustment setting: 1 1/4 (tension), 1/4 (compression)
Velocity: 25 in./sec. (0.635 m/s) (tension), 4 in./sec. (0.1 m/s) (compression)

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

Rate Controls

Catalog No./
Model
ADA 505
ADA 505M
ADA 510
ADA 510M
ADA 515
ADA 515M
ADA 520
ADA 520M
ADA 525
ADA 525M

Damping
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C

Stroke
.63
.63
.63
.63
.63
.63
.63
.63
.63
.63

Extension
450
450
450
450
450
450
450
450
450
450

Compression
450
450
450
450
450
450
450
450
450
450

Max. Propelling Force
450
450
450
450
450
450
450
450
450
450

Max. in.-lbs./Rev
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000

Model Weight lbs.
0.68
1.0
0.80
0.52
1.1
0.445
1.1
0.500
1.1
0.590

Technical Data

Catalog No./
Model
ADA 505
ADA 505M
ADA 510
ADA 510M
ADA 515
ADA 515M
ADA 520
ADA 520M
ADA 525
ADA 525M

Damping
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C

Stroke
.63
.63
.63
.63
.63
.63
.63
.63
.63
.63

Extension
450
450
450
450
450
450
450
450
450
450

Compression
450
450
450
450
450
450
450
450
450
450

Max. Propelling Force
450
450
450
450
450
450
450
450
450
450

Max. in.-lbs./Rev
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000

Model Weight lbs.
0.68
1.0
0.80
0.52
1.1
0.445
1.1
0.500
1.1
0.590

Rate Controls

ADA 505 → ADA 525 Series

Catalog No./
Model
ADA 505
ADA 505M
ADA 510
ADA 510M
ADA 515
ADA 515M
ADA 520
ADA 520M
ADA 525
ADA 525M

Damping
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C

Stroke
.63
.63
.63
.63
.63
.63
.63
.63
.63
.63

Extension
450
450
450
450
450
450
450
450
450
450

Compression
450
450
450
450
450
450
450
450
450
450

Max. Propelling Force
450
450
450
450
450
450
450
450
450
450

Max. in.-lbs./Rev
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000

Model Weight lbs.
0.68
1.0
0.80
0.52
1.1
0.445
1.1
0.500
1.1
0.590

Technical Data

Catalog No./
Model
ADA 505
ADA 505M
ADA 510
ADA 510M
ADA 515
ADA 515M
ADA 520
ADA 520M
ADA 525
ADA 525M

Damping
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C
T, C or T and C

Stroke
.63
.63
.63
.63
.63
.63
.63
.63
.63
.63

Extension
450
450
450
450
450
450
450
450
450
450

Compression
450
450
450
450
450
450
450
450
450
450

Max. Propelling Force
450
450
450
450
450
450
450
450
450
450

Max. in.-lbs./Rev
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000
650,000

Model Weight lbs.
0.68
1.0
0.80
0.52
1.1
0.445
1.1
0.500
1.1
0.590

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Rate Controls
ADA Series

**Technical Data**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Damping Direction</th>
<th>Bore Size in. (mm)</th>
<th>Stroke in. (mm)</th>
<th>(F,J) Max. Propelling Force</th>
<th>(E,C) Max. in./lbs./hour</th>
<th>Model Weight (lbs.)</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA 705 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>2</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>3.5</td>
<td>9.35</td>
</tr>
<tr>
<td>ADA 710 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>4</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>4.4</td>
<td>13.35</td>
</tr>
<tr>
<td>ADA 715 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>6</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>5.1</td>
<td>17.35</td>
</tr>
<tr>
<td>ADA 720 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>8</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>6.4</td>
<td>25.30</td>
</tr>
<tr>
<td>ADA 725 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>10</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>7.1</td>
<td>29.35</td>
</tr>
<tr>
<td>ADA 730 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>12</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>7.9</td>
<td>33.35</td>
</tr>
<tr>
<td>ADA 735 T, C or T and C</td>
<td>(25)</td>
<td>98</td>
<td>14</td>
<td>Ø10 H7, SW=10</td>
<td>2,500</td>
<td>(11 000)</td>
<td>8.6</td>
<td>37.35</td>
</tr>
</tbody>
</table>

*Note 1: The maximum load capacity for mounting option K and D is 6,500 lbs.
Note 2: The maximum load capacity for mounting option K and D is 1,600 N.*
## Rate Controls

### ADA 740 Series

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Tension</th>
<th>Compression</th>
<th>Max Weight</th>
<th>A</th>
<th>B</th>
<th>Stroke</th>
<th>Tension Connection Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA 740 T, C or T and C</td>
<td>.98</td>
<td>16</td>
<td>2,500</td>
<td>2,500</td>
<td>3,500,000</td>
<td>8.6</td>
<td>37.30</td>
</tr>
<tr>
<td>ADA 745 T, C or T and C</td>
<td>.98</td>
<td>18</td>
<td>2,500</td>
<td>2,000</td>
<td>3,900,000</td>
<td>9.3</td>
<td>41.30</td>
</tr>
<tr>
<td>ADA 750 T, C or T and C</td>
<td>.98</td>
<td>20</td>
<td>2,500</td>
<td>1,700</td>
<td>4,200,000</td>
<td>9.9</td>
<td>45.30</td>
</tr>
<tr>
<td>ADA 755 T, C or T and C</td>
<td>.98</td>
<td>22</td>
<td>2,500</td>
<td>1,400</td>
<td>4,600,000</td>
<td>10.6</td>
<td>49.35</td>
</tr>
<tr>
<td>ADA 760 T, C or T and C</td>
<td>.98</td>
<td>24</td>
<td>2,500</td>
<td>1,200</td>
<td>4,900,000</td>
<td>11.5</td>
<td>53.35</td>
</tr>
<tr>
<td>ADA 765 T, C or T and C</td>
<td>.98</td>
<td>26</td>
<td>2,500</td>
<td>1,000</td>
<td>5,300,000</td>
<td>12.1</td>
<td>57.35</td>
</tr>
<tr>
<td>ADA 770 T, C or T and C</td>
<td>.98</td>
<td>28</td>
<td>2,500</td>
<td>900</td>
<td>5,600,000</td>
<td>12.8</td>
<td>61.30</td>
</tr>
<tr>
<td>ADA 775 T, C or T and C</td>
<td>.98</td>
<td>30</td>
<td>2,500</td>
<td>800</td>
<td>6,000,000</td>
<td>13.4</td>
<td>65.30</td>
</tr>
<tr>
<td>ADA 780 T, C or T and C</td>
<td>.98</td>
<td>32</td>
<td>2,500</td>
<td>700</td>
<td>6,300,000</td>
<td>14.3</td>
<td>69.35</td>
</tr>
</tbody>
</table>

*Notes: 1. The maximum load capacity for mounting option for K and D is 650 lbs. 2. The maximum load capacity for mounting option for K and D is 1600 N.*
Remote Adjustment Cable for ADA 500 Series

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

- Standard remote adjustment cable length is 48" (1220 mm). Optional lengths available upon request.
- Remote adjustment cable can be used in a single position only.

Note: If rotary application, please complete application worksheet on page 104 and forward to Enidine.

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Part Number</th>
<th>Accessory Description</th>
<th>LA in. (mm)</th>
<th>Weight oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAC48</td>
<td>1K495748</td>
<td>Remote Adjustment Cable</td>
<td>48 (1220)</td>
<td>7 (191)</td>
</tr>
<tr>
<td>RAC4957</td>
<td>AJ4957325</td>
<td>Adjustable Cartridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAC “x”</td>
<td>NJ “x” 4957327</td>
<td>Non-Adjustable Cartridge (0-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW4957</td>
<td>SL4957302</td>
<td>Cartridge Wrench</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FFP4957</td>
<td>PA4957326</td>
<td>Free Flow Plug</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes**
- “x” specify desired setting “0-6”. May be used in place of adjustable cartridge.
- For installing adjustable and non-adjustable cartridges.
- Provides least amount of damping force for ADA Models.
## Rate Controls

### DA Series

**DA 705 → DA 720 Series**

**DA 75M x 50 → DA 75M x 100 Series**

### Technical Data

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Damping Direction</th>
<th>Stroke (in.)</th>
<th>Max. Propelling Force (lbs.)</th>
<th>Max. Max. Rate, Repeatability (In./Cycle)</th>
<th>Max. Max. Rate, Repeatability (In./Cycle)</th>
<th>Model Weight (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA 705</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>2,500</td>
<td>1,100,000</td>
<td>1,100,000</td>
<td>3.1</td>
</tr>
<tr>
<td>DA 710</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>2,500</td>
<td>1,400,000</td>
<td>1,400,000</td>
<td>4.4</td>
</tr>
<tr>
<td>DA 715</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>2,500</td>
<td>1,800,000</td>
<td>1,800,000</td>
<td>5.1</td>
</tr>
<tr>
<td>DA 720</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>2,500</td>
<td>2,100,000</td>
<td>2,100,000</td>
<td>5.7</td>
</tr>
<tr>
<td>DA 75 x 2</td>
<td>T, C or T and C</td>
<td>1.50</td>
<td>5,000</td>
<td>2,700,000</td>
<td>2,700,000</td>
<td>25.0</td>
</tr>
<tr>
<td>DA 75M x 50</td>
<td>(38.0)</td>
<td>1.50</td>
<td>5,000</td>
<td>3,106,000</td>
<td>3,106,000</td>
<td>29.0</td>
</tr>
<tr>
<td>DA 75 x 4</td>
<td>T, C or T and C</td>
<td>1.50</td>
<td>5,000</td>
<td>3,106,000</td>
<td>3,106,000</td>
<td>29.0</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DA 705</td>
<td>1.77 (45.0)</td>
<td>55</td>
<td>8.04 (205.0)</td>
<td>12.09 (306.0)</td>
<td>.579</td>
<td>1.50</td>
<td>1.16</td>
<td>.945</td>
<td>.51</td>
<td>2</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
<tr>
<td>DA 710</td>
<td>1.77 (45.0)</td>
<td>55</td>
<td>10.04 (256.0)</td>
<td>16.11 (407.0)</td>
<td>.579</td>
<td>1.50</td>
<td>1.16</td>
<td>.945</td>
<td>.51</td>
<td>4</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
<tr>
<td>DA 715</td>
<td>1.77 (45.0)</td>
<td>55</td>
<td>12.05 (311.0)</td>
<td>18.12 (458.0)</td>
<td>.579</td>
<td>1.50</td>
<td>1.16</td>
<td>.945</td>
<td>.51</td>
<td>6</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
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</tr>
<tr>
<td>DA 720</td>
<td>1.77 (45.0)</td>
<td>55</td>
<td>14.02 (356.0)</td>
<td>20.66 (517.0)</td>
<td>.579</td>
<td>1.50</td>
<td>1.16</td>
<td>.945</td>
<td>.51</td>
<td>8</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
<tr>
<td>DA 75 x 2</td>
<td>3.00 (76.0)</td>
<td>75</td>
<td>9.58 (243.0)</td>
<td>13.23 (336.0)</td>
<td>.579</td>
<td>3.00</td>
<td>1.06</td>
<td>.81</td>
<td>.50</td>
<td>2</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
<tr>
<td>DA 75M x 50</td>
<td>(76.0)</td>
<td>(19.0)</td>
<td>(345)</td>
<td>(488)</td>
<td>(19.4)</td>
<td>(96.0)</td>
<td>(33.0)</td>
<td>(21.0)</td>
<td>(7.0)</td>
<td>(50.0)</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
<tr>
<td>DA 75 x 4</td>
<td>3.00 (76.0)</td>
<td>75</td>
<td>11.58 (293.0)</td>
<td>15.75 (396.0)</td>
<td>.579</td>
<td>3.00</td>
<td>1.50</td>
<td>.81</td>
<td>.50</td>
<td>4</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
<tr>
<td>DA 75M x 100</td>
<td>(76.0)</td>
<td>(19.0)</td>
<td>(395)</td>
<td>(986)</td>
<td>(19.4)</td>
<td>(96.0)</td>
<td>(33.0)</td>
<td>(21.0)</td>
<td>(7.0)</td>
<td>(60.0)</td>
<td>±.015 (±0,38)</td>
<td>±.010 (±0,25)</td>
<td></td>
</tr>
</tbody>
</table>

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

DA 75 x 6 → TB 100 x 6 Series
DA 75M x 150 → DA 75M x 250 Series

OPTIONAL PROTECTIVE SLEEVE, TOW BAR (TB) MODELS ONLY

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Damping Direction</th>
<th>Base Size</th>
<th>(S) Stroke</th>
<th>Max Propelling Force lbs.</th>
<th>Max. in-lbs./cycle lbs./cycle</th>
<th>Max. in-lbs./hr. lbs/hr.</th>
<th>Model Weight lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA 75 x 6</td>
<td>T and C</td>
<td>(38.0)</td>
<td>(150.0)</td>
<td>(22,250)</td>
<td>(3,360)</td>
<td>(406,000)</td>
<td>(15,0)</td>
</tr>
<tr>
<td>DA 75M x 100</td>
<td>T and C</td>
<td>(38.0)</td>
<td>(200.0)</td>
<td>(22,250)</td>
<td>(4,800)</td>
<td>(443,000)</td>
<td>(16,0)</td>
</tr>
<tr>
<td>DA 75 x 10</td>
<td>T and C</td>
<td>(38.0)</td>
<td>(150.0)</td>
<td>(5,000)</td>
<td>(5,000)</td>
<td>(5,000)</td>
<td>(41,0)</td>
</tr>
<tr>
<td>DA 75M x 250</td>
<td>T and C</td>
<td>(38.0)</td>
<td>(250.0)</td>
<td>(22,250)</td>
<td>(5,000)</td>
<td>(5,000)</td>
<td>(41,0)</td>
</tr>
<tr>
<td>TB 100 x 4</td>
<td>T and C</td>
<td>(57.2)</td>
<td>(100.0)</td>
<td>(10,000)</td>
<td>(4,000)</td>
<td>(4,000)</td>
<td>(32,0)</td>
</tr>
<tr>
<td>TB 100 x 6</td>
<td>T and C</td>
<td>(57.2)</td>
<td>(150.0)</td>
<td>(10,000)</td>
<td>(4,400)</td>
<td>(4,400)</td>
<td>(32,0)</td>
</tr>
</tbody>
</table>

Technical Data

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.
The ITT Enidine Application Worksheet makes shock absorber sizing and selection easier. Fax, phone, or mail worksheet data to Enidine headquarters or your nearest ITT Enidine subsidiary/affiliate or distributor. (See catalog back cover for ITT Enidine locations, or visit www.enidine.com for a list of ITT Enidine distributors.)

Upon ITT 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.)

**APPLICATION DESCRIPTION**

Motion Direction (Check One):
- [ ] Horizontal
- [ ] Vertical
- [ ] Incline
- [ ] Rotary Horizontal
- [ ] Rotary Vertical

Weight (Min./Max.): __________________________ (lbs.)(Kg)
Cycle Rate ____________________________________________ (cycles/hour)
Additional Propelling Force (If Known)__________________________ (lbs.)(N)

Air Cyl: Bore______ (in.)(mm) Max. Pressure______(psi)(bar) Rod Dia.______(in.)(mm)

Hydraulic Cyl: Bore______ (in.)(mm) Max. Pressure______(psi)(bar) Rod Dia.______ (in.)(mm)

Motor _____________ (hp)(kW)  Torque _____________(in-lbs.)(Nm)

Ambient Temp.________________________________________________________ °F (°C)

Environmental Considerations: ______________________________________________________

**SHOCK ABSORBER APPLICATION**

Number of Shock Absorbers to Stop Load
Impact Velocity (min./max.)__________________________ (in./sec.)(m/sec.)
Shock Absorber Stroke Requirements:__________________________ (in.)(mm)
G Load Requirements__________________________ (G)(m/sec²)

(All Data Taken at Shock Absorber)
Under the ITT Enidine Inc. brand, we are a global leader in the design and manufacture of standard and custom energy absorption and vibration isolation product solutions. Product ranges include shock absorbers, rate controls, air springs, wire rope isolators, heavy duty buffers and emergency stops. From Original Equipment Manufacturers (OEM) to aftermarket applications, ITT Enidine offers a unique combination of product selection, engineering excellence and technical support to meet the toughest energy absorption requirements.

**Common Applications:**
- Automotive
- Auto, Storage and Retrieval
- Bridges and Structures
- Conveyor Systems
- Steel Mills
- Plastic Bottle Manufacturing
- Packaging Machinery
- Overhead Cranes
- Robotics
- Electronics Cabins
- Sub-Sea Equipment
- Medical Equipment

ITT Enidine provides energy absorption and vibration isolation solutions to meet the challenging demands of heavy industries.
Shock Absorbers and Rate Controls

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