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.
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Overview

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 Soluable 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.

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 e-mail us at industrialsales@enidine.com and let us get started today.
Theory of Energy Absorption
ITT Enidine Inc.

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 usable adjustment setting graphs. Watching and “listening” to a shock absorber as it functions aids in proper adjustment.

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

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

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

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

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

Shock Absorber Performance When Weight or Impact Velocity Vary

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

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

- **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.

<table>
<thead>
<tr>
<th>ORIFICE AREA TOO SMALL (DAMPING FORCE TOO HIGH)</th>
<th>ORIFICE AREA TOO LARGE (DAMPING FORCE TOO LOW)</th>
<th>PROPERLY ADJUSTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>STROKE</td>
<td>STROKE</td>
<td>STROKE</td>
</tr>
<tr>
<td>SHOCK FORCE</td>
<td>SHOCK FORCE</td>
<td>SHOCK FORCE</td>
</tr>
</tbody>
</table>

Figure 1

Figure 2
**SHOCK ABSORBER SIZING**

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

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

A. Weight of the load to be stopped (lbs)(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).
F. Damping direction (i.e., tension [T], compression [C], or both [T and C]).
G. Required stroke (in/mm)

**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.

\[ E_K = \frac{1}{2} M V^2 \]  
\[ E_K = \frac{1}{2} M \omega^2 \] (rotary) or \[ E_K = \frac{1}{2} M V^2 (\text{metric}) \]

(Note: \( \omega \) = angular velocity, \( V \) = linear velocity, \( \omega \) = angular velocity, \( V \) = linear velocity, \( I \) = moment of inertia, \( K \) = radius of gyration, \( J \) = mass moment of inertia, \( W \) = weight, \( S \) = stroke)

**STEP 3:** Calculate the total energy per cycle.

\[ E_T = E_K + E_W \]

**STEP 4:** Calculate the energy that must be absorbed per hour. Even though the shock absorber can absorb the energy in a single impact, it may not be able to dissipate the heat generated if the cycle rate is too high.

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

**STEP 5:** Calculate the propelling force at the rate control in each direction damping is required. (See sizing examples on page 6-12).

**STEP 6:** Return to Step 3.

**RATE CONTROL SIZING**

Follow the next five steps to manually size ITT Enidine rate controls.

**STEP 1:** Identify the following parameters.

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 direction damping is required. (See sizing examples on page 6-12).

**STEP 3:** Calculate the total energy per cycle.

\[ E_T = EW (tension) + EW (compression) \]

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

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

**STEP 5:** Return to Step 3.

**Overview**

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)

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

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

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 (OEM, HP or HDA series), refer to the Useable Adjustment Setting Range graph for the chosen model. The desired velocity must fall within the limits shown on the graph.
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:

\[ V = \sqrt{386 \times H} \]

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

\[ G = F_P - F_D \]

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

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

For PRO/PM and TK Models:

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

NOTE: Constants are printed in bold.

Shock Absorber Sizing Examples

Typical Shock Absorber Applications

\[ \alpha = \text{Angle of incline (degrees)} \]
\[ \theta = \text{Start point from true vertical 0˚ (degrees)} \]
\[ \mu = \text{Coefficient of friction} \]
\[ \phi = \text{Angle of rotation (degrees)} \]
\[ \omega = \text{Angular velocity (radians/sec)} \]

USEFUL FORMULAS

1. To Determine Shock Force

\[ F_P = \frac{E_T}{S \times 0.85} \]

For PRO and PM Series only, use

\[ F_P = \frac{E_T}{S \times 0.50} \]

2. To Determine Impact Velocity

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

\[ V = \sqrt{\frac{2}{\mu} \times D} \]

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

3. To Determine Propelling Force Generated by Electric Motor

\[ FD = \frac{19,800}{3,000} \times \text{Hp} \]

STEP 1: Application Data

(W) Weight = 3,400 lbs.
(H) Height = 20 in.
(C) Cycles/Hr = 2

STEP 2: Calculate kinetic energy

\[ E_k = W \times H \]

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

STEP 3: Calculate work energy

\[ E_W = S \times \text{Hp} \]

STEP 4: Calculate total energy per cycle

\[ E_T = E_k + E_W \]

STEP 5: Calculate total energy per hour

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

STEP 6: Calculate impact velocity and confirm selection

\[ V = \sqrt{\frac{2 \times 386 \times H}{\mu}} \]

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.
(P) Pressure = 70 psi
(C) Cycles/Hr = 200

STEP 2: Calculate kinetic energy

\[ E_k = \frac{W}{2} \times V^2 = \frac{3,400}{2} \times 80^2 \]

Assume Model OEM 4.0M x 4 is adequate (Page 32).

STEP 3: Calculate work energy

\[ E_W = F_D \times S \]

\[ F_D = \frac{\mu}{\mu + \phi} \times F_P \]

\[ F_P = \frac{E_T}{S \times 0.85} \]

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

Model OEM 4.0M x 4 is adequate.
**EXAMPLE 3:** Vertical Moving Load with Propelling Force Upward

**STEP 1:** Application Data

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

**STEP 2:** Calculate kinetic energy

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

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

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

**STEP 3:** Calculate work energy

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

\[ F_D = 2 \times 0.7854 \times 6^2 \times 70 = 3,400 \]

\[ E_W = F_D \times S \\ E_W = 3,400 \times 5 \]

\[ E_W = 17,000 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \\ E_T = 28,187 + 17,000 \]

\[ E_T = 45,187 \text{ in-lbs./c} \]

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

\[ E_TC = E_T \times C \\ E_TC = 45,187 \times 200 \]

\[ E_TC = 9,037,400 \text{ in-lbs./hr} \]

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

\[ E_K = W \times V^2 = 1,950 \times 60^2 \]

\[ E_K = 695 \text{ in-lbs.} \]

**STEP 3:** Calculate work energy

Assume Model OEM 1.25 x 2 is adequate (Page 24).

\[ E_W = F_D \times S \\ E_W = 695 \times 2 \]

\[ E_W = 1,390 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \\ E_T = 695 + 1,390 \]

\[ E_T = 2,085 \text{ in-lbs./c} \]

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

\[ E_TC = E_T \times C \\ E_TC = 2,085 \times 200 \]

\[ E_TC = 417,000 \text{ in-lbs./hr} \]

Model OEM 2.0M x 2 is adequate.

---

**EXAMPLE 5:** Horiztonal Moving Load

**STEP 1:** Application Data

- **(W)** Weight = 200 lbs.
- **(V)** Velocity = 60 in./sec.
- **(Hp)** Motor horsepower = 1.5 Hp
- **(C)** Cycles/Hr = 100

**STEP 2:** Calculate kinetic energy

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

\[ E_K = 593 \text{ in-lbs.} \]

**STEP 3:** Calculate work energy

**CASE A: UP**

\[ F_D = 19,800 \times \frac{V}{60} - W \\ F_D = 19,800 \times 1.5 - 200 \]

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

Assume Model OEM 1.25 x 2 is adequate (Page 24).

\[ E_W = F_D \times S \\ E_W = 295 \times 2 \]

\[ E_W = 590 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \\ E_T = 593 + 590 \]

\[ E_T = 1,183 \text{ in-lbs./c} \]

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

\[ E_TC = E_T \times C \\ E_TC = 1,183 \times 100 \]

\[ E_TC = 118,300 \text{ in-lbs./hr} \]

Model OEM 1.25 x 2 is adequate.

**CASE B: DOWN**

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

\[ F_D = 695 \text{ lbs.} \]

Assume Model OEM 2.0M x 2 is adequate (Page 24).

\[ E_W = F_D \times S \\ E_W = 695 \times 2 \]

\[ E_W = 1,390 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \\ E_T = 593 + 1,390 \]

\[ E_T = 1,983 \text{ in-lbs./c} \]

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

\[ E_TC = E_T \times C \\ E_TC = 1,983 \times 100 \]

\[ E_TC = 198,300 \text{ in-lbs./hr} \]

Model OEM 2.0M x 2 is adequate.
**Overview**

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

**STEP 2: Calculate kinetic energy**

\[ E_K = \frac{W \times V^2}{722} \]

\[ E_K = \frac{1,950 \times 60^2}{722} \]

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

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

**STEP 3: Calculate work energy**

\[ F_D = \frac{.7854 \times d^2 \times P}{480} \]

\[ F_D = \frac{.7854 \times 3^2 \times 70}{480} \]

\[ F_D = 495 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 495 \times 2 \]

\[ E_W = 990 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \]

\[ E_T = 9,093 + 990 \]

\[ E_T = 10,083 \text{ in-lbs./c} \]

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

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

\[ E_{TC} = 10,083 \times 200 \]

\[ E_{TC} = 2,016,600 \text{ in-lbs./hr} \]

Model OEMXT 2.0M x 2 is adequate.

**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**

\[ E_K = \frac{W \times V^2}{722} \]

\[ E_K = \frac{2,200 \times 60^2}{722} \]

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

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

**STEP 3: Calculate work energy**

\[ F_D = \frac{19,800 \times Hp \times V}{480} \]

\[ F_D = \frac{19,800 \times 1.5 \times 60}{480} \]

\[ F_D = 495 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 495 \times 2 \]

\[ E_W = 990 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \]

\[ E_T = 10,259 + 990 \]

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

**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**

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

\[ F_D = 550 \times \sin 30° \]

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

\[ E_W = F_D \times S \]

\[ E_W = 275 \times 3 \]

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

**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**

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

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

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

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

\[ V = \sqrt{\frac{772 \times H}{772}} \]

\[ V = \sqrt{\frac{772 \times 8}{772}} \]

\[ V = 79 \text{ in./sec.} \]

Model OEMXT 1.5M x 3 is adequate.
Shock Absorber Sizing Examples

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**

\[ K = \frac{.289}{\sqrt{4 \times A^2 + B^2}} \]

\[ K = \frac{.289}{\sqrt{4 \times 40^2 + .5^2}} \]

\[ K = 23.12 \text{ in-lbs.} \]

**STEP 3: Calculate work energy**

\[ I = W \times K^2 \]

\[ I = 50 \times 23.12^2 \]

\[ I = 69 \text{ in-lbs.} \]

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

\[ E_t = \frac{I}{2} \times \omega^2 \]

\[ E_t = \frac{69}{2} \times 2.5^2 \]

\[ E_t = 132 \text{ in-lbs.} \]

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

\[ E_h = E_t \times C \]

\[ E_h = 132 \times 250 \]

\[ E_h = 33000 \text{ in-lbs./hr} \]

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

\[ V = RS \times \omega \]

\[ V = 20 \times 2.5 \]

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

Model STH .5M is adequate.

---

**EXAMPLE 10:** Horizontal Rotating Door

**STEP 1: Application Data**

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

**STEP 2: Calculate kinetic energy**

\[ I = W \times K^2 \]

\[ I = 200 \times 15^2 \]

\[ I = 117 \text{ in-lbs./sec.}^2 \]

**STEP 3: Calculate work energy**

\[ F_D = T \times RS \]

\[ F_D = 1065 \times 20 \]

\[ F_D = 53 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 53 \times .5 \]

\[ E_W = 26.5 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \]

\[ E_T = 23.12 + 2.5 \]

\[ E_T = 25.62 \text{ in-lbs./c} \]

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

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

\[ E_{TC} = 25.62 \times 120 \]

\[ E_{TC} = 3074.4 \text{ in-lbs./hr} \]

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

\[ V = RS \times \omega \]

\[ V = 20 \times 1.5 \]

\[ V = 30 \text{ in./sec.} \]

Model STH .5M 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.
- Rotary table dia. = 20 in.
- (KLoad) Radius of gyration = 8 in.
- (RS) Mounting radius = 8.86 in.
- (C) Cycles/Hr = 1
- (ω) Direction

**STEP 2: Calculate kinetic energy**

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

\[ I = \frac{440}{386} \times 8^2 \]

\[ I = 41 \text{ in-lbs./sec.}^2 \]

**STEP 3: Calculate work energy**

\[ F_D = T \times RS \]

\[ F_D = 2200 \times 8.86 \]

\[ F_D = 19472 \text{ lbs.} \]

\[ E_W = F_D \times S \]

\[ E_W = 19472 \times .5 \]

\[ E_W = 9736 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W \]

\[ E_T = 41 + 9736 \]

\[ E_T = 9777 \text{ in-lbs./c} \]

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

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

\[ E_{TC} = 9777 \times 1 \]

\[ E_{TC} = 9777 \text{ in-lbs./hr} \]

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

\[ V = RS \times \omega \]

\[ V = 8.86 \times 6.28 \]

\[ V = 55.4 \text{ in./sec.} \]

From ECO Sizing Graph.

Model ECO 50 is adequate.
**STEP 2: Calculate kinetic energy**

\[ K = \frac{1}{2} I \omega^2 \]

\[ I = \frac{1}{3} WB^2 \]

\[ \omega = \frac{\theta}{\Delta t} \]

\[ K = \frac{1}{2} \left( \frac{1}{3} WB^2 \right) \left( \frac{\theta}{\Delta t} \right)^2 = \frac{1}{6} WB^2 \theta^2 \]

**EXAMPLE 12:**

- **Application Data**
  - Weight: 110 lbs.
  - Angular velocity: 2 rad./sec.
  - Torque: 3,100 in-lbs.
  - Starting point of load from true vertical: 30°
  - Angle of rotation at impact: 15°
  - Radius of gyration: 24 in.
  - Cycles/hour: \( R_s \) = 1

**STEP 2: Calculate kinetic energy**

\[ \frac{1}{6} WB^2 \theta^2 \]

\[ I = \frac{1}{6} \times 110 \times 24^2 \times 30^2 \]

\[ K = \frac{1}{6} \times 110 \times 24^2 \times 30^2 \]

\[ K = 328 \text{ in-lbs.} \]

**STEP 3: Calculate work energy**

\[ E_W = F_D \times S \]

\[ F_D = T + (W \times K \times \sin (\theta + \phi)) \]

\[ E_W = F_D \times S \]

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

\[ E_T = E_K + E_W \]

\[ E_T = 328 + 67 \]

\[ E_T = 394.7 \text{ in-lbs./c} \]

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

- Not applicable, \( C = 1 \)

**STEP 6: Calculate impact velocity**

\[ V = R_s \times \frac{\theta}{\Delta t} \]

\[ V = 16 \times 2 = 32 \text{ in./sec.} \]

**EXAMPLE 13:**

- **Application Data**
  - Weight: 540 lbs.
  - Angular velocity: 3.5 rad./sec.
  - Torque: 250 in-lbs.
  - Starting point of load from true vertical: 30°
  - Angle of rotation at impact: 150°
  - Radius of gyration: 24 in.
  - Cycles/hour: \( R_s \) = 1

**STEP 2: Calculate kinetic energy**

\[ \frac{1}{6} WB^2 \theta^2 \]

\[ I = \frac{1}{6} \times 540 \times 24^2 \times 30^2 \]

\[ K = \frac{1}{6} \times 540 \times 24^2 \times 30^2 \]

\[ K = 354.7 \text{ in-lbs./c} \]

**EXAMPLE 14:**

- **Application Data**
  - Weight: 540 lbs.
  - Angular velocity: 2 rad./sec.
  - Torque: 3,100 in-lbs.
  - Starting point of load from true vertical: 50°
  - Angle of rotation at impact: 50°
  - Radius of gyration: 20 in.
  - Thickness: 2.5 in.
  - Length: 24 in.
  - Cycles/hour: \( R_s \) = 1

**STEP 2: Calculate kinetic energy**

\[ \frac{1}{6} WB^2 \theta^2 \]

\[ I = \frac{1}{6} \times 540 \times 24^2 \times 50^2 \]

\[ K = \frac{1}{6} \times 540 \times 24^2 \times 50^2 \]

\[ K = 2,838 \text{ in-lbs./c} \]

**STEP 3: Calculate work energy**

\[ E_W = F_D \times S \]

\[ F_D = T + (W \times K \times \sin (\theta + \phi)) \]

\[ E_W = F_D \times S \]

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

\[ E_T = E_K + E_W \]

\[ E_T = 2,838 + 1,653 \]

\[ E_T = 4,491 \text{ in-lbs./c} \]

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

- Not applicable, \( C = 1 \)

**STEP 6: Calculate impact velocity**

\[ V = R_s \times \frac{\theta}{\Delta t} \]

\[ V = 20 \times 3.5 = 70 \text{ in./sec.} \]
**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 Intertia = 885 in-lbs/sec.²
- (C/G) Center-of-Gravity = 12 in.
- (θ) Starting point from true vertical = 60°
- (R5) Mounting radius = 10 in.
- (A) Width = 60 in.
- (B) Thickness = 1 in.
- (C) Cycles/Hr = 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**

\[ F_D = \frac{(W \times C/G \times \sin (\theta + \phi))}{R_S} \]

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

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

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

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

\[ E_T = 2,034.6 \text{ in-lbs.} \]

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

\[ E_{TC} = E_T \times C = 2,034.6 \times 1 \]

\[ E_{TC} = 2,034.6 \text{ in-lbs/hr.} \]

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

\[ V = R_S \times \sqrt{\frac{E_T}{M}} \]

\[ V = 10 \times \sqrt{\frac{2,034.6}{300}} \approx 3.5 \text{ in/sec.} \]

Model OEM 1.15 x 1 is adequate (Page 24).

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**EXAMPLE 16:**
Vertical Rotation with Known Intertia Aided by Gravity

**STEP 1: Application Data**
- (W) Weight = 2,000 lbs.
- (ω) Angular Velocity = 2 rad/sec.
- (T) Torque = 19,800 in-lbs.
- (Hp) Motor horsepower = 0.25 Hp
- (I) Known Intertia = 6,232 in-lbs/sec.²
- (C/G) Center-of-Gravity = 12 in.
- (θ) Starting point from true vertical = 60°
- (φ) Angle of rotation at impact = 30°
- (RS) Mounting radius = 30 in.
- (A) Width = 60 in.
- (B) Thickness = 1 in.
- (C) Cycle/Hr = 1

**STEP 2: Calculate kinetic energy**

\[ K = \frac{(W \times C/G \times \sin (\theta + \phi))}{R_S} \]

\[ K = \frac{(2,000 \times 6,232 \times \sin (60° + 30°))}{30} = 539.6 \text{ lbs.} \]

**STEP 3: Calculate work energy**

\[ F_D = \frac{(W \times C/G \times \sin (\theta + \phi))}{R_S} \]

\[ F_D = \frac{(2,000 \times 6,232 \times \sin (60° + 30°))}{30} = 539.6 \text{ lbs.} \]

\[ F_D \times S = 539.6 \times 2 = 1,079.2 \text{ in-lbs.} \]

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

\[ E_T = E_K + E_W = 539.6 + 1,079.2 \]

\[ E_T = 1,618.8 \text{ in-lbs.} \]

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

\[ E_{TC} = E_T \times C = 1,618.8 \times 1 \]

\[ E_{TC} = 1,618.8 \text{ in-lbs/hr.} \]

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

\[ V = R_S \times \sqrt{\frac{E_T}{M}} \]

\[ V = 30 \times \sqrt{\frac{1,618.8}{300}} \approx 20 \text{ in/sec.} \]

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

**STEP 1: Application Data**
- (W) Weight = 220.5 lbs.
- (ω) Angular velocity = 2 rad./sec.
- (T) Torque = 2,750 in-lbs.
- (İ) Known Inertia = 885 in-lbs/sec²
- (C/G) Center-of-Gravity = 12 in.
- (a) Starting point from vertical = 120°
- (β) Angle of rotation at impact = 30°
- (R0) Mounting radius = 10 in.
- (C) Cycles/Hr = 100

**STEP 2: Calculate kinetic energy**

\[ KE = \frac{I \times \omega^2}{2} \]

\[ KE = \frac{885 \times 2^2}{2} \]

\[ KE = 1,770 \text{ in-lbs.} \]

**STEP 3: Calculate work energy**

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

\[ FD = \frac{2,750 - (220.5 \times 12 \times \sin(120° - 30°))}{10} \]

\[ FD = 10.4 \text{ lbs.} \]

\[ EW = FD \times S = 10.4 \times 1 = 10.4 \text{ in-lbs.} \]

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

\[ ET = KE + EW = 1,770 + 10.4 \]

\[ ET = 1,780.4 \text{ in-lbs/cycle} \]

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

\[ ETC = ET \times C \]

\[ ETC = 1,780.4 \times 100 \]

\[ ETC = 178,040 \text{ in-lbs/hr.} \]

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

\[ V = R_S \times \omega = 10 \times 2 = 20 \text{ in./sec.} \]

Model OEMXT 1.5 x 1 is adequate (Page 27).

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

**STEP 1: Application Data**
- (W) Weight = 220.5 lbs.
- (ω) Angular Velocity = 2 rad/sec.
- (T) Torque = 2,750 in-lbs.
- (İ) Known Intertia = 885 in-lbs/sec²
- (C/G) Center-of-Gravity = 12 in.
- (θ) Starting point from true vertical = 120°
- (Ø) Angle of rotation at impact = 30°
- (R0) Mounting radius = 10 in.
- (B) Thickness = 2 in.
- (C) Cycles/Hr = 100

**STEP 2: Calculate kinetic energy**

\[ KE = \frac{I \times \omega^2}{2} \]

\[ KE = \frac{885 \times 2^2}{2} \]

\[ KE = 1,770 \text{ in-lbs.} \]

**STEP 3: Calculate work energy**

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

\[ FD = \frac{2,750 - (220.5 \times 12 \times \sin(120° - 30°))}{10} \]

\[ FD = 10.4 \text{ lbs.} \]

\[ EW = FD \times S = 10.4 \times 1 = 10.4 \text{ in-lbs.} \]

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

\[ ET = KE + EW = 1,770 + 10.4 \]

\[ ET = 1,780.4 \text{ in-lbs/cycle} \]

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

\[ ETC = ET \times C \]

\[ ETC = 1,780.4 \times 100 \]

\[ ETC = 178,040 \text{ in-lbs/hr.} \]

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

\[ V = R_S \times \omega = 10 \times 2 = 20 \text{ in./sec.} \]

Model OEM 1.0 is adequate.
Shock Absorber Sizing Examples

Typical Shock Absorber and Crane Applications

Overview

Please note:
Unless instructed otherwise, ITT Enidine will always calculate with:
• 100% velocity \( V \), and
• 100% propelling force \( F \).

### Application 1
Crane A against Solid Stop

Velocity:
\[ V_r = V_a \]

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

\[ W_d = 2 \times W_1 \]

\[ W_d = (W_1 + W_2) \times \text{Total Number of Shocks} \]

### Application 2
Crane A against Crane B

Velocity:
\[ V_r = V_a + V_b \]

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

\[ W_d = W_b + (1.8) W_{tb} \]

\[ W_d = (W_1 + W_2) \times \text{Total Number of Shocks} \]

### Application 3
Crane B against Crane C

Velocity:
\[ V_r = V_b + V_c \]

Impact weight per buffer:
\[ W_d = W_b + (1.8) W_{tb} \]

\[ W_d = W_c + (1.8) W_{tc} \]

\[ W_d = (W_1 + W_2) \times \text{Total Number of Shocks} \]

### Application 4
Crane C against Solid Stop

Velocity:
\[ V_r = V_c \]

Impact weight per buffer:
\[ W_d = W_c + (1.8) W_{tc} \]

\[ W_d = 2 \times W_1 \]

\[ W_d = (W_1 + W_2) \times \text{Total Number of Shocks} \]
**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.

### Calculation Example for Harbor Cranes as Application 1

- **Bridge Weight:** 837,750 lbs.
- **Weight of Trolley:** 99,200 lbs.
- **Crane Velocity:** 60 in./sec.
- **Required Stroke:** 24 in.
- **Trolley Velocity:** 160 in./sec.
- **Required Stroke:** 40 in.

\[ W_d = W_a + (1.8) W_{ta} \]

\[ W_d = 837,750 + (1.8)(99,200) \]

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

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

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

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

Selecting for required 24-inch stroke:

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

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

\[ W_t = \frac{99,200}{2} \]

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

\[ E_t = \frac{W_t}{772} \cdot \frac{V_t^2}{772} \]

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

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

Selecting for required 40-inch stroke:

- HDN 4.0 x 40, maximum shock force ca. 48,376 lbs = \( F_s \)
### 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:** $H = 60$ ft.
- **Distance to C of G1 - Upper:** $X_1 = 45$ ft.
- **Distance to C of G1 - Lower:** $Y_1 = 15$ ft.
- **Distance to C of G2 - Upper:** $X_2 = 21$ ft.
- **Distance to C of G1 - Lower:** $Y_2 = 39$ ft.
- **Total Weight:** $W = 40,000$ lbs.

#### Calculation for Lower Shock Absorbers

**Calculation Example**

\[
W_{\text{max}d} = X_1 \cdot \frac{W}{H} = 45 \cdot \frac{40,000}{60} = 30,000 \text{ lbs.}
\]

**Calculation Example**

\[
W_{\text{max}d} = Y_1 \cdot \frac{W}{H} = 15 \cdot \frac{40,000}{60} = 10,000 \text{ lbs.}
\]

#### Calculation for Upper Shock Absorbers

**Calculation Example**

\[
W_{\text{max}u} = X_2 \cdot \frac{W}{50} = 21 \cdot \frac{40,000}{50} = 16,800 \text{ lbs.}
\]

**Calculation Example**

\[
W_{\text{max}u} = Y_2 \cdot \frac{W}{50} = 39 \cdot \frac{40,000}{50} = 31,200 \text{ lbs.}
\]

#### Shock Absorber Selection

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

Typical Applications

Overhead Crane Applications

Cargo Crane Applications

Stacker Crane Applications
Shock Absorber and Rate Controls Quick Selection Guide

Typical Selections

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 Adjustable Shock Absorbers

<table>
<thead>
<tr>
<th>Catalog No. (Model)</th>
<th>Stocks (E)</th>
<th>(E) Max. In./in./cycle (lbs.</th>
<th>Damping Type</th>
<th>Page No.</th>
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<tbody>
<tr>
<td>OEM 0.1M (B)</td>
<td>0.25</td>
<td>50</td>
<td>D</td>
<td>21</td>
</tr>
<tr>
<td>ECO OEM 0.1M (B)</td>
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<td>50</td>
<td>D</td>
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<td>OEMXT 2.0 x 2</td>
<td>0.25</td>
<td>50</td>
<td>D</td>
<td>21</td>
</tr>
<tr>
<td>OEMXT 2.0 x 2</td>
<td>0.25</td>
<td>50</td>
<td>D</td>
<td>21</td>
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<tr>
<td>OEMXT 2.0 x 2</td>
<td>0.25</td>
<td>50</td>
<td>D</td>
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<tr>
<td>OEMXT 2.0 x 2</td>
<td>0.25</td>
<td>50</td>
<td>D</td>
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<tr>
<td>OEMXT 2.0 x 2</td>
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<td>50</td>
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<tr>
<td>OEMXT 2.0 x 2</td>
<td>0.25</td>
<td>50</td>
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<td>21</td>
</tr>
<tr>
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### ITT Enidine Non-Adjustable Shock Absorbers

<table>
<thead>
<tr>
<th>Catalog No. (Model)</th>
<th>Stocks (E)</th>
<th>(E) Max. In./in./cycle (lbs.</th>
<th>Damping Type</th>
<th>Page No.</th>
</tr>
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<tbody>
<tr>
<td>TK 6</td>
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<td>50</td>
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<tr>
<td>TK 8</td>
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<td>50</td>
<td>D</td>
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<td>TK 21</td>
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<td>21</td>
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<tr>
<td>TK 8</td>
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<td>50</td>
<td>D</td>
<td>21</td>
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<td>TK 10M</td>
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<td>TK 15</td>
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<td>21</td>
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<td>TK 50</td>
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<td>TK 1.0M</td>
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<td>PMXT 2050</td>
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<td>PMXT 2100</td>
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<td>PMXT 2500</td>
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</tbody>
</table>

### Technical Data

- 1 in. = 25.4mm
- 1 in.-lb. = .11 Nm
- 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. Propelling Force (Tension lbs., Compression lbs.)</th>
<th>Damping Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA 505</td>
<td>2.00</td>
<td>450, 450, 650,000</td>
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<tr>
<td>ADA 510</td>
<td>4.00</td>
<td>450, 375, 850,000</td>
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<tr>
<td>ADA 515</td>
<td>6.00</td>
<td>450, 300, 1,050,000</td>
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<tr>
<td>ADA 520</td>
<td>8.00</td>
<td>450, 200, 1,250,000</td>
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<tr>
<td>ADA 525</td>
<td>10.00</td>
<td>450, 125, 1,450,000</td>
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<tr>
<td>ADA 705</td>
<td>2.00</td>
<td>2,500, 2,500, 1,100,000</td>
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<tr>
<td>ADA 710</td>
<td>4.00</td>
<td>2,500, 2,500, 1,400,000</td>
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<tr>
<td>ADA 715</td>
<td>6.00</td>
<td>2,500, 2,500, 1,800,000</td>
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<td>ADA 720</td>
<td>8.00</td>
<td>2,500, 2,500, 2,100,000</td>
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<tr>
<td>ADA 725</td>
<td>10.00</td>
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<td>ADA 730</td>
<td>12.00</td>
<td>2,500, 2,500, 2,800,000</td>
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<td>ADA 735</td>
<td>14.00</td>
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<td>ADA 740</td>
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<td>ADA 745</td>
<td>18.00</td>
<td>2,500, 2,500, 3,900,000</td>
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<td>ADA 750</td>
<td>20.00</td>
<td>2,500, 1,700, 4,200,000</td>
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</tr>
<tr>
<td>ADA 755</td>
<td>22.00</td>
<td>2,500, 1,400, 4,600,000</td>
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<tr>
<td>ADA 760</td>
<td>24.00</td>
<td>2,500, 1,200, 4,900,000</td>
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<td>ADA 765</td>
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<td>ADA 775</td>
<td>30.00</td>
<td>2,500, 600, 6,000,000</td>
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<td>ADA 780</td>
<td>32.00</td>
<td>2,500, 400, 6,300,000</td>
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<td>ADA 785</td>
<td>34.00</td>
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<td>ADA 790</td>
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<td>ADA 795</td>
<td>38.00</td>
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<td>ADA 800</td>
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**ITT Enidine Non-Adjustable Rate Controls**

<table>
<thead>
<tr>
<th>Catalog No. (Model)</th>
<th>Stroke (in.)</th>
<th>Min./Max. Propelling Force (Tension lbs., Compression lbs.)</th>
<th>Damping Type</th>
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<tbody>
<tr>
<td>BCN 0-5</td>
<td>0.5-5</td>
<td>100,000, 125,000</td>
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<tr>
<td>RCS 4</td>
<td>4-12</td>
<td>200,000, 2,300,000</td>
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</tr>
<tr>
<td>XLR 1-4</td>
<td>1-4</td>
<td>200,000, 2,300,000</td>
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</tr>
<tr>
<td>LR 2-6</td>
<td>2-6</td>
<td>400,000, 2,300,000</td>
<td></td>
</tr>
</tbody>
</table>
Adjustable Series Hydraulic Shock Absorbers

**Overview**

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

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.

- **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 (~30°F to 210°F).
  - Food grade options available.
- **ISO quality standards** result in reliable, long-life 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).**
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). 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). The adjustable multiple orifice shock absorber is shown above. When force is applied to the piston rod, the check ball is seated and the valve remains closed.

ITT Enidine Adjustable Single Orifice Shock Absorbers

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

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

The internal structure of an adjustable single orifice shock absorber is shown above. When force is applied to the piston rod, the check ball is seated and the valve remains closed. Oil is forced out of the high pressure shock tube chamber 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 piston rod return to the original extended position. The closed cellular foam accumulator compensates for fluid displaced by the piston rod during compression and extension. Without the fluid displacement volume provided by the foam accumulator, the closed system would be hydraulically locked. This type of orifice design produces constant orifice area damping.

ITT Enidine Adjustable Multiple Orifice Shock Absorbers

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

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.

www.enidine.com  Email: industrialsales@enidine.com  Tel.: 1-800-832-8508  Fax: 1-716-662-0406
## Adjustable Series Hydraulic Shock Absorbers

### ECO OEM

**ECO OEM Small Bore Series**

**Technical Data**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>A (in.)</th>
<th>A₁ (in.)</th>
<th>C₁ (in.)</th>
<th>D (in.)</th>
<th>E₁ (in.)</th>
<th>F (in.)</th>
<th>G (in.)</th>
<th>H (in.)</th>
<th>J (in.)</th>
<th>WF (lbs.)</th>
<th>WL (lbs.)</th>
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<tbody>
<tr>
<td>OEM .1M (B)</td>
<td>2.23</td>
<td>2.43</td>
<td>1.68 x 1.0</td>
<td>.12</td>
<td>.34</td>
<td>1.95</td>
<td>.34</td>
<td>.40</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>OEM .15M (B)</td>
<td>2.23</td>
<td>2.43</td>
<td>1.68 x 1.0</td>
<td>.12</td>
<td>.34</td>
<td>1.95</td>
<td>.34</td>
<td>.40</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECO UOM .1 (B)</td>
<td>3.22</td>
<td>3.50</td>
<td>2.75</td>
<td>.27</td>
<td>.49</td>
<td>2.81</td>
<td>.49</td>
<td>.56</td>
<td>.28</td>
<td>39.5</td>
<td>39.5</td>
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<td>ECO UOM .25 (B)</td>
<td>3.22</td>
<td>3.50</td>
<td>2.75</td>
<td>.27</td>
<td>.49</td>
<td>2.81</td>
<td>.49</td>
<td>.56</td>
<td>.28</td>
<td>39.5</td>
<td>39.5</td>
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<tr>
<td>ECO UOM .35 (B)</td>
<td>3.96</td>
<td>4.36</td>
<td>3.44 x 1.5</td>
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<td>.57</td>
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<td>.57</td>
<td>.64</td>
<td>.50</td>
<td>30.5</td>
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<tr>
<td>ECO UOM .5 (B)</td>
<td>10.46</td>
<td>11.67</td>
<td>5.16 x 1.5</td>
<td>.60</td>
<td>.79</td>
<td>5.33</td>
<td>.79</td>
<td>.90</td>
<td>.78</td>
<td>117.5</td>
<td>117.5</td>
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<tr>
<td>ECO UOM .1M (B)</td>
<td>3.96</td>
<td>4.36</td>
<td>3.44 x 1.5</td>
<td>.33</td>
<td>.57</td>
<td>3.27</td>
<td>.57</td>
<td>.64</td>
<td>.50</td>
<td>30.5</td>
<td>30.5</td>
</tr>
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<td>ECO UOM .25M (B)</td>
<td>67.84</td>
<td>81.05</td>
<td>20.25 x 1.5</td>
<td>1.32</td>
<td>2.01</td>
<td>16.10</td>
<td>2.01</td>
<td>2.28</td>
<td>2.10</td>
<td>86.6</td>
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<td>51.81</td>
<td>63.60</td>
<td>15.04 x 1.5</td>
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<td>1.79</td>
<td>12.30</td>
<td>1.79</td>
<td>1.92</td>
<td>1.81</td>
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<td>165.00</td>
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<td>1.27</td>
<td>1.79</td>
<td>12.30</td>
<td>1.79</td>
<td>1.92</td>
<td>1.81</td>
<td>73.7</td>
<td>73.7</td>
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</tbody>
</table>

### Notes:

1. All shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. More than 5%, a smaller model should be specified.
2. For mounting accessories, see pages 22-23.
3. For mounting accessories, see page 22-23.

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### Notes:

1. All shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. More 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.

---

### Notes:

1. All shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle. More than 5%, a smaller model should be specified.
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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

**OEM 0.1M → (LR)OEM 1.0 Series**

### Jam Nut (JN)

- **Metric**
  - SC M10 x 1
  - SC M12 x 1
  - SC M14 x 1.5
  - SC M20 x 1.5
  - SC M25 x 1.5

- **Universal Retaining Flange (Small Bore) (UF)**
  - UF 1/2 - 20
  - UF 9/16 - 18
  - UF M12 x 1.5

### Accessories

<table>
<thead>
<tr>
<th>Catalog No. / Model</th>
<th>Part Number</th>
<th>Model (Roll)</th>
<th>CA in. (mm)</th>
<th>CB in. (mm)</th>
<th>WF in. (mm)</th>
<th>WL in. (mm)</th>
<th>Weight (oz.) (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JN M10 x 1</td>
<td>0233940157</td>
<td>ECO OEM 0.1M (8)</td>
<td>0.55 (14.0)</td>
<td>0.55 (14.0)</td>
<td>0.69 (17.5)</td>
<td>–</td>
<td>1.0 (28.0)</td>
</tr>
<tr>
<td>JN M12 x 1</td>
<td>0233940130</td>
<td>ECO OEM 1.0M (8)</td>
<td>0.89 (22.5)</td>
<td>0.89 (22.5)</td>
<td>1.00 (25.5)</td>
<td>–</td>
<td>1.5 (43.0)</td>
</tr>
<tr>
<td>JN 3/8 - 20</td>
<td>0228042160</td>
<td>ECO (LR)OEM 3/8 (15)</td>
<td>0.75 (19.0)</td>
<td>0.75 (19.0)</td>
<td>0.98 (25.0)</td>
<td>–</td>
<td>0.7 (19.5)</td>
</tr>
<tr>
<td>JN M14 x 1.5</td>
<td>0233940155</td>
<td>ECO (LR)OEM 1.5M (16)</td>
<td>1.00 (25.5)</td>
<td>1.00 (25.5)</td>
<td>1.20 (30.0)</td>
<td>–</td>
<td>1.2 (34.0)</td>
</tr>
<tr>
<td>JN M20 x 1.5</td>
<td>0233940134</td>
<td>ECO (LR)OEM 1.5M (16)</td>
<td>1.00 (25.5)</td>
<td>1.00 (25.5)</td>
<td>1.38 (35.0)</td>
<td>–</td>
<td>1.6 (45.5)</td>
</tr>
</tbody>
</table>

### Stop Collar (SC)

- **Imperial**
  - HEX JAM NUT (NOT INCLUDED)

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

- **Metric**
  - UF 3/8 - 20
  - UF M10 x 1 → UF M16 x 1.5

- **Universal Retaining Flange (Small Bore) (UF)**
  - UF 1/2 - 18
  - UF M20 x 1.5 → UF M27 x 3

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

Hydraulic Shock Absorbers

ECO OEM Small Bore Series

Side Load Adaptor (SLA)

Notes:
1. Maximum sideload angle is 30°.
2. Part Numbers in page colors are non-standard lead time items, contact ITT Enidine.

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Clevis Mount

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### Accessories

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<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>SLA 10MF</td>
<td>SLA 33657</td>
<td>ECO OEM 0.1M</td>
<td>0.35</td>
<td>0.47</td>
<td>0.53</td>
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<td>0.10</td>
<td>0.09</td>
<td>0.10</td>
<td>0.09</td>
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<td>SLA 12MF</td>
<td>SLA 33299</td>
<td>ECO OEM 1.0M</td>
<td>0.38</td>
<td>0.71</td>
<td>0.55</td>
<td>0.82</td>
<td>0.34</td>
<td>0.29</td>
<td>0.34</td>
<td>0.29</td>
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<tr>
<td>SLA 1/2-20 x .30</td>
<td>SLA 34762</td>
<td>ECO OEM 5MS</td>
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<td>0.60</td>
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<tr>
<td>SLA 5/8-20 x .30</td>
<td>SLA 34763</td>
<td>ECO OEM 5MS</td>
<td>0.30</td>
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<td>0.60</td>
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</tr>
</tbody>
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<tr>
<td>ECO OEM 0.1M CMS</td>
<td>1.0</td>
<td>0.47</td>
<td>0.53</td>
<td>0.80</td>
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</tr>
</tbody>
</table>

---

Note: 1. Maximum sideload angle is 30°. 2. Part Numbers in page colors are non-standard lead time items, contact ITT Enidine.
Adjustable Series Hydraulic Shock Absorbers
ECO OEM Small Bore Series

OEM 1.15 ➔ (LR)OEM 1.25 Series

Technical Data

**Note:** A1 and E1 apply to urethane striker cap accessory.

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>A1 (in.)</th>
<th>E1 (in.)</th>
<th>D1 (in.)</th>
<th>E2 (in.)</th>
<th>G1 (in.)</th>
<th>H (in.)</th>
<th>Wfl (lbs.)</th>
<th>Wfl (oz.)</th>
</tr>
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<tbody>
<tr>
<td>UC 8609</td>
<td>0.52</td>
<td>0.17</td>
<td>0.39</td>
<td>0.17</td>
<td>0.39</td>
<td>0.52</td>
<td>3.0</td>
<td>86.0</td>
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</table>

**Catalog No./Part Number**

| UC 8609 | CN9W9F9 | (ECO)OEM 1.15/1.25 | 0.52  | 0.17  | 0.39  | 0.17  | 0.39  | 0.52  | 3.0    | 86.0   |

---

**Urethane Striker Cap (USC)**
### Adjustable Series Hydraulic Shock Absorbers

#### ECO OEM Small Bore Series

---

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Jam Nut (JN)</th>
<th>Stop Collar (SC)</th>
<th>Rectangular Flange (RF)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Jam Nut (JN)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Catalog No./ Part Number</strong></td>
<td><strong>Model (Ref)</strong></td>
<td><strong>JA in. (mm)</strong></td>
<td><strong>JA in. (mm)</strong></td>
</tr>
<tr>
<td><strong>JN 1 1/2 - 1 2</strong></td>
<td>ECO-OEM 1.15</td>
<td>1.73</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>JN M33 x 1.5</strong></td>
<td>ECO-OEM 1.15N</td>
<td>(44.0)</td>
<td>(38.0)</td>
</tr>
<tr>
<td><strong>JN 1 1/2 - 1 2</strong></td>
<td>ECO-OEM 1.75</td>
<td>1.88</td>
<td>1.60</td>
</tr>
<tr>
<td><strong>JN M36 x 1.5</strong></td>
<td>ECO-OEM 1.25N</td>
<td>(47.3)</td>
<td>(41.0)</td>
</tr>
<tr>
<td><strong>Stop Collar (SC)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Catalog No./ Part Number</strong></td>
<td><strong>Model (Ref)</strong></td>
<td><strong>CA in. (mm)</strong></td>
<td><strong>CD in. (mm)</strong></td>
</tr>
<tr>
<td><strong>SC 1 1/2 - 1 2</strong></td>
<td>ECO-OEM 1.15</td>
<td>2.50</td>
<td>1.50</td>
</tr>
<tr>
<td><strong>SC M33 x 1.5</strong></td>
<td>ECO-OEM 1.15N</td>
<td>(63.5)</td>
<td>(43.5)</td>
</tr>
<tr>
<td><strong>SC 1 1/2 - 1 2</strong></td>
<td>ECO-OEM 1.75</td>
<td>2.49</td>
<td>1.49</td>
</tr>
<tr>
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<td>ECO-OEM 1.25N</td>
<td>(63.5)</td>
<td>(43.5)</td>
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<tr>
<td><strong>SC 1 1/2 - 1 2</strong></td>
<td>ECO-OEM 1.25M</td>
<td>(71.1)</td>
<td>(52.0)</td>
</tr>
<tr>
<td><strong>Rectangular Flange (RF)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Catalog No./ Part Number</strong></td>
<td><strong>Model (Ref)</strong></td>
<td><strong>EC in. (mm)</strong></td>
<td><strong>FH in. (mm)</strong></td>
</tr>
<tr>
<td><strong>RF 1 1/2 - 1 2</strong></td>
<td>ECO-OEM 1.15N</td>
<td>(55.5)</td>
<td>(41.3)</td>
</tr>
<tr>
<td><strong>RF M33 x 1.5</strong></td>
<td>ECO-OEM 1.15N</td>
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**Notes:**
- Do not use with urethane striker cap.
- Δ = Non-standard lead time items, contact Enidine.

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### Adjustable Series Hydraulic Shock Absorbers

**ECO OEM Small Bore Series**

#### Clevis Mount

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>FT Stroke in. (mm)</th>
<th>L in. (mm)</th>
<th>M H0 (mm)</th>
<th>N H0 (mm)</th>
<th>P H0 (mm)</th>
<th>Q H0 (mm)</th>
<th>S H0 (mm)</th>
<th>T H0 (mm)</th>
<th>V in. (mm)</th>
<th>W H0 (mm)</th>
<th>X H0 (mm)</th>
<th>CR in. (mm)</th>
<th>Weight (lbs)</th>
<th>CEU</th>
<th>QSPRINT</th>
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<tbody>
<tr>
<td>ECO (LR)OEM 1.15 x 1 CM(S)</td>
<td>1.0</td>
<td>6.44</td>
<td>231</td>
<td>231</td>
<td>300</td>
<td>300</td>
<td>1.50</td>
<td>88</td>
<td>22</td>
<td>33</td>
<td>23</td>
<td>44</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ECO (LR)OEM 1.15 x 2 CM(S)</td>
<td>2.0</td>
<td>9.07</td>
<td>231</td>
<td>231</td>
<td>300</td>
<td>300</td>
<td>1.50</td>
<td>88</td>
<td>22</td>
<td>33</td>
<td>23</td>
<td>44</td>
<td>1.6</td>
<td></td>
<td></td>
</tr>
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<td>1.0</td>
<td>6.44</td>
<td>231</td>
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<td>22</td>
<td>33</td>
<td>23</td>
<td>44</td>
<td>1.6</td>
<td></td>
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<td>9.07</td>
<td>231</td>
<td>231</td>
<td>300</td>
<td>300</td>
<td>1.50</td>
<td>88</td>
<td>22</td>
<td>33</td>
<td>23</td>
<td>44</td>
<td>1.6</td>
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</tr>
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Notes:
1. "S" designates model is supplied with spring.
2. \( \Delta \) = 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 (Bollard)</th>
<th>Y in. (mm)</th>
<th>Z in. (mm)</th>
<th>FA H0 (mm)</th>
<th>FB H0 (mm)</th>
<th>FC H0 (mm)</th>
<th>CD H0 (mm)</th>
<th>FE H0 (mm)</th>
<th>FG H0 (mm)</th>
<th>FK H0 (mm)</th>
<th>Size W (in.)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM 1 1/4 - 12</td>
<td>2F21449305</td>
<td>EN1H00115</td>
<td>2.20</td>
<td>1.25</td>
<td>1.75</td>
<td>2.08</td>
<td>23</td>
<td>1.75</td>
<td>0.96</td>
<td>0.35</td>
<td>0.88</td>
<td>#1B</td>
<td>4.0 oz</td>
</tr>
<tr>
<td>FM 1 1/2 - 12</td>
<td>2F21449310</td>
<td>EN125H00125</td>
<td>2.20</td>
<td>1.25</td>
<td>1.75</td>
<td>2.08</td>
<td>23</td>
<td>1.75</td>
<td>0.96</td>
<td>0.35</td>
<td>0.88</td>
<td>#1B</td>
<td>4.0 oz</td>
</tr>
<tr>
<td>FM 33 x 1.5</td>
<td>2F21449306</td>
<td>EN115H0150</td>
<td>2.46</td>
<td>1.70</td>
<td>1.65</td>
<td>2.08</td>
<td>23</td>
<td>1.75</td>
<td>0.96</td>
<td>0.35</td>
<td>0.88</td>
<td>#1B</td>
<td>4.0 oz</td>
</tr>
<tr>
<td>FM 36 x 1.5</td>
<td>2F21449306</td>
<td>EN1125H0150</td>
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<td>1.70</td>
<td>1.65</td>
<td>2.08</td>
<td>23</td>
<td>1.75</td>
<td>0.96</td>
<td>0.35</td>
<td>0.88</td>
<td>#1B</td>
<td>4.0 oz</td>
</tr>
</tbody>
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# Adjustable Series Hydraulic Shock Absorbers

## OEMXT Mid-Bore Series

### Technical Data

#### Nominal Coil Spring Force

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke Range</th>
<th>Max. Propelling Force</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEMXT 3/4 x 1</td>
<td>1 - 12 in.</td>
<td>1,120 lbs.</td>
<td></td>
</tr>
<tr>
<td>OEMXT 3/4 x 2</td>
<td>2 - 12 in.</td>
<td>2,240 lbs.</td>
<td></td>
</tr>
<tr>
<td>OEMXT 3/4 x 3</td>
<td>3 - 12 in.</td>
<td>3,360 lbs.</td>
<td></td>
</tr>
<tr>
<td>OEMXT 1.5M x 1</td>
<td>25 - 100 mm</td>
<td>250 Kg</td>
<td></td>
</tr>
<tr>
<td>OEMXT 1.5M x 2</td>
<td>50 - 100 mm</td>
<td>500 Kg</td>
<td></td>
</tr>
<tr>
<td>OEMXT 1.5M x 3</td>
<td>75 - 100 mm</td>
<td>750 Kg</td>
<td></td>
</tr>
</tbody>
</table>

#### Optimal (F_p) and (F_d)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>(S) in.</th>
<th>(E_T) m/s</th>
<th>(E_TC) m/s/sec</th>
<th>Max. Reaction Force</th>
<th>Max. Reaction Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEMXT 3/4 x 1</td>
<td>1</td>
<td>3 - 55</td>
<td>7,500</td>
<td>4,500</td>
<td>1,500</td>
</tr>
<tr>
<td>OEMXT 3/4 x 2</td>
<td>2</td>
<td>3 - 55</td>
<td>7,500</td>
<td>4,500</td>
<td>1,500</td>
</tr>
<tr>
<td>OEMXT 3/4 x 3</td>
<td>3</td>
<td>3 - 55</td>
<td>7,500</td>
<td>4,500</td>
<td>1,500</td>
</tr>
<tr>
<td>OEMXT 1.5M x 1</td>
<td>25,0</td>
<td>0.08 - 1.3</td>
<td>425</td>
<td>20,000</td>
<td>2,890</td>
</tr>
<tr>
<td>OEMXT 1.5M x 2</td>
<td>50,0</td>
<td>0.08 - 1.3</td>
<td>425</td>
<td>20,000</td>
<td>2,890</td>
</tr>
<tr>
<td>OEMXT 1.5M x 3</td>
<td>75,0</td>
<td>0.08 - 1.3</td>
<td>425</td>
<td>20,000</td>
<td>2,890</td>
</tr>
</tbody>
</table>

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*Note: A1 and E1 apply to urethane striker cap accessory.*
Adjustable Series

Hydraulic Shock Absorbers

OEMXT Mid-Bore Series

Clevis Mount

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>(LR)OEMXT 3/4 x 1 CM(S)</td>
<td>1.0</td>
<td>7.84</td>
<td>1.06</td>
<td>3.75</td>
<td>3.00</td>
<td>0.34</td>
<td>2.16</td>
<td>0.50</td>
<td>1.16</td>
<td>0.38</td>
<td>0.75</td>
<td>5/16</td>
<td>12.0 oz.</td>
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<tr>
<td>(LR)OEMXT 1.5M x 1 CM(S)</td>
<td>35</td>
<td>194.0</td>
<td>(9.94</td>
<td>1.06</td>
<td>3.75</td>
<td>3.00</td>
<td>0.34</td>
<td>2.16</td>
<td>0.50</td>
<td>1.16</td>
<td>0.38</td>
<td>0.75</td>
<td>5/16</td>
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<td>(LR)OEMXT 3/4 x 2 CM(S)</td>
<td>2.0</td>
<td>9.84</td>
<td>1.06</td>
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<td>3.00</td>
<td>0.34</td>
<td>2.16</td>
<td>0.50</td>
<td>1.16</td>
<td>0.38</td>
<td>0.75</td>
<td>5/16</td>
<td>12.0 oz.</td>
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<tr>
<td>(LR)OEMXT 1.5M x 2 CM(S)</td>
<td>50</td>
<td>255.0</td>
<td>(12.79</td>
<td>1.06</td>
<td>3.75</td>
<td>3.00</td>
<td>0.34</td>
<td>2.16</td>
<td>0.50</td>
<td>1.16</td>
<td>0.38</td>
<td>0.75</td>
<td>5/16</td>
</tr>
<tr>
<td>(LR)OEMXT 3/4 x 3 CM(S)</td>
<td>3.0</td>
<td>11.84</td>
<td>1.06</td>
<td>3.75</td>
<td>3.00</td>
<td>0.34</td>
<td>2.16</td>
<td>0.50</td>
<td>1.16</td>
<td>0.38</td>
<td>0.75</td>
<td>5/16</td>
<td>12.0 oz.</td>
</tr>
<tr>
<td>(LR)OEMXT 1.5M x 3 CM(S)</td>
<td>75</td>
<td>330.0</td>
<td>(17.04</td>
<td>1.06</td>
<td>3.75</td>
<td>3.00</td>
<td>0.34</td>
<td>2.16</td>
<td>0.50</td>
<td>1.16</td>
<td>0.38</td>
<td>0.75</td>
<td>5/16</td>
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Note: 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.)</th>
<th>Z (in.)</th>
<th>FA (in.)</th>
<th>EB (in.)</th>
<th>FC (in.)</th>
<th>FD (in.)</th>
<th>FE (in.)</th>
<th>EG (in.)</th>
<th>Ej (in.)</th>
<th>Daily Ship. Wts (lbs)</th>
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<tbody>
<tr>
<td>FM 1-12</td>
<td>3172940</td>
<td>(60.5) 1.56</td>
<td>(8.01)</td>
<td>(6.4)</td>
<td>(2.73)</td>
<td>(3.20)</td>
<td>(2.55)</td>
<td>(2.05)</td>
<td>(1.97)</td>
<td>(1.33)</td>
<td>(1.09)</td>
<td>(5.00)</td>
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<tr>
<td>FM M12 x 1.5</td>
<td>3172940</td>
<td>3172940-1.56</td>
<td>(8.01)</td>
<td>(6.4)</td>
<td>(2.73)</td>
<td>(3.20)</td>
<td>(2.55)</td>
<td>(2.05)</td>
<td>(1.97)</td>
<td>(1.33)</td>
<td>(1.09)</td>
<td>(5.00)</td>
</tr>
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www.enidine.com  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406
## Technical Data

### Imperial

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke</th>
<th>Adjustable Spring Range</th>
<th>Max. Reaction Force</th>
<th>Extended No.</th>
<th>Compressed No.</th>
<th>Propelling Force</th>
<th>Weight lbs.</th>
</tr>
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<tbody>
<tr>
<td>(LR)OEMXT 1 1/8 x 1</td>
<td>1 3/30</td>
<td>10,000</td>
<td>2,000,000</td>
<td>11,500</td>
<td>26</td>
<td>35</td>
<td>4,000</td>
</tr>
<tr>
<td>(LR)OEMXT 1 1/8 x 2</td>
<td>2 12.140</td>
<td>20,000</td>
<td>2,400,000</td>
<td>11,500</td>
<td>17</td>
<td>35</td>
<td>1,500</td>
</tr>
<tr>
<td>(LR)OEMXT 1 1/4 x 2</td>
<td>2 3/30</td>
<td>20,000</td>
<td>2,400,000</td>
<td>11,500</td>
<td>17</td>
<td>35</td>
<td>4,000</td>
</tr>
<tr>
<td>(LR)OEMXT 1 1/4 x 4</td>
<td>4 12.140</td>
<td>40,000</td>
<td>2,300,000</td>
<td>11,500</td>
<td>16</td>
<td>36</td>
<td>1,000</td>
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<tr>
<td>(LR)OEMXT 1 1/4 x 6</td>
<td>6 12.140</td>
<td>60,000</td>
<td>2,700,000</td>
<td>11,500</td>
<td>18</td>
<td>36</td>
<td>1,000</td>
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</tbody>
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### Metric

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke</th>
<th>Adjustable Spring Range</th>
<th>Max. Reaction Force</th>
<th>Extended N</th>
<th>Compressed N</th>
<th>Propelling Force</th>
<th>Mass Kg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(LR)OEMXT 2.0M x 1</td>
<td>25.0</td>
<td>8.00-1.35</td>
<td>130</td>
<td>226</td>
<td>000</td>
<td>51</td>
<td>000</td>
</tr>
<tr>
<td>(LR)OEMXT 2.0M x 2</td>
<td>50.0</td>
<td>8.00-1.35</td>
<td>260</td>
<td>271</td>
<td>000</td>
<td>51</td>
<td>000</td>
</tr>
<tr>
<td>(LR)OEMXT 2.0M x 4</td>
<td>100.0</td>
<td>8.00-1.35</td>
<td>430</td>
<td>362</td>
<td>000</td>
<td>51</td>
<td>000</td>
</tr>
<tr>
<td>(LR)OEMXT 2.0M x 6</td>
<td>150.0</td>
<td>8.00-1.35</td>
<td>670</td>
<td>421</td>
<td>000</td>
<td>51</td>
<td>000</td>
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</tbody>
</table>

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**Note:** Small end sizes may apply to urethane striker cap accessory.
Adjustable Series Hydraulic Shock Absorbers
OEMXT Mid-Bore Series Accessories

**OEMXT 1 1/8 & OEMXT 2.0M Series**

### Clevis Mount

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>(Z) Stroke (mm)</th>
<th>L (mm)</th>
<th>D1 (mm)</th>
<th>D2 (mm)</th>
<th>P (mm)</th>
<th>Q (mm)</th>
<th>S (mm)</th>
<th>T (mm)</th>
<th>U (mm)</th>
<th>V (mm)</th>
<th>W (mm)</th>
<th>Z + STROKE (mm)</th>
<th>CR + STROKE (mm)</th>
<th>Weight (lbs/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100KX-1 1/8 x 2 CM(S)</td>
<td>2.0 12.06</td>
<td>.751</td>
<td>.751</td>
<td>1.250</td>
<td>1.50</td>
<td>2.88</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>.640</td>
<td>11.7</td>
<td>9.0</td>
<td>.90</td>
</tr>
<tr>
<td>100KX-2.0M x 2 CM(S)</td>
<td>16.0 (50)</td>
<td>(100)</td>
<td>(306)</td>
<td>(19)</td>
<td>(19)</td>
<td>(31)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>13.4</td>
<td>11.5</td>
<td>10.8</td>
</tr>
<tr>
<td>100KX-1 1/8 x 4 CM(S)</td>
<td>4.0 16.06</td>
<td>.751</td>
<td>.751</td>
<td>1.250</td>
<td>1.50</td>
<td>2.88</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>.640</td>
<td>13.4</td>
<td>11.5</td>
<td>10.8</td>
</tr>
<tr>
<td>100KX-2.0M x 4 CM(S)</td>
<td>19.9 (100)</td>
<td>(396)</td>
<td>(187)</td>
<td>(19)</td>
<td>(19)</td>
<td>(31)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>16.3</td>
<td>14.4</td>
<td>13.7</td>
</tr>
<tr>
<td>100KX-1 1/8 x 6 CM(S)</td>
<td>6.0 21.13</td>
<td>.751</td>
<td>.751</td>
<td>1.250</td>
<td>1.50</td>
<td>2.88</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>.640</td>
<td>16.3</td>
<td>14.4</td>
<td>13.7</td>
</tr>
<tr>
<td>100KX-2.0M x 6 CM(S)</td>
<td>25.7 (150)</td>
<td>(537)</td>
<td>(197)</td>
<td>(19)</td>
<td>(19)</td>
<td>(31)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>(38)</td>
<td>18.0</td>
<td>16.0</td>
<td>15.3</td>
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</table>

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

### Flange Foot Mount

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model</th>
<th>(Z) Stroke (mm)</th>
<th>L (mm)</th>
<th>D1 (mm)</th>
<th>D2 (mm)</th>
<th>P (mm)</th>
<th>Q (mm)</th>
<th>S (mm)</th>
<th>T (mm)</th>
<th>U (mm)</th>
<th>V (mm)</th>
<th>W (mm)</th>
<th>Z + STROKE (mm)</th>
<th>CR + STROKE (mm)</th>
<th>Weight (lbs/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMX 2 1/2 - 12</td>
<td>FMX64 x 2</td>
<td>(LR)OEM 1 1/8</td>
<td>2.08</td>
<td>.751</td>
<td>.751</td>
<td>1.250</td>
<td>1.50</td>
<td>2.88</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.06</td>
<td>.640</td>
<td>13.4</td>
<td>11.5</td>
<td>10.8</td>
</tr>
<tr>
<td>FMX 2 1/2 - 12</td>
<td>FMX64 x 2</td>
<td>(LR)OEM 1 1/8</td>
<td>2.08</td>
<td>.751</td>
<td>.751</td>
<td>1.250</td>
<td>1.50</td>
<td>2.88</td>
<td>1.50</td>
<td>1.50</td>
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<td>1.06</td>
<td>.640</td>
<td>13.4</td>
<td>11.5</td>
<td>10.8</td>
</tr>
</tbody>
</table>

**Notes:**
1. = Non-standard lead time item, contact ITT Enidine.
2. **SPRING OPTIONAL**
OEM 4.0M → OEM 4.0M Series

### Standard

**Technical Data**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke (in.)</th>
<th>Optimal Velocity (in./sec.)</th>
<th>Max. Roundstroke Energy per Cycle (Nm/cycle)</th>
<th>Max. Roundstroke Energy (Nm)</th>
<th>Nominal Spring Force (N)</th>
<th>Compressed Spring Force (N)</th>
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<tbody>
<tr>
<td>OEM 3.0M x 2</td>
<td>2.0</td>
<td>12-170</td>
<td>13,000</td>
<td>15,000</td>
<td>25</td>
<td>45</td>
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<tr>
<td>OEM 3.0M x 3.5</td>
<td>3.5</td>
<td>16-190</td>
<td>13,000</td>
<td>15,000</td>
<td>25</td>
<td>45</td>
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<tr>
<td>OEM 3.0M x 5</td>
<td>5.0</td>
<td>19-210</td>
<td>15,000</td>
<td>15,000</td>
<td>25</td>
<td>45</td>
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<tr>
<td>OEM 3.0M x 6.5</td>
<td>6.5</td>
<td>22-240</td>
<td>15,000</td>
<td>15,000</td>
<td>25</td>
<td>45</td>
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<td></td>
</tr>
<tr>
<td>OEM 4.0M x 2</td>
<td>2.0</td>
<td>12-170</td>
<td>13,000</td>
<td>25,000</td>
<td>50</td>
<td>65</td>
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<td></td>
</tr>
<tr>
<td>OEM 4.0M x 4</td>
<td>4.0</td>
<td>16-190</td>
<td>16,000</td>
<td>25,000</td>
<td>35</td>
<td>65</td>
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<td></td>
</tr>
<tr>
<td>OEM 4.0M x 6</td>
<td>6.0</td>
<td>20-220</td>
<td>20,000</td>
<td>25,000</td>
<td>30</td>
<td>70</td>
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<td>OEM 4.0M x 8</td>
<td>8.0</td>
<td>24-260</td>
<td>24,000</td>
<td>25,000</td>
<td>30</td>
<td>80</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>OEM 4.0M x 10</td>
<td>10.0</td>
<td>27-290</td>
<td>26,000</td>
<td>25,000</td>
<td>30</td>
<td>80</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 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. Δ: Non-standard lead time items, contact ITT Enidine.
## Adjustable Series Hydraulic Shock Absorbers

OEM Mid-Bore Series

### OEM 3.0M → OEM 4.0M Series

#### Accessories

<table>
<thead>
<tr>
<th>OEM 3.0M</th>
<th>OEM 4.0M</th>
</tr>
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<tbody>
<tr>
<td>Clevis Mount</td>
<td>Flange Foot Mount</td>
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### Adjustable Series

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>L</th>
<th>N</th>
<th>P</th>
<th>Q</th>
<th>S</th>
<th>T</th>
<th>U</th>
<th>V</th>
<th>Z</th>
<th>CR</th>
<th>Weight (mass)</th>
</tr>
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<tbody>
<tr>
<td>OEM 3.0M x 2 CM(S)</td>
<td>2.0</td>
<td>1.25</td>
<td>1.50</td>
<td>1.50</td>
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<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>OEM 3.0M x 3.5 CM(S)</td>
<td>3.5</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
<td>1.50</td>
</tr>
<tr>
<td>OEM 4.0M x 2 CM(S)</td>
<td>2.0</td>
<td>1.75</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>OEM 4.0M x 4 CM(S)</td>
<td>4.0</td>
<td>2.25</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>OEM 4.0M x 6 CM(S)</td>
<td>6.0</td>
<td>2.75</td>
<td>3.00</td>
<td>3.00</td>
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<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>OEM 4.0M x 8 CM(S)</td>
<td>8.0</td>
<td>3.25</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
<td>3.50</td>
</tr>
</tbody>
</table>

### Notes:

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

### Flange Foot Mount

- **Adjustment Knob**
- **Lock Ring**
- **ADJUSTMENT**

### Catalog Numbers:

- **FM 385 x 2**
  - 203230
  - OEM 3.0M
  - OEM 4.0M
- **FM 4115 x 2**
  - 203270
  - OEM 4.0M

### Notes:

1. ENIDINE 385 x 4.5, 7.0-2mm diameter in 2.3mm.
2. ENIDINE 4115 x 4 and 8 mm 10 mm in 2.5mm diameter in 42.3mm.
3. For rear foot mount, diameter to 23.8mm.

---

**Environmental Protection Information:**

- **Bolt Weight:**
  - J
  - Y
  - Z
  - FA
  - FB
  - FC
  - FD
  - FE
  - FG
  - FJ
  - FK

- **Weight (mass):**
  - lbs.
  - Kg.

---

**Additional Information:**

- **Project:** Rev B
- **Date:** 10/11/18 2:09 PM
- **Page:** 32
Adjustable Series Hydraulic Shock Absorbers
OEM Mid-Bore Accessories

**Stop Collar (SC)**

(LR)OEM ¾ → (LR)OEM 2.0M

**Lock Ring (LR)**

**Square Flange (SF)**

---

### Accessories

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>CA in. (mm)</th>
<th>CB in. (mm)</th>
<th>CD in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>∆SC 1 ¾ - 12</td>
<td>BK2940</td>
<td>(LR)OEMXT ¾</td>
<td>1.94</td>
<td>1.94</td>
<td>2.22</td>
<td>12.0</td>
</tr>
<tr>
<td>∆SC 2 ¼ - 12</td>
<td>BK3010</td>
<td>(LR)OEMXT ½ &amp; ¾</td>
<td>2.00</td>
<td>2.00</td>
<td>2.25</td>
<td>15.0</td>
</tr>
<tr>
<td>∆SC 2 ½ - 12</td>
<td>BK3012</td>
<td>OEMXT 1/4 x 6</td>
<td>2.75</td>
<td>2.75</td>
<td>3.00</td>
<td>37.0</td>
</tr>
<tr>
<td>∆SC M42 x 1.5</td>
<td>BK2941</td>
<td>(LR)OEMXT 1.5M x 2</td>
<td>2.75</td>
<td>2.75</td>
<td>3.00</td>
<td>37.0</td>
</tr>
<tr>
<td>∆SC M42 x 1.5</td>
<td>BK2942</td>
<td>OEMXT 1.5M x 3</td>
<td>2.75</td>
<td>2.75</td>
<td>3.00</td>
<td>37.0</td>
</tr>
<tr>
<td>∆SC M64 x 2</td>
<td>BK3010</td>
<td>OEMXT 2.0M x 2</td>
<td>3.50</td>
<td>3.50</td>
<td>4.00</td>
<td>40.0</td>
</tr>
<tr>
<td>∆SC M64 x 2</td>
<td>BK3011</td>
<td>OEMXT 2.0M x 4</td>
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<td>4.50</td>
<td>5.00</td>
<td>50.0</td>
</tr>
</tbody>
</table>

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

---

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>B in. (mm)</th>
<th>LH in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR 1 ½ - 12</td>
<td>FB29400449</td>
<td>(LR)OEMXT ½</td>
<td>2.00</td>
<td>.38</td>
<td>2.0</td>
</tr>
<tr>
<td>LR 2 ¼ - 12</td>
<td>FB30100449</td>
<td>(LR)OEMXT 1 ½</td>
<td>2.00</td>
<td>.38</td>
<td>3.0</td>
</tr>
<tr>
<td>LR M42 x 1.5</td>
<td>FB29400449</td>
<td>(LR)OEMXT 1.5M</td>
<td>2.00</td>
<td>.38</td>
<td>3.0</td>
</tr>
<tr>
<td>LR M64 x 2</td>
<td>FB30100449</td>
<td>(LR)OEMXT 2.0M</td>
<td>2.00</td>
<td>.50</td>
<td>4.0</td>
</tr>
<tr>
<td>LR M8 x 2</td>
<td>FB33300449</td>
<td>(LR)OEMXT 3.0M</td>
<td>3.00</td>
<td>.63</td>
<td>8.0</td>
</tr>
<tr>
<td>LR M115 x 2</td>
<td>FB37200449</td>
<td>(LR)OEMXT 4.0M</td>
<td>5.00</td>
<td>.88</td>
<td>14.0</td>
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---

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>FC in. (mm)</th>
<th>FH in. (mm)</th>
<th>SA in. (mm)</th>
<th>SB in. (mm)</th>
<th>Bolt Size in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 1 ½ - 12</td>
<td>ME2940129</td>
<td>(LR)OEMXT ½</td>
<td>.34</td>
<td>.50</td>
<td>.25</td>
<td>.63</td>
<td>⅞ (M8)</td>
<td>5.0</td>
</tr>
<tr>
<td>SF 2 ¼ - 12</td>
<td>ME3010129</td>
<td>(LR)OEMXT 1 ½</td>
<td>.41</td>
<td>.62</td>
<td>.30</td>
<td>.75</td>
<td>⅞ (M10)</td>
<td>20.0</td>
</tr>
<tr>
<td>SF M42 x 1.5</td>
<td>M42940129</td>
<td>(LR)OEMXT 1.5M</td>
<td>.34</td>
<td>.50</td>
<td>.25</td>
<td>.63</td>
<td>⅞ (M8)</td>
<td>5.0</td>
</tr>
<tr>
<td>SF M64 x 2</td>
<td>M43010141</td>
<td>(LR)OEMXT 2.0M</td>
<td>.41</td>
<td>.62</td>
<td>.30</td>
<td>.75</td>
<td>⅞ (M10)</td>
<td>20.0</td>
</tr>
<tr>
<td>SF M8 x 2</td>
<td>M4330141</td>
<td>OEM 3.0M</td>
<td>.53</td>
<td>.75</td>
<td>.40</td>
<td>.80</td>
<td>⅞ (M10)</td>
<td>24.0</td>
</tr>
<tr>
<td>SF M115 x 2</td>
<td>M43720141</td>
<td>OEM 4.0M</td>
<td>.65</td>
<td>1.00</td>
<td>1.00</td>
<td>1.13</td>
<td>⅞ (M16)</td>
<td>56.0</td>
</tr>
</tbody>
</table>

---

Project1-RevB_BP_ITT_2012_revB:Project1-RevB_BP  8/5/19  1:34 PM  Page 33
Adjustable Series Hydraulic Shock Absorbers
OEM Mid-Bore Accessories

Adjustable Series

Rectangular Flange (RF)

Stop Bar Kit

Urethane Striker Cap (UC)

Stop Collar With Flange (SCF)

---

Notes:
1. Kit includes 2 Stop Bars, Rectangular Flange for OEM 3/4 and 1.5, Square Flange for 1 1/8 and 2.0 and Lock Ring.
2. ± .0002
3. Locking set screw feature provided as standard.
4. Δ = Non-standard lead time items, contact ITT Enidine.
After properly sizing the shock absorber, the useable range of adjustment settings for the application can be determined:

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

**Example:**

**OEM 1.25 x 1**

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

**Example:**

**(LR)OEMXT 1½ x 2**

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

---

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

**Useable Adjustment Setting Range**

---

**Adjustment Techniques**

**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 1½ x 2**

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

---

**360° adjustment with setscrew locking**

*OEMXT 3/4 and (LR)OEMXT 1 1/8*

*OEMXT 1.5M and (LR)OEMXT 2.0M*

---

**180° adjustment with setscrew locking**

*ECO OEM 0.1M - (LR)OEM 1.0*

---

**ECO OEM Small Series**

*ECO OEM 0.1M - ECO OEM 1.0*

---

**ECO OEM/ECO XT**

*ECO (LR)OEM 0.15M - (LR)OEM 0.5*

---
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

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.
Non-Adjustable Series Hydraulic Shock Absorbers

TK Micro-Bore Series

Technical Data

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Bore Size</th>
<th>Stroke</th>
<th>Compression</th>
<th>Extension</th>
<th>Max. Force</th>
<th>Spring Rate</th>
<th>Damping Constant</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK 6M</td>
<td>.16</td>
<td>9</td>
<td>31,863</td>
<td>81</td>
<td>.2</td>
<td>.14</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>TK 8M</td>
<td>.16</td>
<td>9</td>
<td>42,480</td>
<td>87</td>
<td>.2</td>
<td>.16</td>
<td></td>
<td>14</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.

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>A</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>Q</th>
</tr>
</thead>
</table>

TK 6M/TK 8M

TOTAL ENERGY (in-lbs/c) vs. IMPACT VELOCITY (in/sec)

TOTAL ENERGY (Nm/c) vs. IMPACT VELOCITY (m/sec)
Non-Adjustable Series Hydraulic Shock Absorbers

TK Micro-Bore Series

TK 10M Series

**Standard**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>(S) Stroke (in.)</th>
<th>(E) Max. In-Cha./cycle (Nm/c)</th>
<th>(E) Max. Max. Shock Force (N)</th>
<th>Extended No. (N)</th>
<th>Normal Cell Spring Force Ext. Force (N)</th>
<th>Weight (mils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK 10M (B)</td>
<td>50</td>
<td>1.39</td>
<td>1.13</td>
<td>1.50</td>
<td>0.65</td>
<td>1.50</td>
</tr>
<tr>
<td>TK 10M (M)</td>
<td>35</td>
<td>1.14</td>
<td>0.75</td>
<td>1.81</td>
<td>0.35</td>
<td>2.20</td>
</tr>
</tbody>
</table>

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

TK 21M Series

**Standard**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>(S) Stroke (in.)</th>
<th>(E) Max. In-Cha./cycle (Nm/c)</th>
<th>(E) Max. Max. Shock Force (N)</th>
<th>Extended No. (N)</th>
<th>Normal Cell Spring Force Ext. Force (N)</th>
<th>Weight (mils)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK 21M (B)</td>
<td>50</td>
<td>1.39</td>
<td>1.13</td>
<td>1.50</td>
<td>0.65</td>
<td>1.50</td>
</tr>
<tr>
<td>TK 21M (M)</td>
<td>35</td>
<td>1.14</td>
<td>0.75</td>
<td>1.81</td>
<td>0.35</td>
<td>2.20</td>
</tr>
</tbody>
</table>

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

**Technical Data**

**TK 10M**

**TOTAL ENERGY (in-lbs/c)**

**IMPACT VELOCITY (in/sec)**

**TOTAL ENERGY (Nm/c)**

**IMPACT VELOCITY (m/sec)**

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

### Technical Data

#### Custom Orificed Products

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>D (in.)</th>
<th>E (in.)</th>
<th>C (in.)</th>
<th>D (in.)</th>
<th>E (in.)</th>
<th>F (in.)</th>
<th>WF (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>STH .25M</td>
<td>0.30</td>
<td>0.10</td>
<td>0.25</td>
<td>0.20</td>
<td>0.10</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>STH .5M</td>
<td>0.60</td>
<td>0.10</td>
<td>0.40</td>
<td>0.30</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>STH .75M</td>
<td>0.80</td>
<td>0.10</td>
<td>0.50</td>
<td>0.40</td>
<td>0.10</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>STH 1.0M</td>
<td>1.00</td>
<td>0.10</td>
<td>0.60</td>
<td>0.50</td>
<td>0.10</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>STH 1.0M x 2</td>
<td>2.00</td>
<td>0.20</td>
<td>1.00</td>
<td>0.80</td>
<td>0.20</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>STH 1.5M x 1</td>
<td>1.50</td>
<td>0.20</td>
<td>0.80</td>
<td>0.50</td>
<td>0.20</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>STH 1.5M x 2</td>
<td>3.00</td>
<td>0.20</td>
<td>1.50</td>
<td>0.80</td>
<td>0.20</td>
<td>0.30</td>
<td>0.30</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.
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>A (in)</th>
<th>B (in)</th>
<th>C (in)</th>
<th>D (in)</th>
<th>E (in)</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>JN 7/8 - 32</td>
<td>JS4015034</td>
<td>TK 21</td>
<td>58</td>
<td>50</td>
<td>69</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JN M10 x 1</td>
<td>J20462035</td>
<td>TK10M/TK21M</td>
<td>59</td>
<td>51</td>
<td>13</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JN M14 X 1</td>
<td>J20450035</td>
<td>STH - 25W</td>
<td>77</td>
<td>61</td>
<td>36</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>JN M22 X 1.5</td>
<td>J20462035</td>
<td>STH 35W</td>
<td>134</td>
<td>106</td>
<td>53</td>
<td>0.5</td>
<td></td>
<td></td>
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<tr>
<td>JN M30 X 2</td>
<td>J20560035</td>
<td>STH - 55W</td>
<td>163</td>
<td>127</td>
<td>77</td>
<td>0.9</td>
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<tr>
<td>JN M36 X 1.5</td>
<td>J20560035</td>
<td>STH 1.0 X 3W</td>
<td>166</td>
<td>131</td>
<td>85</td>
<td>0.9</td>
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### Lock Ring (LR)

<table>
<thead>
<tr>
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<th>Part Number</th>
<th>Model (Ref)</th>
<th>A (in)</th>
<th>B (in)</th>
<th>C (in)</th>
<th>D (in)</th>
<th>E (in)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR M45 x 1.5</td>
<td>FR4637049</td>
<td>STH 1.5 Series</td>
<td>2.25</td>
<td>3.5</td>
<td>3.5</td>
<td>0.9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Square Flange (SF)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A (in)</th>
<th>B (in)</th>
<th>C (in)</th>
<th>D (in)</th>
<th>E (in)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF M45 X 1.5</td>
<td>FR4837729</td>
<td>STH 1.5 Series</td>
<td>34</td>
<td>28</td>
<td>57.0</td>
<td>1.63</td>
<td>35.3</td>
<td>5/16</td>
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</tbody>
</table>

### Side Load Adapter (SLA)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A (in)</th>
<th>B (in)</th>
<th>C (in)</th>
<th>D (in)</th>
<th>E (in)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLA 7/8 - 32 x 33</td>
<td>SI 33845</td>
<td>TK 21</td>
<td>36</td>
<td>47</td>
<td>36</td>
<td>8.4</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>SLA 10 MF</td>
<td>SI 37457</td>
<td>TK10M/TK21M</td>
<td>27</td>
<td>47</td>
<td>36</td>
<td>8.4</td>
<td>1.5</td>
<td></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

#### Rectangular Flange (RF)

![Rectangular Flange (RF)](image)

<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>G (in.) (mm)</th>
<th>H (in.) (mm)</th>
<th>I (in.) (mm)</th>
<th>J (in.) (mm)</th>
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<tbody>
<tr>
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<td>M58637053</td>
<td>STH 1.5 Series</td>
<td>.34 (8.6)</td>
<td>.50 (12.7)</td>
<td>.34 (.86)</td>
<td>.24 (6.0)</td>
<td>.60 (15.2)</td>
<td>.25 (6.3)</td>
<td>.50 (12.7)</td>
<td>.14 (3.6)</td>
<td>.90 (23)</td>
<td>9 (.09)</td>
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#### Universal Retaining Flange (UF)

![Universal Retaining Flange (UF)](image)

<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>G (in.) (mm)</th>
<th>H (in.) (mm)</th>
<th>I (in.) (mm)</th>
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<tr>
<td>UF M10 x 1</td>
<td>016368169</td>
<td>TK 10 10 UNF</td>
<td>1.00 (25.4)</td>
<td>.50 (12.7)</td>
<td>.34 (.86)</td>
<td>.24 (6.0)</td>
<td>.60 (15.2)</td>
<td>.25 (6.3)</td>
<td>.50 (12.7)</td>
<td>.14 (3.6)</td>
<td>.90 (23)</td>
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<tr>
<td>UF 1/4 - 32</td>
<td>01903909</td>
<td>TK21</td>
<td>1.50 (38.1)</td>
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<td>.24 (6.0)</td>
<td>.60 (15.2)</td>
<td>.25 (6.3)</td>
<td>.50 (12.7)</td>
<td>.14 (3.6)</td>
<td>.90 (23)</td>
</tr>
</tbody>
</table>
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.

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.

Non-Adjustable Series Hydraulic Shock Absorbers
ECO Series

ITT Enidine Non-Adjustable Multiple Orifice Shock Absorbers

Overview

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.
Non-Adjustable Series Hydraulic Shock Absorbers

**ECO Series**

### Technical Data

#### Nominal Coil Spring Force

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Nominal Coil Spring Force</th>
<th>Nominal Coil Spring Force (N)</th>
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<tr>
<td>ECO 8 (B)</td>
<td>1050</td>
<td>10.5</td>
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<tr>
<td>ECO 10 (B)</td>
<td>1850</td>
<td>18.5</td>
</tr>
<tr>
<td>ECO 15 (B)</td>
<td>2850</td>
<td>28.5</td>
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<tr>
<td>ECO S 25 (B)</td>
<td>5450</td>
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<tr>
<td>ECO 50 (B)</td>
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<td>10.9</td>
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<td>ECO S 50 (B)</td>
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<td>ECO 100 (B)</td>
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<td>21.8</td>
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#### Damping Constant

<table>
<thead>
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<th>Damping Constant</th>
<th>Damping Constant (cm)</th>
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<tr>
<td>ECO 8 (B)</td>
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<tr>
<td>ECO 10 (B)</td>
<td>0.28</td>
</tr>
<tr>
<td>ECO 15 (B)</td>
<td>0.41</td>
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<tr>
<td>ECO S 25 (B)</td>
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<tr>
<td>ECO 50 (B)</td>
<td>0.50</td>
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<tr>
<td>ECO S 50 (B)</td>
<td>0.50</td>
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<tr>
<td>ECO 100 (B)</td>
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#### Standard

<table>
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<tbody>
<tr>
<td>ECO 8</td>
<td>ECO 100</td>
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</tbody>
</table>

#### Notes:

1. See page 54 for constant damping curves.

### Notes:

- See page 54 for constant damping curves.
Non-Adjustable Series Hydraulic Shock Absorbers

ECO Series

**Accessories**

ECO 8 ➞ ECO 100 Series

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

---

**Stop Collar (SC)**

ECOB ➞ ECO100

---

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>ECO Series Part Number</th>
<th>Model (Ref)</th>
<th>CA in. (mm)</th>
<th>CD in. (mm)</th>
<th>WF in. (mm)</th>
<th>WL in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
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<tbody>
<tr>
<td>SC 3/8 - 20</td>
<td>MW2809257</td>
<td>ECO 8 (B)</td>
<td>0.75 0.58</td>
<td>0.58 0.46</td>
<td>– –</td>
<td>– –</td>
<td>0.75 0.58 0.46 0.3</td>
</tr>
<tr>
<td>SC M8 x 0,75</td>
<td>MW2809275</td>
<td>ECO 8 (B)</td>
<td>0.75 0.58</td>
<td>0.58 0.46</td>
<td>– –</td>
<td>– –</td>
<td>0.75 0.58 0.46 0.3</td>
</tr>
<tr>
<td>SC M8 x 1</td>
<td>MW2809305</td>
<td>ECO 10 (B)</td>
<td>0.75 0.63</td>
<td>0.58 0.46</td>
<td>– –</td>
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<td>0.75 0.63 0.58 0.46</td>
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<tr>
<td>SC 7/16 - 28</td>
<td>MW2809257</td>
<td>ECO 10 (B)</td>
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<td>0.58 0.46</td>
<td>– –</td>
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<td>0.75 0.63 0.58 0.46</td>
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<tr>
<td>SC M8 x 1</td>
<td>MW2809275</td>
<td>ECO 10 (B)</td>
<td>0.75 0.63</td>
<td>0.58 0.46</td>
<td>– –</td>
<td>– –</td>
<td>0.75 0.63 0.58 0.46</td>
</tr>
<tr>
<td>SC 7/8 - 32</td>
<td>MW2809257</td>
<td>ECO 10 (B)</td>
<td>0.75 0.63</td>
<td>0.58 0.46</td>
<td>– –</td>
<td>– –</td>
<td>0.75 0.63 0.58 0.46</td>
</tr>
<tr>
<td>SC M10 x 1</td>
<td>MW2809305</td>
<td>ECO 15 (B)</td>
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<td>0.58 0.46</td>
<td>– –</td>
<td>– –</td>
<td>0.75 0.63 0.58 0.46</td>
</tr>
<tr>
<td>SC 1-12 x 1.5</td>
<td>MW2809257</td>
<td>ECO 100 (B)</td>
<td>1.25 1.00</td>
<td>0.69 0.52</td>
<td>– –</td>
<td>– –</td>
<td>1.25 1.00 0.69 0.52</td>
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<td>ECO 100 (B)</td>
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<td>0.69 0.52</td>
<td>– –</td>
<td>– –</td>
<td>1.25 1.00 0.69 0.52</td>
</tr>
</tbody>
</table>

---

**Weight (mass)** oz. (g)

**HEX JAM NUT INCLUDED WITH SHOCK ABSORBER**

---

**Non-Adjustable Series**

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

#### Side Load Adaptor (SLA)

<table>
<thead>
<tr>
<th>Catalog No./Part Number</th>
<th>Model (Ref)</th>
<th>Stroke 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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<tbody>
<tr>
<td>SLA 33270</td>
<td>ECO 100 MF</td>
<td>48,0</td>
<td>15,0</td>
<td>8,0</td>
<td>6,5</td>
<td>35,0</td>
<td>35,0</td>
<td>4,75</td>
<td>10,0</td>
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<td>SLA 33270</td>
<td>ECO 150 MF</td>
<td>48,0</td>
<td>15,0</td>
<td>8,0</td>
<td>6,5</td>
<td>35,0</td>
<td>35,0</td>
<td>4,75</td>
<td>10,0</td>
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<tr>
<td>SLA 33270</td>
<td>ECO 200 MF</td>
<td>48,0</td>
<td>15,0</td>
<td>8,0</td>
<td>6,5</td>
<td>35,0</td>
<td>35,0</td>
<td>4,75</td>
<td>10,0</td>
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### Universal Retaining Flange (UF)

#### LF 3/8 – 12

<table>
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<th>Catalog No./Part Number</th>
<th>Model (Ref)</th>
<th>A (in.)</th>
<th>B (in.)</th>
<th>C (in.)</th>
<th>D (in.)</th>
<th>E (in.)</th>
<th>H (in.)</th>
<th>J (in.)</th>
<th>L (in.)</th>
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<tbody>
<tr>
<td>UF M10 x 1</td>
<td>U16001001</td>
<td>0.18</td>
<td>0.25</td>
<td>0.35</td>
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<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
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<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
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<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
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<tr>
<td>UF M16 x 1</td>
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<td>0.35</td>
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<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
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<td>0.25</td>
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<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
</tr>
<tr>
<td>UF M20 x 1</td>
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<td>0.18</td>
<td>0.25</td>
<td>0.35</td>
<td>0.50</td>
<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
</tr>
<tr>
<td>UF M24 x 1</td>
<td>U28001001</td>
<td>0.18</td>
<td>0.25</td>
<td>0.35</td>
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<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
</tr>
<tr>
<td>UF M28 x 1</td>
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<td>0.18</td>
<td>0.25</td>
<td>0.35</td>
<td>0.50</td>
<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
</tr>
<tr>
<td>UF M32 x 1</td>
<td>U32001001</td>
<td>0.18</td>
<td>0.25</td>
<td>0.35</td>
<td>0.50</td>
<td>0.50</td>
<td>0.20</td>
<td>0.19</td>
<td>0.31</td>
</tr>
</tbody>
</table>

### Accessories

- **Hex Jam Nut**
- **WF**
- **WL**
- **E**
- **FL**
- **Ø(4,5)**
- **Ø(5,5)**
- **Ø.18**
- **Ø.22**
- **Ø.31**

Notes:
- 1. Hex Jam Nut NOT INCLUDED.

---

For more information, please visit www.endine.com or contact us at 1-800-832-8308.
Non-Adjustable Series Hydraulic Shock Absorbers
ECO Series

PROJECT 1-REV B_BP ITT 2012_revB: Project1-RevB_BP 11/29/18 8:49 AM Page 50

Non-Adjustable Series

PRO 110 → ECO 225 Series

Standard

Technical Data

Catalog No./Model Nominal Coil Spring Force

Notes: 1. See page 55 for constant damping curves.
2. *The PRO 110 Model is a Nickel Plated Shock Absorber.

Notes: *Maximum energy rating for emergency use only. Estimated cycle life of 1-5 cycles if used at maximum emergency rating.

Notes: 1. See page 55 for constant damping curves.
2. *The PRO 110 Model is a Nickel Plated Shock Absorber.

Catalog No./ Model Stroke in. in./cycle Emergency Max. in./lbs./cycle (Nm/cycle) (Nm/h) Nominal Coil Spring Force Extended lbs. lbs. Compressed lbs. lbs. Reaction lbs. lbs. Propelling lbs. lbs.

Notes: *Maximum energy rating for emergency use only. Estimated cycle life of 1-5 cycles if used at maximum emergency rating.

Notes: 1. See page 55 for constant damping curves.
2. *The PRO 110 Model is a Nickel Plated Shock Absorber.

Catalog No./ Model Damping Constant A in. in. A in. in. C in. in. D in. in. E in. in. E in. in. F in. in. J in. in. WF in. in. WL in. in.

Notes: 1. See page 55 for constant damping curves.
2. *The PRO 110 Model is a Nickel Plated Shock Absorber.

Catalog No./ Model Stroke in. in./cycle Emergency Max. in./lbs./cycle (Nm/cycle) (Nm/h) Nominal Coil Spring Force Extended lbs. lbs. Compressed lbs. lbs. Reaction lbs. lbs. Propelling lbs. lbs.

Notes: *Maximum energy rating for emergency use only. Estimated cycle life of 1-5 cycles if used at maximum emergency rating.

Notes: 1. See page 55 for constant damping curves.
2. *The PRO 110 Model is a Nickel Plated Shock Absorber.
Non-Adjustable Series

Hydraulic Shock Absorbers

ECO Series

**Non-Adjustable Series**

**ECO 120 → ECO 225 Series**

**Clevis Mount**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>L (in.)</th>
<th>M (± .000/ .005)</th>
<th>N (± .000/ .005)</th>
<th>P (± .000/ .005)</th>
<th>G (± .000/ .005)</th>
<th>S (in. (± .000))</th>
<th>U (in. (± .000))</th>
<th>V (in. (± .000))</th>
<th>W (in. (± .000))</th>
<th>X (in. (± .000))</th>
<th>CR (in. (± .000))</th>
<th>Weight (lbs) (Kg)</th>
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<tbody>
<tr>
<td>ECO 120 CM (S)</td>
<td>6.59</td>
<td>.251</td>
<td>.251</td>
<td>.500</td>
<td>.500</td>
<td>1.50</td>
<td>.88</td>
<td>.33</td>
<td>.48</td>
<td>.31</td>
<td>1.44</td>
<td>1.3 (5.98)</td>
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<td>ECO 230 CM (S)</td>
<td>9.22</td>
<td>.251</td>
<td>.251</td>
<td>.500</td>
<td>.500</td>
<td>1.50</td>
<td>.88</td>
<td>.33</td>
<td>.48</td>
<td>.31</td>
<td>4.44</td>
<td>1.7 (7.71)</td>
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<td>ECO 125 CM (S)</td>
<td>6.59</td>
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<td>.251</td>
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<td>.88</td>
<td>.33</td>
<td>.93</td>
<td>.23</td>
<td>1.64</td>
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<tr>
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<td>.251</td>
<td>.500</td>
<td>.500</td>
<td>1.50</td>
<td>.88</td>
<td>.33</td>
<td>.93</td>
<td>.23</td>
<td>4.44</td>
<td>1.9 (8.94)</td>
</tr>
</tbody>
</table>

Notes:
1. Shock absorber must be ordered separately from foot mount kit.
2. All foot mount kits include two foot mounts.

**Flange Foot Mount**

<table>
<thead>
<tr>
<th>Catalog No./Part Number</th>
<th>Model (Ref)</th>
<th>T (in.)</th>
<th>Z (in.)</th>
<th>FA (in.)</th>
<th>FB (in.)</th>
<th>DC (in.)</th>
<th>FD (in.)</th>
<th>FB (in.)</th>
<th>FG (in.)</th>
<th>FJ (in.)</th>
<th>FK (in.)</th>
<th>Weight (lbs) (Kg)</th>
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<tr>
<td>FM T 1/2 - 12</td>
<td>2F21049305</td>
<td>ECO 120/220</td>
<td>2.25</td>
<td>1.25</td>
<td>2.75</td>
<td>2.38</td>
<td>20</td>
<td>1.77</td>
<td>20</td>
<td>90</td>
<td>82</td>
<td>4.0 (1.82)</td>
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<tr>
<td>FM M3 x 1.5</td>
<td>2F21049306</td>
<td>ECO 120/220</td>
<td>2.25</td>
<td>1.25</td>
<td>2.75</td>
<td>2.38</td>
<td>20</td>
<td>1.77</td>
<td>20</td>
<td>90</td>
<td>82</td>
<td>4.0 (1.82)</td>
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<tr>
<td>FM M3 x 1.5</td>
<td>2F21049307</td>
<td>ECO 120/220</td>
<td>2.25</td>
<td>1.25</td>
<td>2.75</td>
<td>2.38</td>
<td>20</td>
<td>1.77</td>
<td>20</td>
<td>90</td>
<td>82</td>
<td>4.0 (1.82)</td>
</tr>
</tbody>
</table>

Notes:
1. Shock absorber must be ordered separately from foot mount kit.
2. All foot mount kits include two foot mounts.
Non-Adjustable Series Hydraulic Shock Absorbers

**ECO Series**

**Non-Adjustable Series**

**Stop Collar (SC)**

### Imperial

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Roll)</th>
<th>CA (in)</th>
<th>CD H. (in)</th>
<th>WF (in)</th>
<th>WL (in)</th>
<th>Weight (oz)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC 1 3/16-12</td>
<td>M930290177</td>
<td>41.0</td>
<td>38.0</td>
<td>36.0</td>
<td>170</td>
<td>210</td>
<td>270</td>
</tr>
<tr>
<td>SC 1/4-12</td>
<td>M930290178</td>
<td>43.4</td>
<td>41.0</td>
<td>38.0</td>
<td>180</td>
<td>270</td>
<td>210</td>
</tr>
<tr>
<td>SC 3/8-12</td>
<td>M930290179</td>
<td>45.0</td>
<td>43.0</td>
<td>41.0</td>
<td>190</td>
<td>270</td>
<td>210</td>
</tr>
</tbody>
</table>

**Metric**

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Roll)</th>
<th>CA (mm)</th>
<th>CD H. (mm)</th>
<th>WF (mm)</th>
<th>WL (mm)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC 1 3/16-12</td>
<td>M930290177</td>
<td>41.0</td>
<td>38.0</td>
<td>36.0</td>
<td>170</td>
<td>210</td>
</tr>
<tr>
<td>SC 1/4-12</td>
<td>M930290178</td>
<td>43.4</td>
<td>41.0</td>
<td>38.0</td>
<td>180</td>
<td>270</td>
</tr>
<tr>
<td>SC 3/8-12</td>
<td>M930290179</td>
<td>45.0</td>
<td>43.0</td>
<td>41.0</td>
<td>190</td>
<td>210</td>
</tr>
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</table>

### Jam Nut (JN)

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Roll)</th>
<th>Model (Ref)</th>
<th>JN (in)</th>
<th>JN (mm)</th>
<th>JN (mm)</th>
<th>Weight (oz)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JN 1 3/16-12</td>
<td>M930290180</td>
<td>ECO 120/220</td>
<td>2.50</td>
<td>64.0</td>
<td>(64.0)</td>
<td>7.0</td>
<td>210</td>
</tr>
<tr>
<td>JN 1 1/4-12</td>
<td>M930290181</td>
<td>ECO 120/220</td>
<td>2.50</td>
<td>64.0</td>
<td>(64.0)</td>
<td>7.0</td>
<td>210</td>
</tr>
</tbody>
</table>

**Accessories**

ECO 120 ➞ ECO 225 Series
ECO Non-Adjustable Series Hydraulic Shock Absorbers

**Overview**

**Urethane Striker Cap (USC)**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>A in. (mm)</th>
<th>E in. (mm)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US 8609</td>
<td>98609009</td>
<td>ECO 120, 125, 220 &amp; 225</td>
<td>0.22</td>
<td>0.38</td>
<td>1.13</td>
</tr>
</tbody>
</table>

**Rectangular Flange (RF)**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>FC in. (mm)</th>
<th>FH in. (mm)</th>
<th>RD in. (mm)</th>
<th>RE in. (mm)</th>
<th>SA in. (mm)</th>
<th>SB in. (mm)</th>
<th>Width Slot in. (mm)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF 1 1/4 - 1/2</td>
<td>01310049129</td>
<td>ECO 120/220</td>
<td>0.39</td>
<td>1.20</td>
<td>0.10</td>
<td>1.75</td>
<td>1.33</td>
<td>1.00</td>
<td>#4-40</td>
<td>7.0</td>
</tr>
<tr>
<td>RF M39 x 1.5</td>
<td>01310049161</td>
<td>ECO 120/220</td>
<td>0.43</td>
<td>1.43</td>
<td>0.10</td>
<td>1.75</td>
<td>1.33</td>
<td>1.00</td>
<td>#4-40</td>
<td>7.0</td>
</tr>
<tr>
<td>RF 1 1/2 - 1/2</td>
<td>01310049199</td>
<td>ECO 120/220</td>
<td>0.39</td>
<td>1.20</td>
<td>0.10</td>
<td>1.75</td>
<td>1.33</td>
<td>1.00</td>
<td>#4-40</td>
<td>7.0</td>
</tr>
<tr>
<td>RF M46 x 1.5</td>
<td>01310049200</td>
<td>ECO 120/220</td>
<td>0.43</td>
<td>1.43</td>
<td>0.10</td>
<td>1.75</td>
<td>1.33</td>
<td>1.00</td>
<td>#4-40</td>
<td>7.0</td>
</tr>
</tbody>
</table>
Non-Adjustable Series Hydraulic Shock Absorbers

ECO Series

ECO 8 ➔ ECO S50 Series

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

ECO Series

ECO 50 vs ECO 225 Series

Sizing Curves

Note: Minimum impact velocity for PRO and ECO models is 4 in./sec (0.1 m/sec).

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ENIDINE
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.
Non-Adjustable Series Hydraulic Shock Absorbers
PMXT Mid-Bore Series

ITT Enidine Non-Adjustable Multiple Orifice Shock Absorbers

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 shock 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 shock 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.

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.
Non-Adjustable Series Hydraulic Shock Absorbers

PMXT Mid-Bore Series

Technical Data

PMXT 1525 ➞ PMXT 2150 Series

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Stroke (in.)</th>
<th>(Ff) Max. in.-lbs./cycle</th>
<th>(Ee) Max. lbs./hr.</th>
<th>Nominal Coil Spring Force</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 1525</td>
<td>1.00</td>
<td>3,250</td>
<td>1,120,000</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>(250)</td>
<td>(327)</td>
<td>(126,000)</td>
<td>(68,000)</td>
</tr>
<tr>
<td>PMXT 1550</td>
<td>2.00</td>
<td>6,500</td>
<td>1,475,000</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>(350)</td>
<td>(375)</td>
<td>(167,000)</td>
<td>(78,000)</td>
</tr>
<tr>
<td>PMXT 1575</td>
<td>3.00</td>
<td>10,000</td>
<td>1,775,000</td>
<td>6,500</td>
</tr>
<tr>
<td></td>
<td>(375)</td>
<td>(400)</td>
<td>(201,000)</td>
<td>(78,000)</td>
</tr>
<tr>
<td>PMXT 2050</td>
<td>2.00</td>
<td>16,500</td>
<td>2,400,000</td>
<td>13,750</td>
</tr>
<tr>
<td></td>
<td>(350)</td>
<td>(375)</td>
<td>(271,000)</td>
<td>(115,000)</td>
</tr>
<tr>
<td>PMXT 2100</td>
<td>4.00</td>
<td>33,000</td>
<td>3,200,000</td>
<td>13,750</td>
</tr>
<tr>
<td></td>
<td>(350)</td>
<td>(375)</td>
<td>(362,000)</td>
<td>(133,000)</td>
</tr>
<tr>
<td>PMXT 2150</td>
<td>6.00</td>
<td>50,000</td>
<td>3,730,000</td>
<td>13,750</td>
</tr>
<tr>
<td></td>
<td>(375)</td>
<td>(400)</td>
<td>(421,000)</td>
<td>(173,000)</td>
</tr>
</tbody>
</table>

Notes:
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

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Note: A1 and E1 apply to button models and urethane striker cap accessory.
## 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>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 1525 CM (S)</td>
<td>7.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>3.8</td>
<td>3.0</td>
</tr>
<tr>
<td>PMXT 1550 CM (S)</td>
<td>9.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>5.2</td>
<td>3.0</td>
</tr>
<tr>
<td>PMXT 1575 CM (S)</td>
<td>11.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>6.4</td>
<td>3.0</td>
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</table>

### Flange Foot Mount

**PMXT 1525 CM**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>L (in.)</th>
<th>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 1525 CM (S)</td>
<td>7.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>3.8</td>
</tr>
</tbody>
</table>

**PMXT 1550 CM (S)**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>L (in.)</th>
<th>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 1550 CM (S)</td>
<td>9.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>5.2</td>
</tr>
</tbody>
</table>

**PMXT 1575 CM (S)**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>L (in.)</th>
<th>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 1575 CM (S)</td>
<td>11.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>6.4</td>
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</table>

**PMXT 2050 CM (S)**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>L (in.)</th>
<th>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 2050 CM (S)</td>
<td>13.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>8.2</td>
</tr>
</tbody>
</table>

**PMXT 2100 CM (S)**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>L (in.)</th>
<th>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 2100 CM (S)</td>
<td>16.84</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>9.3</td>
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</table>

**PMXT 2150 CM (S)**

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>L (in.)</th>
<th>M Ø (in.)</th>
<th>P Ø (in.)</th>
<th>Q Ø (in.)</th>
<th>R Ø (in.)</th>
<th>S (in.)</th>
<th>T (in.)</th>
<th>U (in.)</th>
<th>V (in.)</th>
<th>W (in.)</th>
<th>CR Ø (in.)</th>
<th>Weight (oz.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMXT 2150 CM (S)</td>
<td>21.13</td>
<td>0.375</td>
<td>0.375</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.88</td>
<td>1.65</td>
<td>.87</td>
<td>0.50</td>
<td>11.2</td>
</tr>
</tbody>
</table>

### Accessories

**Non-Adjustable Series**

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---

1. α = Non-standard lead time items, contact ITT Enidine.
2. (S) indicates model comes with spring.
Non-Adjustable Series Hydraulic Shock Absorbers

PMXT Mid-Bore Series

Stop Collar (SC)

Lock Ring (LR)

Urethane Striker Cap (USC)

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>CA in. (mm)</th>
<th>OD in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC 1 3/4 - 12</td>
<td>8K32940</td>
<td>PMXT 1500 Series</td>
<td>1.94</td>
<td>1.75</td>
<td>0.5 (24,5)</td>
</tr>
<tr>
<td>SC M45 x 1.5</td>
<td>M8K9450</td>
<td>PMXT 1500M Series (57,2)</td>
<td>49,0</td>
<td>44,5</td>
<td>0.5 (14)</td>
</tr>
<tr>
<td>SC 2 1/2 - 12</td>
<td>8K33010</td>
<td>PMXT 2050 / 2100 Series</td>
<td>2.47</td>
<td>2.25</td>
<td>0.8 (24,5)</td>
</tr>
<tr>
<td>SC M64 x 2 x 6</td>
<td>M8K93012</td>
<td>PMXT 2150M Series (93,6)</td>
<td>89,0</td>
<td>76,0</td>
<td>0.9 (27)</td>
</tr>
</tbody>
</table>

Note: Part numbers in color are non-standard lead time items, contact ITT Enidine.

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>SC in. (mm)</th>
<th>D1 in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC 29400</td>
<td>C92940079</td>
<td>PMXT 1500</td>
<td>0</td>
<td>24,5</td>
<td>0.5 (14)</td>
</tr>
<tr>
<td>UC 30100</td>
<td>C93010079</td>
<td>PMXT 2050</td>
<td>0.15</td>
<td>24,5</td>
<td>0.8 (27)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>LR in. (mm)</th>
<th>LH in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LR 1 3/4 - 12</td>
<td>FR85469199</td>
<td>PMXT 1500 Series</td>
<td>1.75</td>
<td>1.3</td>
<td>0.75 (21.5)</td>
</tr>
<tr>
<td>LR M45 x 1.5</td>
<td>FR85670099</td>
<td>PMXT 1500M Series (73)</td>
<td>49,5</td>
<td>38,5</td>
<td>0.75 (21.5)</td>
</tr>
<tr>
<td>LR 2 1/2 - 12</td>
<td>FR85100999</td>
<td>PMXT 2050 Series</td>
<td>2.5</td>
<td>1.3</td>
<td>0.75 (21.5)</td>
</tr>
<tr>
<td>LR M64 x 2 x 6</td>
<td>FR851010099</td>
<td>PMXT 2100M Series (93)</td>
<td>89,0</td>
<td>76,0</td>
<td>0.9 (27)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Part Number</th>
<th>Model (Ref)</th>
<th>SC in. (mm)</th>
<th>D1 in. (mm)</th>
<th>Weight (mass) oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UC 29400</td>
<td>C92940079</td>
<td>PMXT 1500</td>
<td>0</td>
<td>24,5</td>
<td>0.5 (14)</td>
</tr>
<tr>
<td>UC 30100</td>
<td>C93010079</td>
<td>PMXT 2050</td>
<td>0.15</td>
<td>24,5</td>
<td>0.8 (27)</td>
</tr>
</tbody>
</table>

Note: Part numbers in color are non-standard lead time items, contact ITT Enidine.
Non-Adjustable Series Hydraulic Shock Absorbers
PMXT Mid-Bore Series

**Square Flange (SF)**

![Square Flange Diagram]

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Ref)</th>
<th>FC in. (mm)</th>
<th>FH in. (mm)</th>
<th>SA in. (mm)</th>
<th>SB in. (mm)</th>
<th>Bolt Size</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF 1 1/4 - 12</td>
<td>M4E2940053</td>
<td>PMXT 1500 Series</td>
<td>.34</td>
<td>.50</td>
<td>2.25</td>
<td>.62</td>
<td>5/16</td>
</tr>
<tr>
<td>SF M45 x 1,5</td>
<td>M4G637053</td>
<td>PMXT 1500M Series</td>
<td>(8,6)</td>
<td>(12,7)</td>
<td>(57,2)</td>
<td>(M8)</td>
<td>(180)</td>
</tr>
<tr>
<td>SF 2 1/4 - 12</td>
<td>M4E1010056</td>
<td>PMXT 2000 Series</td>
<td>.41</td>
<td>.62</td>
<td>3.50</td>
<td>2.75</td>
<td>3/8</td>
</tr>
<tr>
<td>SF M64 x 2</td>
<td>M4G3010056</td>
<td>PMXT 2000M Series</td>
<td>(10,4)</td>
<td>(15,7)</td>
<td>(85,1)</td>
<td>(M10)</td>
<td>(450)</td>
</tr>
</tbody>
</table>

**Rectangular Flange (RF)**

![Rectangular Flange Diagram]

<table>
<thead>
<tr>
<th>Catalog No./ Part Number</th>
<th>Model (Ref)</th>
<th>FC in. (mm)</th>
<th>FH in. (mm)</th>
<th>RE in. (mm)</th>
<th>SA in. (mm)</th>
<th>SB in. (mm)</th>
<th>Bolt Size</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF 1 1/2 - 12</td>
<td>M4E2940055</td>
<td>PMXT 1500 Series</td>
<td>.36</td>
<td>.60</td>
<td>3.00</td>
<td>2.60</td>
<td>5/16</td>
<td>6</td>
</tr>
<tr>
<td>RF M45 x 1,5</td>
<td>M4G637053</td>
<td>PMXT 1500M Series</td>
<td>(8,6)</td>
<td>(12,7)</td>
<td>(57,2)</td>
<td>(M8)</td>
<td>(200)</td>
<td>(1200)</td>
</tr>
<tr>
<td>RF 2 1/2 - 12</td>
<td>M4E3010056</td>
<td>PMXT 2000 Series</td>
<td>.41</td>
<td>.62</td>
<td>3.50</td>
<td>2.75</td>
<td>3/8</td>
<td>10</td>
</tr>
<tr>
<td>RF M64 x 2</td>
<td>M4G3010056</td>
<td>PMXT 2000M Series</td>
<td>(10,4)</td>
<td>(15,7)</td>
<td>(85,1)</td>
<td>(M10)</td>
<td>(450)</td>
<td>(2500)</td>
</tr>
</tbody>
</table>
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 Series**

<table>
<thead>
<tr>
<th>Model</th>
<th>Catalog No./ Stroke</th>
<th>Max. Return Force w/o BA* (in.)</th>
<th>Max. Return Force w/ BA* (in.)</th>
<th>A, in. (mm)</th>
<th>F, in.-lbs./cycle (Nm/cycle)</th>
<th>T, in.-lbs./hour (Nm/hr)</th>
<th>Z, in. (mm)</th>
<th>CP</th>
<th>FP</th>
<th>Z</th>
<th>Y</th>
<th>We (Kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDN 1.5 x 2</td>
<td>2</td>
<td>27,900</td>
<td>1,676,000</td>
<td>15,750</td>
<td>50</td>
<td>70</td>
<td>9.4</td>
<td>3.4</td>
<td>5.5</td>
<td>3.4</td>
<td>3.0</td>
<td>32</td>
</tr>
<tr>
<td>HDN 1.5 x 4</td>
<td>4</td>
<td>54,200</td>
<td>3,257,300</td>
<td>15,750</td>
<td>50</td>
<td>100</td>
<td>12.2</td>
<td>5.5</td>
<td>3.8</td>
<td>3.6</td>
<td>3.8</td>
<td>57</td>
</tr>
<tr>
<td>HDN 1.5 x 6</td>
<td>6</td>
<td>80,600</td>
<td>4,036,500</td>
<td>15,750</td>
<td>50</td>
<td>150</td>
<td>16.1</td>
<td>7.9</td>
<td>3.5</td>
<td>3.5</td>
<td>3.5</td>
<td>80</td>
</tr>
<tr>
<td>HDN 1.5 x 8</td>
<td>8</td>
<td>108,000</td>
<td>5,025,800</td>
<td>15,750</td>
<td>50</td>
<td>200</td>
<td>21.1</td>
<td>9.9</td>
<td>3.4</td>
<td>3.5</td>
<td>3.6</td>
<td>110</td>
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<tr>
<td>HDN 1.5 x 10</td>
<td>10</td>
<td>136,900</td>
<td>6,015,100</td>
<td>15,750</td>
<td>50</td>
<td>250</td>
<td>26.1</td>
<td>12.5</td>
<td>3.4</td>
<td>3.7</td>
<td>3.7</td>
<td>135</td>
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<tr>
<td>HDN 1.5 x 12</td>
<td>12</td>
<td>164,800</td>
<td>6,994,400</td>
<td>15,750</td>
<td>50</td>
<td>300</td>
<td>32.1</td>
<td>15.5</td>
<td>3.4</td>
<td>3.7</td>
<td>3.7</td>
<td>165</td>
</tr>
<tr>
<td>HDN 1.5 x 14</td>
<td>14</td>
<td>192,700</td>
<td>7,973,700</td>
<td>15,750</td>
<td>50</td>
<td>350</td>
<td>39.1</td>
<td>18.6</td>
<td>3.4</td>
<td>3.7</td>
<td>3.7</td>
<td>195</td>
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<tr>
<td>HDN 1.5 x 16</td>
<td>16</td>
<td>220,600</td>
<td>8,953,000</td>
<td>15,750</td>
<td>50</td>
<td>400</td>
<td>46.1</td>
<td>21.7</td>
<td>3.4</td>
<td>3.7</td>
<td>3.8</td>
<td>225</td>
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<tr>
<td>HDN 1.5 x 18</td>
<td>18</td>
<td>248,500</td>
<td>9,932,300</td>
<td>15,750</td>
<td>50</td>
<td>450</td>
<td>53.1</td>
<td>24.8</td>
<td>3.4</td>
<td>3.7</td>
<td>3.8</td>
<td>255</td>
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<tr>
<td>HDN 1.5 x 20</td>
<td>20</td>
<td>276,400</td>
<td>10,911,600</td>
<td>15,750</td>
<td>50</td>
<td>500</td>
<td>60.1</td>
<td>28.0</td>
<td>3.4</td>
<td>3.8</td>
<td>3.8</td>
<td>280</td>
</tr>
<tr>
<td>HDN 1.5 x 22</td>
<td>22</td>
<td>304,300</td>
<td>11,890,900</td>
<td>15,750</td>
<td>50</td>
<td>550</td>
<td>67.1</td>
<td>31.1</td>
<td>3.4</td>
<td>3.8</td>
<td>3.8</td>
<td>305</td>
</tr>
<tr>
<td>HDN 1.5 x 24</td>
<td>24</td>
<td>332,200</td>
<td>12,869,200</td>
<td>15,750</td>
<td>50</td>
<td>600</td>
<td>74.1</td>
<td>34.1</td>
<td>3.5</td>
<td>3.8</td>
<td>3.8</td>
<td>330</td>
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<tr>
<td>HDN 1.5 x 26</td>
<td>26</td>
<td>360,100</td>
<td>13,848,500</td>
<td>15,750</td>
<td>50</td>
<td>650</td>
<td>81.1</td>
<td>37.2</td>
<td>3.5</td>
<td>3.8</td>
<td>3.8</td>
<td>355</td>
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<tr>
<td>HDN 1.5 x 28</td>
<td>28</td>
<td>388,000</td>
<td>14,827,800</td>
<td>15,750</td>
<td>50</td>
<td>700</td>
<td>88.1</td>
<td>40.3</td>
<td>3.5</td>
<td>3.8</td>
<td>3.8</td>
<td>380</td>
</tr>
<tr>
<td>HDN 1.5 x 30</td>
<td>30</td>
<td>415,900</td>
<td>15,807,100</td>
<td>15,750</td>
<td>50</td>
<td>750</td>
<td>95.1</td>
<td>43.5</td>
<td>3.6</td>
<td>3.8</td>
<td>3.8</td>
<td>405</td>
</tr>
<tr>
<td>HDN 1.5 x 32</td>
<td>32</td>
<td>443,800</td>
<td>16,786,400</td>
<td>15,750</td>
<td>50</td>
<td>800</td>
<td>102.1</td>
<td>46.5</td>
<td>3.6</td>
<td>3.8</td>
<td>3.8</td>
<td>430</td>
</tr>
</tbody>
</table>

**Technical Data**

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.

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

** HDN 2.0 x 56 Series

<table>
<thead>
<tr>
<th>(S) Stroke</th>
<th>Max Force, in. lbs./cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>127,200</td>
</tr>
<tr>
<td>8</td>
<td>169,800</td>
</tr>
<tr>
<td>10</td>
<td>212,500</td>
</tr>
<tr>
<td>12</td>
<td>253,200</td>
</tr>
<tr>
<td>14</td>
<td>285,900</td>
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<tr>
<td>16</td>
<td>318,700</td>
</tr>
<tr>
<td>18</td>
<td>351,500</td>
</tr>
<tr>
<td>20</td>
<td>383,600</td>
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<td>22</td>
<td>418,700</td>
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<td>24</td>
<td>450,600</td>
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<tr>
<td>26</td>
<td>482,500</td>
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<tr>
<td>28</td>
<td>514,600</td>
</tr>
<tr>
<td>30</td>
<td>547,700</td>
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<tr>
<td>32</td>
<td>580,800</td>
</tr>
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<td>34</td>
<td>613,900</td>
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<tr>
<td>36</td>
<td>646,000</td>
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<tr>
<td>38</td>
<td>676,700</td>
</tr>
<tr>
<td>40</td>
<td>707,600</td>
</tr>
<tr>
<td>42</td>
<td>738,700</td>
</tr>
<tr>
<td>44</td>
<td>769,800</td>
</tr>
<tr>
<td>46</td>
<td>799,900</td>
</tr>
</tbody>
</table>

Note: Limited output of 5% of HDN rated energy per cycle.

---

Heavy Duty Series

HDN 2.0 x 6 → HDN 2.0 x 56 Series

Technical Data
Heavy Duty Series Shock Absorber
HDN 3.0 Series

HDN 3.0 x 2 → HDN 3.0 x 60 Series

| HDN 3.0 x 2 | HDN 3.0 x 3 | HDN 3.0 x 5 | HDN 3.0 x 7 | HDN 3.0 x 8 | HDN 3.0 x 10 | HDN 3.0 x 12 | HDN 3.0 x 14 | HDN 3.0 x 16 | HDN 3.0 x 18 | HDN 3.0 x 20 | HDN 3.0 x 22 | HDN 3.0 x 24 | HDN 3.0 x 26 | HDN 3.0 x 28 | HDN 3.0 x 30 | HDN 3.0 x 32 | HDN 3.0 x 34 | HDN 3.0 x 36 | HDN 3.0 x 38 | HDN 3.0 x 40 | HDN 3.0 x 42 | HDN 3.0 x 44 | HDN 3.0 x 46 | HDN 3.0 x 48 | HDN 3.0 x 50 | HDN 3.0 x 52 | HDN 3.0 x 54 | HDN 3.0 x 56 | HDN 3.0 x 58 | HDN 3.0 x 60 | HDN 3.0 x 62 | HDN 3.0 x 64 | HDN 3.0 x 66 | HDN 3.0 x 68 | HDN 3.0 x 70 | HDN 3.0 x 72 |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|

- **HDN 3.0 x 56 and HDN 3.0 x 60 have 2 charge ports.**

**Technical Data**

- **Heavy Duty Series**

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**Note:**

1. HDN shock absorbers are available in a variety of stroke lengths and energy ratings. The chart above shows some of the available options.
2. The maximum Retract Force and return force will depend on the specific application and the load conditions.
3. Return force is the force required to return the shock absorber to its initial position.
4. The stroke length can be adjusted to meet specific application requirements.
5. The maximum Retract Force and return force will depend on the specific application and the load conditions.

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*ITT Enidine, Inc. 2012 Revised 28 January 2012*
### Heavy Duty Series Shock Absorber

### HDN 3.5 Series

#### Technical Data

#### Heavy Duty Series Shock Absorber

HDN 3.5 x 2 → HDN 3.5 x 56 Series

| HDN 3.5 x 2 | 3.5 | 115,300 | 9,110,100 | 67,300 | 266 | 608 | 180 | 11.4 | 15.6 | 3.5 | 3.0 | 2.1 | 13.73 | 3.0 |
| HDN 3.5 x 4 | 4 | 230,400 | 8,793,200 | 67,300 | 230 | 608 | 180 | 11.4 | 15.6 | 3.5 | 3.0 | 2.1 | 21.82 | 3.0 |
| HDN 3.5 x 6 | 6 | 343,300 | 10,283,600 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 8 | 8 | 433,300 | 11,883,000 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 10 | 10 | 538,400 | 13,324,000 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 12 | 12 | 626,500 | 14,844,100 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 16 | 16 | 801,600 | 17,854,700 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 20 | 20 | 1,051,800 | 22,534,500 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 24 | 24 | 1,228,000 | 25,574,800 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 28 | 28 | 1,402,500 | 28,585,400 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 32 | 32 | 1,578,700 | 31,625,800 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 36 | 36 | 1,754,900 | 34,666,100 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 40 | 40 | 1,918,600 | 37,676,700 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 48 | 48 | 2,188,600 | 43,638,200 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |
| HDN 3.5 x 56 | 56 | 2,418,600 | 49,599,700 | 67,300 | 266 | 1,010 | 21.9 | 13.6 | 15.6 | 3.5 | 3.0 | 2.1 | 19.09 | 3.0 |

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

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

*Denotes Shock Absorber Bladder Accumulator Option.

Dimensions are in inches (millimeters).

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**HDN 3.5 x 56 has two charge ports.**

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**Hardened Steel: Series HDN 3.5 x 56 Series**

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**ITT Enidine**

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

---

**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 option and 30 cycles/hr. without BA option.
6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.
7. HDN 3.5 x 56 has two charge ports.
<table>
<thead>
<tr>
<th>Model</th>
<th>Stroke</th>
<th>Max. Shock Force BA*</th>
<th>Max. Return Force BA*</th>
<th>Max. Return Force BA*</th>
<th>CP (lbs.)</th>
<th>Model in. (Km)</th>
<th>BA* in. (Nm/cycle)</th>
<th>BA* in. (Nm/hr)</th>
<th>BA* lbs.</th>
<th>BA* lbs.</th>
<th>BA* lbs.</th>
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<td>13,579,600</td>
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<td>270</td>
<td>485</td>
<td>20.9</td>
<td>13.6</td>
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<td>154</td>
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<tr>
<td>HDN 4.0 x 4</td>
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<td>15,547,700</td>
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<td>270</td>
<td>690</td>
<td>24.9</td>
<td>15.6</td>
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<td>168</td>
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<tr>
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<td>28.9</td>
<td>17.6</td>
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<tr>
<td>HDN 4.0 x 10</td>
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<td>280</td>
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<td>48.6</td>
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<td>64.6</td>
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<td>HDN 4.0 x 24</td>
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<td>1,275</td>
<td>72.6</td>
<td>41.3</td>
<td>346</td>
<td>346</td>
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<td>HDN 4.0 x 28</td>
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<td>280</td>
<td>1,275</td>
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<td>96.6</td>
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</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.
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 option and 30 cycles/hr. without BA option.
6. For impact velocities over 180 in./sec. (4.5 m/s), consult factory.
# Heavy Duty Adjustable Series Shock Absorber

## HDA 3.0 Series

### Technical Data

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>(S) Max. Stroke (in./mm)</th>
<th>(E) Max. End Stroke Force (lbs./N)</th>
<th>(F) Max. Shock Stroke Force (lbs./N)</th>
<th>Nominal Maximum Force (lbs./N)</th>
<th>(Z) Total Force (lbs./N)</th>
<th>(F)*</th>
<th>(F)*</th>
<th>(Z)*</th>
<th>(CG)*</th>
<th>(F)* lbs.</th>
<th>(F)* lbs.</th>
<th>Model Weight (lbs.)</th>
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<td>172</td>
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<td>240</td>
<td>8.4</td>
<td>2.4</td>
<td>40</td>
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<tr>
<td></td>
<td>(50) (4 500)</td>
<td>(271 200)</td>
<td>(354)</td>
<td>(373)</td>
<td>(112)</td>
<td>(41)</td>
<td>(71)</td>
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<td>232</td>
<td>355</td>
<td>320</td>
<td>9.4</td>
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<tr>
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<td>(75) (6 800)</td>
<td>(322 900)</td>
<td>(510)</td>
<td>(387)</td>
<td>(112)</td>
<td>(41)</td>
<td>(72)</td>
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<td>335</td>
<td>510</td>
<td>445</td>
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<td>(125) (11 300)</td>
<td>(503 900)</td>
<td>(669)</td>
<td>(560)</td>
<td>(112)</td>
<td>(41)</td>
<td>(73)</td>
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<tr>
<td>HDA 3.0 x 8</td>
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<td>9,296,000 (230,000)</td>
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<td>16.3</td>
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<td>455</td>
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<td>620</td>
<td>15.4</td>
<td>2.4</td>
<td>44</td>
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<td>(200) (18 100)</td>
<td>(716 300)</td>
<td>(964)</td>
<td>(719)</td>
<td>(112)</td>
<td>(41)</td>
<td>(75)</td>
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<tr>
<td>HDA 3.0 x 10</td>
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<td>13,994,000 (340,000)</td>
<td>24.7</td>
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<td>46</td>
<td>605</td>
<td>950</td>
<td>870</td>
<td>20.4</td>
<td>2.4</td>
<td>46</td>
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<tr>
<td></td>
<td>(250) (22 600)</td>
<td>(1 050 300)</td>
<td>(1 246)</td>
<td>(950)</td>
<td>(112)</td>
<td>(41)</td>
<td>(77)</td>
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<tr>
<td>HDA 3.0 x 12</td>
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<td>20.4</td>
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<td>47</td>
<td>900</td>
<td>1 450</td>
<td>1 250</td>
<td>26.7</td>
<td>2.4</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>(300) (27 200)</td>
<td>(1 510 600)</td>
<td>(1 844)</td>
<td>(1 357)</td>
<td>(112)</td>
<td>(41)</td>
<td>(79)</td>
<td></td>
<td></td>
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</tr>
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</table>

**Notes:**

1. HDA 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.

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 useable range of adjustment settings can be determined:

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

**EXAMPLE: HDA Series**

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

---

**Dimensional Notes:**

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

---

**Heavy Duty Series**

Heavy Duty Adjustable Series Shock Absorber

HDA 3.0 x 2 → HDA 3.0 x 12 Series

---

**Technical Data**

<table>
<thead>
<tr>
<th>Adjustment Setting Range</th>
<th>Useable Adjustment Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>After properly sizing an HDA shock absorber, the useable range</td>
<td>of adjustment settings can be determined:</td>
</tr>
<tr>
<td>Locate the intersection point of the application's impact</td>
<td>velocity and the HDA model graph line.</td>
</tr>
<tr>
<td>The intersection is the maximum adjustment setting to be used.</td>
<td>Adjustments exceeding this setting could overload the shock absorber.</td>
</tr>
<tr>
<td>The useable adjustment setting range is from setting 1 to</td>
<td>the MAXIMUM adjustment setting as determined in step 2.</td>
</tr>
</tbody>
</table>

**EXAMPLE: HDA Series**

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

---

**Adjustment Techniques**

**Useable Adjustment Setting Range**

**HDA**

---

**Dimensional Notes:**

- Dimensions are in inches (millimeters).
- Note: For TF, FF and FR mounting, delete front foot and dimensions.
## Heavy Duty Adjustable Series Shock Absorber

### HDA 4.0 Series

<table>
<thead>
<tr>
<th>Model</th>
<th>Nominal Return Force (lbs.)</th>
<th>BA (Nm/cycle)</th>
<th>FB (Nm/hr)</th>
<th>K (N)</th>
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<tbody>
<tr>
<td>HDA 4.0 x 2</td>
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<td>16.9</td>
<td>13.9</td>
<td>4.0</td>
</tr>
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<td>20.9</td>
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<tr>
<td>HDA 4.0 x 6</td>
<td>280</td>
<td>23.9</td>
<td>16.9</td>
<td>8.0</td>
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<tr>
<td>HDA 4.0 x 8</td>
<td>280</td>
<td>28.9</td>
<td>18.0</td>
<td>11.0</td>
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<td>HDA 4.0 x 10</td>
<td>300</td>
<td>31.9</td>
<td>19.0</td>
<td>13.0</td>
</tr>
</tbody>
</table>

*Dimensions are in inches (millimeters).*

### Notes:
1. HDA 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.
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)
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. (1524mm).

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. HDA models will function satisfactorily at 10% of their maximum rated energy per cycle. If less than these values, a smaller model should be specified. 2. It is recommended that the customer consult 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. For impact velocities over 180 in./sec. (4.5 m/s), consult factory. 7. Note: For TF, FF and FR mounting, delete front foot and dimensions. | Catalog No./ Stroke | Max. Shock Force BA* in.-lbs./cycle | Max. Shock Force BA* in.-lbs./hour | BA* lbs. | BA* Ns/cycle | BA* Ns/hr | Y in. (mm) | Z in. (mm) | CA in. (mm) | We lbs. (Kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| HD 5.0 x 4 | (100) | (46 700) | (1 762 621) | (550 000) | (1 760) | (435) | (186) | (330) | (47) |
| HD 5.0 x 6 | (150) | (70 000) | (2 002 337) | (550 000) | (1 760) | (469) | (466) | (330) | (94) |
| HD 5.0 x 8 | (200) | (95 500) | (2 502 032) | (550 000) | (1 760) | (477) | (477) | (330) | (130) |
| HD 5.0 x 10 | (250) | (117 000) | (2 677 071) | (550 000) | (1 760) | (495) | (495) | (330) | (170) |
| HD 5.0 x 12 | (300) | (140 000) | (2 716 784) | (550 000) | (1 760) | (500) | (500) | (330) | (210) |
| HD 5.0 x 16 | (350) | (200 000) | (3 116 219) | (550 000) | (1 760) | (520) | (520) | (330) | (250) |
| HD 5.0 x 20 | (400) | (250 000) | (3 578 611) | (550 000) | (1 760) | (540) | (540) | (330) | (290) |
| HD 5.0 x 24 | (450) | (300 000) | (4 040 913) | (550 000) | (1 760) | (560) | (560) | (330) | (330) |
| HD 5.0 x 28 | (500) | (350 000) | (4 503 215) | (550 000) | (1 760) | (580) | (580) | (330) | (370) |
| HD 5.0 x 32 | (550) | (400 000) | (5 165 517) | (550 000) | (1 760) | (600) | (600) | (330) | (410) |
| HD 5.0 x 36 | (600) | (450 000) | (5 827 819) | (550 000) | (1 760) | (620) | (620) | (330) | (450) |
| HD 5.0 x 40 | (650) | (500 000) | (6 480 121) | (550 000) | (1 760) | (640) | (640) | (330) | (490) |
| HD 5.0 x 44 | (700) | (550 000) | (7 132 423) | (550 000) | (1 760) | (660) | (660) | (330) | (530) |
| HD 5.0 x 48 | (750) | (600 000) | (7 784 725) | (550 000) | (1 760) | (680) | (680) | (330) | (570) |

Dimensions are in inches (millimeters).

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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

#### HD 6.0 x 4 → HD 6.0 x 48 Series

#### Technical Data

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Max. Stroke (in.)</th>
<th>Max. In. Stroke (in.)</th>
<th>Max. Shock Force (in.-lbs./cycle)</th>
<th>A (in.)</th>
<th>B (in.)</th>
<th>C (in.)</th>
<th>Z (in.)</th>
<th>CA Weight (lbs.)</th>
<th>CA Weight (lb/hr)</th>
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<td>(500)</td>
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<td>(568)</td>
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<td>(197)</td>
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<td>(1 208)</td>
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<td>(1 404)</td>
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<td>(2 700)</td>
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<td>(1 547)</td>
<td>(1 668)</td>
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<td>(1 793)</td>
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</table>

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

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

---

**Note:***

1. HD shock absorbers will function satisfactorily at 5% of their maximum rated energy per cycle.
2. The nominal valve stroke is at 10% of the maximum stroke and energy per cycle. If less than these values, a smaller model should be specified.
3. Rear flange or foot mount configurations are recommended.
4. Maximum cycle rate is 60 cycles/hr.
5. If impact velocities below 30 in./sec. (.8 m/sec.), please contact ITT Enidine for sizing assistance.
6. Maximum cycle rate is 60 cycles/hr.
Heavy Duty Series Shock Absorber
Mounting and Accessories for HDN, HD, HDA Series

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.

FF: Front Flange

FR: Rear Flange

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

---

Clevis Mounts (CM)

Dimensions are in inches (millimeters).

<table>
<thead>
<tr>
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<th>HD(A) 4.0 x 10 Series</th>
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<td>HD(A) 3.0 x 5</td>
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<td>7.9</td>
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<td>7.9</td>
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<td>HD(A) 4.0 x 8</td>
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<tr>
<td>HD(A) 4.0 x 10</td>
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<td>7.9</td>
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Dimensions and notes vary depending on specific model.
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>
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<td>3.4 (86)</td>
<td>0.79 (20)</td>
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<tr>
<td>HDN 2.0 x 6-28</td>
<td>3.8 (96)</td>
<td>0.63 (16)</td>
</tr>
<tr>
<td>HDN 2.0 x 32-56</td>
<td>6.9 (176)</td>
<td>0.63 (16)</td>
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<tr>
<td>HDN 4.0 x 2-10</td>
<td>4.3 (108)</td>
<td>0.35 (9)</td>
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<tr>
<td>HDN 4.0 x 12-48</td>
<td>8.0 (202)</td>
<td>0.35 (9)</td>
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<table>
<thead>
<tr>
<th>Model</th>
<th>Sensor Dia. (in.)</th>
<th>Height Dia. (in.)</th>
</tr>
</thead>
<tbody>
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<td>2.1 (56)</td>
<td>0.39 (10)</td>
</tr>
<tr>
<td>HDN 3.0 x 3-32</td>
<td>4.4 (111)</td>
<td>0.39 (10)</td>
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<tr>
<td>HDN 3.0 x 30-60</td>
<td>6.3 (160)</td>
<td>0.39 (10)</td>
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<tr>
<td>HDN 3.5 x 2-16</td>
<td>3.0 (77.4)</td>
<td>0.35 (9)</td>
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<tr>
<td>HDN 3.5 x 20-56</td>
<td>5.2 (132.4)</td>
<td>0.35 (9)</td>
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<table>
<thead>
<tr>
<th>Model</th>
<th>Dia. A (mm)</th>
<th>Dia. B (mm)</th>
<th>H (mm)</th>
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<tbody>
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<td>3.36</td>
<td>4</td>
</tr>
<tr>
<td>HDN 2.0</td>
<td>65</td>
<td>3.36</td>
<td>4</td>
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<tr>
<td>HDN 3.0</td>
<td>70</td>
<td>3.76</td>
<td>4</td>
</tr>
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</table>
Heavy Industry Products
Configuration Worksheet

Ordering Example
Note: HDN/HD/HDA models are custom-orificed, 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)
   TF (Front and rear flange)
   TR (Rear flange)
   CM (Metric clevis mount)
5 - Options
   C (Sensor cable)
   P (Sensor plug) - See Page 18
   SC (Safety cable)
   BA (Bladder Accumulator)
   UC (Urethane Cap)

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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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.

**Ordering Example**

Example:

- **Select quantity:** 4
- **HI 120 x 100**
- **FR**
- **B**

**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

**Return Force**

<p>| HI 50 x 50 | 2 | 26,500 | 15,700 | 120 | 710 | 11 | 10.3 | – | – | 0.6 | 2.56 | 3.94 | 2.76 | 0.57 | 1/2 | 2.28 |
| HI 100 x 50 | 3.9 | 55,500 | 15,700 | 120 | 710 | 11 | 10.3 | – | – | 0.6 | 2.56 | 3.94 | 2.76 | 0.57 | 1/2 | 2.28 |
| HI 50 x 100 | 2 | 50,200 | 36,000 | 225 | 430 | 36 | 12.8 | – | – | 0.6 | 3.35 | 5.04 | 3.50 | 0.79 | 3/4 | 3.11 |
| HI 100 x 100 | 3.9 | 120,500 | 36,000 | 225 | 1,800 | 49 | 16.7 | – | – | 0.6 | 3.35 | 5.04 | 3.50 | 0.79 | 3/4 | 3.11 |
| HI 50 x 150 | 2 | 88,500 | 52,800 | 370 | 4,050 | 36 | 11.9 | 11.9 | 6.9 | 0.8 | 3.94 | 5.91 | 4.72 | 0.73 | 5/8 | 3.90 |
| HI 100 x 150 | 5.9 | 265,500 | 52,800 | 370 | 4,050 | 62 | 24.3 | 24.1 | 11.8 | 0.8 | 3.94 | 5.91 | 4.72 | 0.73 | 5/8 | 3.90 |
| HI 50 x 200 | 2 | 177,000 | 52,800 | 370 | 4,050 | 75 | 18.5 | 18.4 | 10.6 | 0.8 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 200 | 3.9 | 424,800 | 52,800 | 370 | 4,050 | 86 | 23.5 | 23.3 | 13.0 | 0.8 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 50 x 400 | 2 | 354,000 | 52,800 | 370 | 4,050 | 132 | 38.3 | 38.1 | 20.5 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 400 | 5.9 | 991,200 | 52,800 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 50 x 500 | 3.9 | 1,106,300 | 52,800 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 500 | 7.9 | 1,811,250 | 74,200 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 600 | 3.9 | 2,163,900 | 74,200 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 700 | 3.9 | 2,301,000 | 74,200 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 800 | 3.9 | 2,301,000 | 74,200 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 900 | 3.9 | 2,301,000 | 74,200 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |
| HI 100 x 1000 | 3.9 | 2,301,000 | 74,200 | 370 | 4,050 | 192 | 62.9 | 62.7 | 33.6 | 1.0 | 4.72 | 8.66 | 6.69 | 1.03 | 1 5.0 |</p>
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<th>Catalog No./Model</th>
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<th>Max. Energy/cycle in.-lbs. (Nm)</th>
<th>Max. Shock Force lbs. (kN)</th>
<th>Return Force lbs. (kN)</th>
<th>A1 in. (mm)</th>
<th>A2 in. (mm)</th>
<th>Z in. (mm)</th>
<th>H in. (mm)</th>
<th>ØB in. (mm)</th>
<th>ØE in. (mm)</th>
<th>ØFC in. (mm)</th>
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<td>164,800</td>
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<td>30.4</td>
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<td>8.27</td>
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<td>1,300</td>
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<tr>
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<tr>
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<td>8.27</td>
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<tr>
<td>HI 150 x 600</td>
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<td>35.2</td>
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<tr>
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<td>35.3</td>
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<td>10.63</td>
<td>8.27</td>
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</tr>
</tbody>
</table>

Heavy Industry Shock Absorbers
HI Series

Technical Data

**HI 130 x 250**
- Max. Shock Force: 1,300 lbs.
- Weight: 30.5 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.12 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 130 x 300**
- Max. Shock Force: 1,300 lbs.
- Weight: 30.5 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.12 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 130 x 400**
- Max. Shock Force: 1,300 lbs.
- Weight: 30.5 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.12 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 130 x 600**
- Max. Shock Force: 1,300 lbs.
- Weight: 30.5 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.12 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 130 x 800**
- Max. Shock Force: 1,300 lbs.
- Weight: 30.5 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.12 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 115**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 150**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 400**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 500**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 600**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 800**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.

**HI 150 x 1000**
- Max. Shock Force: 1,125 lbs.
- Weight: 35.3 lbs.
- Compression: 21.5 in.
- Extension: 1.0 in.
- Bolt: 5.91 in.
- Extension: 10.63 in.
- Reduction: 8.27 in.
- Front Flange: 1.03 lbs.
- Mounting Flange: 5.08 lbs.
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
Visco-elastic technology makes use of the fundamental properties of specially formulated Jarret visco-elastic medium.

### Visco-elastic Technology

- **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.
<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
<th>L5</th>
<th>L6</th>
<th>R1</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
<th>D4</th>
<th>D5</th>
<th>D6</th>
<th>D7</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC1ZN</td>
<td>2.95</td>
<td>2.1</td>
<td>2.1</td>
<td>0.39</td>
<td>0.28</td>
<td>1.7</td>
<td>–</td>
<td>0.75</td>
<td>0.79</td>
<td>1.5</td>
<td>2.2</td>
<td>1.6</td>
<td>0.28</td>
<td>0.7</td>
<td>(75) (53) (52) (10) (7) (43) – (19) M25 x 1,5 (20) (38) (57) (41) (7) (0.3)</td>
</tr>
<tr>
<td>BC1BN</td>
<td>4.7</td>
<td>3.9</td>
<td>3.8</td>
<td>0.47</td>
<td>0.31</td>
<td>3.4</td>
<td>–</td>
<td>1.0</td>
<td>1.3</td>
<td>2.0</td>
<td>3.1</td>
<td>2.4</td>
<td>0.35</td>
<td>1.5</td>
<td>(120) (98) (96) (12) (8) (86) – (25) M35 x 1,5 (32) (52) (80) (60) (9) (0.7)</td>
</tr>
<tr>
<td>BC1BN-M</td>
<td>4.7</td>
<td>3.9</td>
<td>3.8</td>
<td>0.47</td>
<td>0.35</td>
<td>–</td>
<td>–</td>
<td>1.0</td>
<td>1.3</td>
<td>2.3</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.8</td>
<td>(120) (98) (96) (12) (9) – – (25) M40 x 1,5 (32) (58) – – – (0.8)</td>
</tr>
<tr>
<td>BC1DN</td>
<td>6.9</td>
<td>5.5</td>
<td>5.4</td>
<td>0.47</td>
<td>0.43</td>
<td>5.0</td>
<td>–</td>
<td>1.5</td>
<td>1.8</td>
<td>2.8</td>
<td>3.5</td>
<td>2.8</td>
<td>0.35</td>
<td>4.2</td>
<td>(175) (140) (138) (12) (11) (128) – (38) M50 x 1,5 (45) (70) (106) (85) (11) (2)</td>
</tr>
<tr>
<td>BC1DN-70</td>
<td>6.9</td>
<td>5.5</td>
<td>5.4</td>
<td>0.47</td>
<td>0.43</td>
<td>5.0</td>
<td>–</td>
<td>1.5</td>
<td>1.8</td>
<td>2.8</td>
<td>4.2</td>
<td>3.3</td>
<td>0.43</td>
<td>4.4</td>
<td>(175) (140) (138) (12) (11) (128) – (38) M50 x 1,5 (45) (70) (106) (85) (11) (2)</td>
</tr>
<tr>
<td>BC1DN-M</td>
<td>6.9</td>
<td>5.5</td>
<td>5.4</td>
<td>0.47</td>
<td>0.43</td>
<td>–</td>
<td>–</td>
<td>1.5</td>
<td>1.8</td>
<td>2.8</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.4</td>
<td>(175) (140) (138) (12) (11) – – (38) M60 x 2 (45) (70) – – – (2)</td>
</tr>
<tr>
<td>BC1EN</td>
<td>8.4</td>
<td>6.6</td>
<td>6.2</td>
<td>0.39</td>
<td>0.51</td>
<td>6.2</td>
<td>5.1</td>
<td>2.4</td>
<td>2.8</td>
<td>3.9</td>
<td>4.8</td>
<td>4.0</td>
<td>0.43</td>
<td>11</td>
<td>(213) (168) (158) (10) (13) (158) (130) (60) M75 x 2 (72) (98) (122) (100) (11) (5)</td>
</tr>
<tr>
<td>BC1FN</td>
<td>10.6</td>
<td>8.3</td>
<td>5.1</td>
<td>0.47</td>
<td>0.63</td>
<td>5.1</td>
<td>5.9</td>
<td>2.9</td>
<td>3.5</td>
<td>4.7</td>
<td>5.9</td>
<td>4.7</td>
<td>0.51</td>
<td>23.1</td>
<td>(270) (210) (130) (12) (16) (130) (150) (74.5) M90 x 2 (90) (120) (150) (120) (13) (10.5)</td>
</tr>
<tr>
<td>BC1GN</td>
<td>13.3</td>
<td>10.1</td>
<td>5.7</td>
<td>0.55</td>
<td>0.75</td>
<td>5.7</td>
<td>13.8</td>
<td>3.5</td>
<td>4.3</td>
<td>5.7</td>
<td>6.9</td>
<td>5.6</td>
<td>0.70</td>
<td>37.5</td>
<td>(337) (257) (145) (14) (19) (145) (350) (90) M110 x 2 (110) (145) (175) (143) (18) (17)</td>
</tr>
</tbody>
</table>

**Technical Data**

<table>
<thead>
<tr>
<th>Model</th>
<th>Return Force Rdymax</th>
<th>Shock Force Max</th>
<th>Energy Capacity Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC1ZN</td>
<td>885 lbs. (0,47 kN)</td>
<td>211 kN (12)</td>
<td>1,213 kN (0,94)</td>
</tr>
<tr>
<td>BC1BN</td>
<td>3,806 lbs. (1,77 kN)</td>
<td>562 kN (22)</td>
<td>3,147 kN (2,5)</td>
</tr>
<tr>
<td>BC1DN</td>
<td>13,276 lbs. (6,12 kN)</td>
<td>1,169 kN (35)</td>
<td>6,295 kN (5,2)</td>
</tr>
<tr>
<td>BC1EN</td>
<td>30,093 lbs. (13,6 kN)</td>
<td>1,753 kN (45)</td>
<td>9,666 kN (7,8)</td>
</tr>
<tr>
<td>BC1FN</td>
<td>61,955 lbs. (27,7 kN)</td>
<td>3,057 kN (60)</td>
<td>17,220 kN (13,6)</td>
</tr>
<tr>
<td>BC1GN</td>
<td>123,910 lbs. (54,6 kN)</td>
<td>4,271 kN (80)</td>
<td>29,225 kN (19,0)</td>
</tr>
</tbody>
</table>

**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.
Sizing Example

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 - Selection Chart

2 - Energy Calculation

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

3 - Allowable Impact Velocity

\[ IF < 20 \times \frac{En}{E} \text{ Impacts/hour} \]

4 - Effective (Actual) Stroke Calculation

\[ Ce = C \left( \frac{E}{En (0.03 V + 0.24)^{+1.36 - 1.17}} \right) \]

\[ Ce = 49 \text{ mm} \]

5 - Calculation of Effective Reaction Force Rdy_e

\[ Rdy_e = \left[ \frac{Rdymax - Rdy_0}{C} \times Ce + Rdy_0 \right] (0.1V + 0.8) \]

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 \[ IF < 20x\frac{E}{74.8} = 29 \]

\[ 25 < 29 \]

4. Effective (Actual) Stroke:

\[ Ce = \left[ \frac{15 \times 90}{0.03 \times 0.8 + 0.24} \right] (0.1 \times 0.8 + 0.8) \]

\[ Ce = 49 \text{ mm} \]

5. Effective Reaction Force:

\[ Rdy_e = 122 \text{ kN} \]

6. Compare standards to results:

<table>
<thead>
<tr>
<th>BC1FN APPLICATION</th>
<th>E (kJ)</th>
<th>C (mm)</th>
<th>Rdymax (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.8</td>
<td>49</td>
<td>122</td>
</tr>
</tbody>
</table>

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

#### BC5A Series

**BC5A-105**
- L1: 16.3 in (415 mm)
- L2: 10.8 in (275 mm)
- L3: 5.5 in (140 mm)
- L4: 0.79 in (20 mm)
- L5: 1.2 in (30 mm)
- L6: 0.59 in (15 mm)
- L7: 5.3 in (135 mm)
- L8: 4.1 in (105 mm)
- D1: 4.6 in (116 mm)
- D2: 4.6 in (116 mm)
- D3: 3.4 in (87 mm)
- D4: 4.7 in (120 mm)
- Weight: 0.55 lbs (25 kg)

**Impact Speed:** BC5 Series shock absorbers are designed for impact velocities of up to 4 m/sec. Higher impact velocities require custom modifications.

#### BC5B Series

**BC5B-130**
- L1: 19.7 in (500 mm)
- L2: 12.8 in (325 mm)
- L3: 6.9 in (175 mm)
- L4: 1.0 in (25 mm)
- L5: 1.3 in (33 mm)
- L6: 1.2 in (30 mm)
- L7: 6.1 in (155 mm)
- L8: 4.9 in (125 mm)
- D1: 5.6 in (142 mm)
- D2: 5.6 in (142 mm)
- D3: 4.5 in (115 mm)
- D4: 5.4 in (138 mm)
- Weight: 0.55 lbs (25 kg)

**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.

#### Max Energy Capacity

**Catalog No./ Model**

<table>
<thead>
<tr>
<th>Model</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>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCSA-105</td>
<td>16.3 (415)</td>
<td>10.8 (275)</td>
<td>5.5 (140)</td>
<td>0.79 (20)</td>
<td>1.2 (30)</td>
<td>0.59 (15)</td>
<td>5.3 (135)</td>
<td>4.1 (105)</td>
<td>4.6 (116)</td>
<td>4.6 (116)</td>
<td>3.4 (87)</td>
<td>4.7 (120)</td>
<td>0.55 (25)</td>
</tr>
<tr>
<td>BCSB-130</td>
<td>19.7 (500)</td>
<td>12.8 (325)</td>
<td>6.9 (175)</td>
<td>1.0 (25)</td>
<td>1.3 (33)</td>
<td>1.2 (30)</td>
<td>6.1 (155)</td>
<td>4.9 (125)</td>
<td>5.6 (142)</td>
<td>5.6 (142)</td>
<td>4.5 (115)</td>
<td>5.4 (138)</td>
<td>0.55 (25)</td>
</tr>
</tbody>
</table>

**Impact Speed:** BC5 Series shock absorbers are designed for impact velocities of up to 4 m/sec. Higher impact velocities require custom modifications.

### Technical Data

#### Technical Data

**Catalog No./ Model**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>BCSA-105</td>
<td>221,268</td>
<td>4.1</td>
<td>31,630</td>
<td>(20)</td>
<td>(185)</td>
<td>(37,543)</td>
<td>65,691</td>
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<tr>
<td>BCSB-130</td>
<td>442,537</td>
<td>4.7</td>
<td>58,416</td>
<td>(30)</td>
<td>(130)</td>
<td>(72,827)</td>
<td>121,397</td>
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<tr>
<td>BCSA-105</td>
<td>603,836</td>
<td>5.5</td>
<td>70,827</td>
<td>(70)</td>
<td>(140)</td>
<td>(99,924)</td>
<td>157,664</td>
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<tr>
<td>BCSB-130</td>
<td>803,375</td>
<td>6.3</td>
<td>85,427</td>
<td>(100)</td>
<td>(140)</td>
<td>(105,664)</td>
<td>184,343</td>
</tr>
</tbody>
</table>

Impact Speed: BC5 Series shock absorbers are designed for impact velocities of up to 4 m/sec. Higher impact velocities require custom modifications.

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

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

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

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

5 - Application Example
   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. \[ E = \frac{1}{2} \left( \frac{1}{2} \times 1.2^2 \right) = 108 \text{ kJ} \]
   
   2. Selection BC5E-180
   
   3. Maximum allowable impact frequency is \( 15 \times \frac{150}{108} \) 21 impacts/hour. Therefore 15 impacts/hour is acceptable.

   \[ 15 < 15 \times \frac{150}{108} \]

   \[ 15 < 21 \]

   4. Effective (actual) stroke is 167 mm
   \[ C_e = 180 \times \left( \frac{108}{150 \times 0.03 \times 0.6 + 0.24^{+1.36 - 1.17}} \right) = 156 \text{ mm} \]

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

   \[ R_{dy_e} = 893 \text{ kN} < 1000 \text{ kN} \]

   6. Compare standards to results:

<table>
<thead>
<tr>
<th>BC5E-180 APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (kJ) ≤ 150 &gt; 108</td>
</tr>
<tr>
<td>IF ≤ 21 &gt; 15</td>
</tr>
<tr>
<td>C (mm) ≤ 180 &gt; 156</td>
</tr>
<tr>
<td>Rdymax (kN) ≤ 1100 &gt; 893</td>
</tr>
</tbody>
</table>

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

   All performance characteristics can be modified.
   Please advise us of your specific requirements.
XLR Series - Front Flange Mount - Fc

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Max. Energy Capacity in. lbs. (kN)</th>
<th>Stroke Extension (mm)</th>
<th>Compression (mm)</th>
<th>Rdy. No. (lbs.)</th>
<th>Rdy. No. (kN)</th>
<th>Impact Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>XLR6-150</td>
<td>61.3</td>
<td>2.3</td>
<td>2.2</td>
<td>8.2</td>
<td>7.2</td>
<td>2 m/sec</td>
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<tr>
<td>XLR12-150</td>
<td>122.6</td>
<td>4.8</td>
<td>4.0</td>
<td>16.4</td>
<td>14.8</td>
<td>4 m/sec</td>
</tr>
<tr>
<td>XLR12-200</td>
<td>183.9</td>
<td>6.3</td>
<td>5.3</td>
<td>24.6</td>
<td>22.6</td>
<td>8 m/sec</td>
</tr>
<tr>
<td>XLR25-200</td>
<td>367.8</td>
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Technical Data

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<th>L4 in. (mm)</th>
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<th>L6 in. (mm)</th>
<th>L7 in. (mm)</th>
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Jarret Shock Absorbers
XLR Series

Jarret Shock Absorbers

XLR6-150 → XLR-800 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

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

1 - Energy Calculation

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

2 - Allowable Impact Frequency (IF)

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

3 - Required Stroke Calculation

\[ Ce = C \left( \frac{E}{En (0,027 \times V + 0,22)} + 1,83 - 1,35 \right) \]

4 - Calculation of Effective Reaction \( Rdy_e \)

\[ Rdy_e = \left( \frac{Rdymax - Rdy_0}{C} \right) \times Ce + Rdy_0 \]

(0,1V + 0,8)

5 - Application Example Data:
- Effective mass = 30 t
- Effective impact speed = 2,2
- 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

\[ IF < 8 \times \frac{72,6}{350} = 11 \]

(11 impacts/hour is acceptable)

4: Effective (actual) stroke:

\[ Ce = 400 \times \left( \frac{72,6}{100 (0,027 \times 2,7 + 0,22) + 1,83 - 1,35} \right) \]

\[ Ce = 290,3 \text{ mm} \]

5: \( Rdy_e \)

\[ Rdy_e = \left( \frac{320 - 175}{400} \right) \times 290,3 + 175 (0,1 \times 2,2 + 0,8) \]

\[ Rdy_e = 285,8 \text{ kN} \]

(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>
</tr>
<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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</tbody>
</table>

Note: maximum allowed structural load is 350 kN > 290,1 kN

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

BCLR Series - Front Flange Mount - Fc

Technical Data

<table>
<thead>
<tr>
<th>Catalog No.</th>
<th>Max Force</th>
<th>Max Stroke</th>
<th>Compression</th>
<th>Extension</th>
<th>Shock Force</th>
<th>Total Shock Force</th>
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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.

For more information, visit www.enidine.com or email industrialsales@enidine.com.

Contact Information

Tel.: 1-800-852-8508
Fax: 1-716-662-0406
Jarret Shock Absorbers
BCLR Series

BCLR-100 ➞ BCLR-1000 Series

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

Sizing Example

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 x \left( \frac{274}{400 (0.027 x 2.7 + 0.22)} \right) + 1.83 - 1.35
   Ce = 587 mm
5: Rdye = 520 (0.1 x 2.7 + 0.8) = 556 kN
   (which is less than maximum allowable reaction force of 650 kN)
6. Compare standards to results:

<table>
<thead>
<tr>
<th></th>
<th>BCLR-400</th>
<th>APPLICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E (kJ)</td>
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<tr>
<td>IF</td>
<td>12</td>
<td>&gt; 10</td>
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<tr>
<td>C (mm)</td>
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</tr>
<tr>
<td>Rdymax (kN)</td>
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<td>&gt; 556</td>
</tr>
</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
Heavy Duty and Heavy Industry Applications

Typical Applications

High Speed Elevator Applications

Material Transport Crane Applications

Amusement Ride Emergency Stops
Rate Controls
ADA/DA Series

Overview

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

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

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

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

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

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

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.

---

**Overview**

**SINGLE ORIFICE RATE CONTROL**

**CONSTANT FORCE OPERATION**

**MULTIPLE ORIFICE RATE CONTROL**

**CONSTANT FORCE OPERATION**

**Compression and Tension**

Endine Rate Control

Typical Application: Print Rollers and Paper Tensioners
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 Settings section for the selected model to determine the proper adjustment setting.
   B. For non-adjustable rate control models, refer to the Damping Constant Selection Instructions for the selected model to determine the proper damping constant.

Example:
1. Damping Direction (T, C or T and C): T and C
   Stroke (S): 4 in. (102 mm)
   Propelling Force (Fp): 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 (1 808 Nm/hr) compression
   16,000 in-lbs./hr (1 808 Nm/hr) tension
   32,000 in-lbs./hr (3 616 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 Range Curves.
Adjustment Techniques

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. (4,448 N) (tension), 1,625 lbs. (7,228 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 1/2 (tension), 1/2 (compression)

2. Adjustment setting: 1/2 (tension), 1/2 (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.
Rate Controls
ADA/DA Series

Typical Applications

Assembly Applications

Automotive Manufacturing Applications

Printing Presses
<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Damping Direction</th>
<th>Bore Size in. (mm)</th>
<th>Stroke Extension in. (mm)</th>
<th>Max. Preparing Force Extension lbs. (N)</th>
<th>Compression lbs. (N)</th>
<th>Max. In.-lbs./hr. Ave. (Nm/hr.)</th>
<th>Model Weight Lbs. (Kg)</th>
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<td>(1,335)</td>
<td>(118,600)</td>
<td>(0.445)</td>
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<tr>
<td>ADA 520</td>
<td>T, C or T and C</td>
<td>.63 (16,0)</td>
<td>450 (2068)</td>
<td>300 (1,335)</td>
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<td>(16,0)</td>
<td>(50,0)</td>
<td>(2,000)</td>
<td>(1,335)</td>
<td>(141,250)</td>
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<td>450 (2068)</td>
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<td>(16,0)</td>
<td>(50,0)</td>
<td>(2,000)</td>
<td>(563)</td>
<td>(163,850)</td>
<td>(0.590)</td>
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</table>
Rate Controls
ADA Series

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Damping Direction</th>
<th>Bore Size in. (mm)</th>
<th>Stroke in. (mm)</th>
<th>(C) Max. Propelling Force</th>
<th>Tension Max in./lbs./hr (Nm/hr)</th>
<th>Compression Max in./lbs./hr (Nm/hr)</th>
<th>Max Weight (Kgs)</th>
<th>A (in.)</th>
<th>B (in.)</th>
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<tbody>
<tr>
<td>ADA 705</td>
<td>T, C or T and C</td>
<td>1.25</td>
<td>2</td>
<td>3,500</td>
<td>3,500</td>
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<td>10</td>
<td>8.5</td>
<td>2.5</td>
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<td>ADA 710</td>
<td>T, C or T and C</td>
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<td>4</td>
<td>3,500</td>
<td>3,500</td>
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<td>6</td>
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<td>11.0</td>
<td>8.5</td>
<td>2.5</td>
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<tr>
<td>ADA 720</td>
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<td>3,500</td>
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<td>11.5</td>
<td>8.5</td>
<td>2.5</td>
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<tr>
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<td>T, C or T and C</td>
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<td>10</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>12.0</td>
<td>8.5</td>
<td>2.5</td>
</tr>
<tr>
<td>ADA 730</td>
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<td>1.25</td>
<td>12</td>
<td>3,500</td>
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<td>12.5</td>
<td>8.5</td>
<td>2.5</td>
</tr>
<tr>
<td>ADA 735</td>
<td>T, C or T and C</td>
<td>1.25</td>
<td>14</td>
<td>3,500</td>
<td>3,500</td>
<td>3,500</td>
<td>13.0</td>
<td>8.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Notes:
1. The maximum weight capacity for mounting option A is 5,000 lbs.
2. The maximum weight capacity for mounting option B is 10,000 lbs.

Rate Controls
ADA Series Technical Data

---

Left column:
- **Catalog No./Model**: ADA 705 → ADA 735 Series
- **Damping**: Compression, Tension
- **Bore Size**: 1.25” (32 mm)
- **Stroke**: Varies

Middle column:
- **Tension Max**: 3,500 lbs./hr (Nm/hr)
- **Compression Max**: 3,500 lbs./hr (Nm/hr)
- **Max Weight**: 10 lbs.

Right column:
- **A**: 8.5 inches
- **B**: 2.5 inches

---

Diagram:
- Tension and Compression adjustment locations
- Stroke measurement
- Bore size specification

---

**Note**: The maximum weight capacity for mounting option A is 5,000 lbs. and for option B is 10,000 lbs.
### Rate Controls

#### ADA Series

**Technical Data**

<table>
<thead>
<tr>
<th>Catalog No./Model</th>
<th>Damping Device</th>
<th>Bore Size in. (mm)</th>
<th>(C) Stroke in.</th>
<th>(g) Max. Propelling Force</th>
<th>(g-C) Max. in.-lbs./hr (N)</th>
<th>Model Weight lbs. (Kg)</th>
<th>A in. (mm)</th>
<th>B in. (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADA 740</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>16</td>
<td>1,500</td>
<td>3,500,000</td>
<td>8.6</td>
<td>37.30</td>
<td>21.10</td>
</tr>
<tr>
<td>ADA 745</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>20</td>
<td>1,500</td>
<td>3,900,000</td>
<td>9.3</td>
<td>41.30</td>
<td>23.10</td>
</tr>
<tr>
<td>ADA 750</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>24</td>
<td>1,500</td>
<td>4,200,000</td>
<td>9.9</td>
<td>45.30</td>
<td>25.10</td>
</tr>
<tr>
<td>ADA 755</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>28</td>
<td>1,500</td>
<td>4,600,000</td>
<td>10.6</td>
<td>49.35</td>
<td>27.10</td>
</tr>
<tr>
<td>ADA 760</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>32</td>
<td>1,500</td>
<td>4,900,000</td>
<td>11.5</td>
<td>53.35</td>
<td>29.10</td>
</tr>
<tr>
<td>ADA 765</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>36</td>
<td>1,500</td>
<td>5,300,000</td>
<td>12.1</td>
<td>57.35</td>
<td>31.10</td>
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<tr>
<td>ADA 770</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>40</td>
<td>1,500</td>
<td>5,600,000</td>
<td>12.8</td>
<td>61.30</td>
<td>33.10</td>
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<tr>
<td>ADA 775</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>44</td>
<td>1,500</td>
<td>6,000,000</td>
<td>13.4</td>
<td>65.30</td>
<td>35.10</td>
</tr>
<tr>
<td>ADA 780</td>
<td>T, C or T and C</td>
<td>.98</td>
<td>48</td>
<td>1,500</td>
<td>6,300,000</td>
<td>14.3</td>
<td>69.35</td>
<td>37.10</td>
</tr>
</tbody>
</table>

**Notes:**
1. The maximum load capacity for mounting option for K and D is 650 lbs. (2950 N).
2. The maximum load capacity for mounting option for K and D is 1,600 N.

---

**ADA 740 → ADA 780 Series**

**Compression Adjustment Location**

- Ø.55 (Ø14)

**Tension Adjustment Location**

- Ø.69 (Ø18)

---

**Rate Controls**

**ADA Series**

---

**Contact Information**

[www.enidine.com](http://www.enidine.com)  Email: industrialsales@enidine.com  Tel.: 1-800-852-8508  Fax: 1-716-662-0406
## Rate Controls

### ADA Series

**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.

---

**Catalog**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
<th>LA in. (mm)</th>
<th>Weight oz. (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAC4975</td>
<td>Remote Adjustment Cable</td>
<td>48 (1220)</td>
<td>7 (191)</td>
</tr>
<tr>
<td>RAC4957</td>
<td>Adjustable Cartridge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAC “a”</td>
<td>Non-Adjustable Cartridge (0-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW4957</td>
<td>Cartridge Wrench</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FF4957</td>
<td>Free Flow Plug</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Notes**

- Remote adjustment cable can be used in a single position only.
- Standard remote adjustment cable length is 48" (1220 mm). Optional lengths available upon request.
- Remote adjustment cable can be used in place of adjustable cartridge.
- Provides least amount of damping force for ADA Models.

---

### Technical Data

**Rate Controls DA Series**

**Rate Controls**

**DA 705 → DA 720 Series**

**DA 75M x 50 → DA 75M x 100 Series**

---

**Catalog No./ Model | Damping Direction | Bore Size in. (mm) | Stroke in. (S) | (F D) (E T) (E TC) | Max. Propelling Force lbs. (N) | Max. In. lbs.-cycle (Nm/cycle) | Max. In. lbs.-cycle (Nm/hr) | Model Weight lbs. (Kg) | Model Weight lbs (Kg)**
---

| DA 705 | T, C or T and C | 1.77 (45.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 3.1 |
| DA 710 | T, C or T and C | 3.00 (76.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 4.4 |
| DA 715 | T, C or T and C | 3.00 (76.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 5.5 |
| DA 720 | T, C or T and C | 3.00 (76.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 6.6 |
| DA 75 x 2 | T, C or T and C | 3.00 (76.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 7.7 |
| DA 75M x 50 | (38.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 8.8 |
| DA 75 x 4 | T, C or T and C | 3.00 (76.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 9.9 |
| DA 75M x 100 | (38.0) | 2.06 (52.0) | 2.500 (11.000) | – | 1,100,000 (1,100,000) | 10.10 |

---

**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.

---

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Rate Controls
DA Series

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

Technical Data

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Damping Displacement</th>
<th>Bore Size (in.)</th>
<th>(S) Stroke Depth (in.)</th>
<th>(F) Max. Propelling Force (lb.)</th>
<th>(B) Max. Inc. lbs./cycle (lbs./cycle)</th>
<th>(I) Max. Inc. lbs./min (lbs./min)</th>
<th>Model Weight (lb.)</th>
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<tr>
<td>DA 75 x 6</td>
<td>T and C</td>
<td>0.75</td>
<td>1.00</td>
<td>750</td>
<td>3.30</td>
<td>3.30</td>
<td>150</td>
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<tr>
<td>DA 75M x 100</td>
<td>T and C</td>
<td>0.75</td>
<td>1.00</td>
<td>750</td>
<td>3.30</td>
<td>3.30</td>
<td>150</td>
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<tr>
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<td>T and C</td>
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<td>1.00</td>
<td>750</td>
<td>3.30</td>
<td>3.30</td>
<td>150</td>
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<tr>
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<td>T and C</td>
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<td>1.00</td>
<td>750</td>
<td>3.30</td>
<td>3.30</td>
<td>150</td>
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<tr>
<td>TB 100 x 4</td>
<td>T and C</td>
<td>0.75</td>
<td>1.00</td>
<td>750</td>
<td>3.30</td>
<td>3.30</td>
<td>150</td>
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<tr>
<td>TB 100 x 6</td>
<td>T and C</td>
<td>0.75</td>
<td>1.00</td>
<td>750</td>
<td>3.30</td>
<td>3.30</td>
<td>150</td>
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</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.

Optimal Protective Sleeve, Tow Bar (TB) Models Only

<table>
<thead>
<tr>
<th>Catalog No./ Model</th>
<th>Bore Size (in.)</th>
<th>Damping Displacement</th>
<th>Fic. (mm)</th>
<th>Lb. (mm)</th>
<th>S (mm)</th>
<th>T (mm)</th>
<th>W (mm)</th>
<th>V (mm)</th>
<th>X (mm)</th>
<th>(S) Stroke (mm)</th>
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<tr>
<td>DA 75 x 6</td>
<td>1.50</td>
<td>T and C</td>
<td>0.75</td>
<td>15.0</td>
<td>75</td>
<td>3.30</td>
<td>2.00</td>
<td>1.580</td>
<td>0.75</td>
<td>1.58</td>
</tr>
<tr>
<td>DA 75M x 100</td>
<td>1.50</td>
<td>T and C</td>
<td>0.75</td>
<td>15.0</td>
<td>75</td>
<td>3.30</td>
<td>2.00</td>
<td>1.580</td>
<td>0.75</td>
<td>1.58</td>
</tr>
<tr>
<td>DA 75M x 150</td>
<td>1.50</td>
<td>T and C</td>
<td>0.75</td>
<td>15.0</td>
<td>75</td>
<td>3.30</td>
<td>2.00</td>
<td>1.580</td>
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<tr>
<td>DA 75M x 250</td>
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<td>2.00</td>
<td>1.580</td>
<td>0.75</td>
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</tr>
<tr>
<td>TB 100 x 4</td>
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<td>T and C</td>
<td>0.75</td>
<td>15.0</td>
<td>75</td>
<td>3.30</td>
<td>2.00</td>
<td>1.580</td>
<td>0.75</td>
<td>1.58</td>
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<tr>
<td>TB 100 x 6</td>
<td>1.50</td>
<td>T and C</td>
<td>0.75</td>
<td>15.0</td>
<td>75</td>
<td>3.30</td>
<td>2.00</td>
<td>1.580</td>
<td>0.75</td>
<td>1.58</td>
</tr>
</tbody>
</table>

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

**APPLICATION DESCRIPTION**

Motion Direction (Check One):
- Horizontal
- Vertical
- Up
- Down
- 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)

---

**GENERAL INFORMATION**

CONTACT: ____________________________
DEPT/TITLE: ____________________________
COMPANY: ____________________________
ADDRESS: ____________________________
TEL: __________________ FAX: __________________
EMAIL: __________________
PRODUCTS MANUFACTURED: ____________________________

---

**APPLICATION SKETCHES / NOTES**

---

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.)

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107 www.enidine.com Email: industrialsales@enidine.com Tel.: 1-800-852-8508 Fax: 1-716-662-0406
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 Manufactures (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 Cabinets
- Sub-Sea Equipment
- Medical Equipment

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