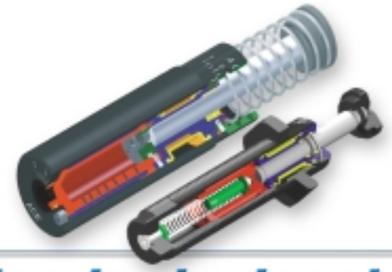
ACE Controls
Industrial Shock Absorber Designs



Self-Compensating Design

ACE Controls self-compensating shock absorbers are fixed, multi-orifice units that decelerate moving weights smoothly regardless of changing conditions, and require no adjustment. These versatile performers offer wide effective weight ranges for handling a wider range of applications and increased velocities.

As a moving load impacts the shock absorber the piston travels through the stroke and forces hydraulic fluid through the multi-orifice inner tube. The total orifice area decreases at a rate consistent with the decay of impact velocity, resulting in true linear deceleration.

The versatile SC² Series offers soft contact in combination with self-compensating performance. Soft contact is suggested when a low initial reaction force is recognized at impact. The self-compensating feature is utilized to obtain maximum energy absorption capability.

Award Winning Magnum Group

Adjustable Design

The standard adjustable ACE shock absorber is based on the multiple-orifice design principle and includes a series of orifices machined along the length of a fixed inner tube. The Magnum Group adjustable shock absorber, shown to the right, has a stationary metering tube, with an inner tube that rotates upon adjustment. These unique models offer dual adjustability by turning the stop collar or the hex socket adjuster at the rear.

The adjustable shock absorber offers flexibility in application design and selection procedure. When an effective weight change is required, one simply adjusts the setting. The total orifice area changes, providing true linear deceleration.

Adjustable models offer a wide range of effective weight. One model is capable of handling numerous applications.

World leader in deceleration technology

For over 37 years ACE Controls has provided superior industrial deceleration products to meet the needs of the automotive, steel, machine tool, lumber, theme park, medical, and other industries. Industrial shock absorber innovations include: the adjustable and self-compensating models, as well as the more recent award winning SC² Heavyweight Series which elevated shock absorber effective weight capacity and energy absorption capability to new heights. In 1999 ACE introduced the ultimate in shock absorber design...the award winning Magnum Group, offering up to 390% of the effective weight capacity, plus up to 150% of the energy per cycle of standard models.

Lifetime Warranty

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

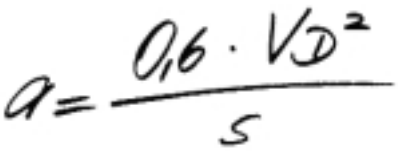
Award Winning SC² Heavyweight Series

SC² Heavyweight Design

The revolutionary, award-winning SC² Heavyweight design offers up to 950% of the effective weight capacity and up to 280% of the energy absorption capability of standard models. These durable units combine the piston and inner tube into a single component, *the piston tube*, which acts as both the pressure creating and pressure controlling device. The Heavyweight Series offers a full effective weight range for a wider range of applications.

2 General Information

page



Industrial Shock Absorbers

Safety Shock Absorbers

Velocity and Feed Controllers

Media, Catalogs and Distributors

Virtually all manufacturing processes involve movement of some kind. In production machinery this can involve linear transfers, rotary index motions, fast feeds etc. At some point these motions change direction or come to a stop.

Any moving object possesses kinetic energy as a result of its motion. When the object changes direction or is brought to rest, the dissipation of this kinetic energy can result in destructive shock forces within the structural and operating parts of the machine.

Kinetic energy increases as an exponential function of velocity. The heavier the object, or the faster it travels, the more energy it has. An increase in production rates is only possible by dissipating this kinetic energy smoothly and thereby eliminating destructive deceleration forces.

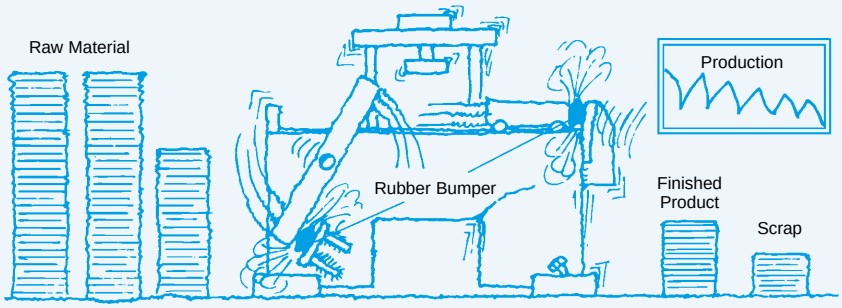
Older methods of energy absorption such as rubber buffers, springs, hydraulic dashpots and cylinder cushions do not provide this required smooth deceleration characteristic – they are non linear and produce high peak forces at some point during their stroke.

The optimum solution is achieved by an **ACE industrial shock absorber**. This utilizes a series of metering orifices spaced throughout its stroke length and provides a **constant linear deceleration** with the lowest possible reaction force in the shortest stopping time.

ACE Controlled Linear Deceleration

ACE Wine Drop Display Property
An ACE shock absorber decelerates a free-falling 100 lb (45 kg) weight so effectively that the contents of the glass don't even spill.

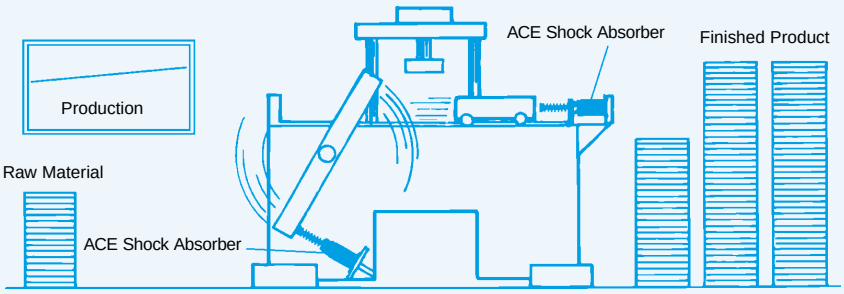
Stopping with Rubber Bumpers, Springs, Dashpots or Cylinder cushions



Result:

- Loss of Production
- Machine Damage
- Increased Maintenance Costs
- Increased Operating Noise
- Higher Machine Construction Costs

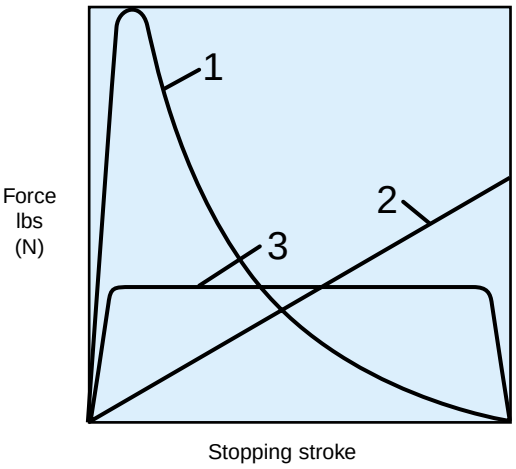
Stopping with ACE Shock Absorbers



Benefits:

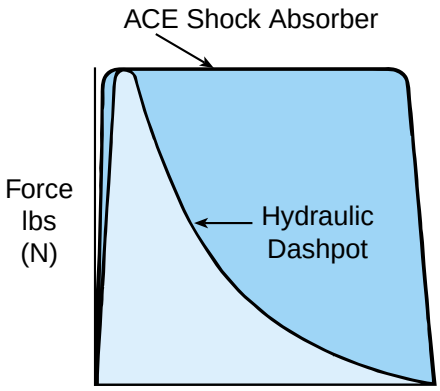
- Increased Production
- Increased Operating Life of the Machine
- Improved Machine Efficiency
- Reduced Construction Costs of the Machine
- Reduced Maintenance Costs
- Reduced Noise Pollution
- Reduced Energy Costs

Comparison



1. **Cylinder Cushions and Dashpots (High stopping force at start of the stroke).**
   With only one metering orifice the moving load is abruptly slowed down at the start of the stroke. The braking force rises to a very high peak at the start of the stroke (giving high shock loads) and then falls away rapidly.
2. **Springs and Rubber Bumpers (High stopping forces at end of stroke).**
   The moving load is slowed down by a constantly rising reaction force up to the point of full compression. These devices store energy rather than dissipate it, which causes the load bounce back.
3. **ACE Industrial Shock Absorbers (Uniform stopping force through the entire stroke).** The moving load is smoothly and gently brought to rest by a constant resisting force throughout the entire shock absorber stroke.The load is decelerated with the lowest possible force in the shortest possible time eliminating damaging force peaks and shock damage to machines and equipment. This is a linear deceleration force stroke curve and is the curve provided by ACE industrial shock absorbers.

Energy Capacity

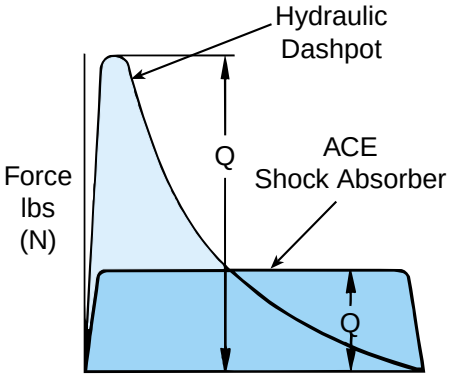


Premise:
Same maximum reaction force.

Result:
The ACE shock absorber can absorb considerably more energy (represented by the area under the curve.)

Benefit:
By installing an ACE shock absorber production rates can be more than doubled without increasing deceleration forces or reaction forces on the machine.

Reaction Force
(stopping force)

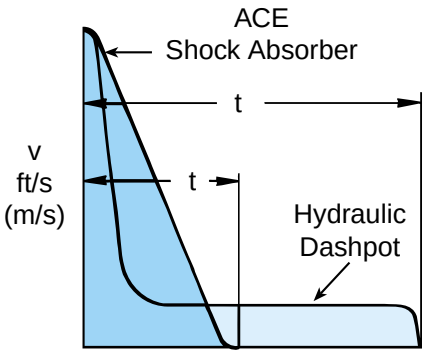


Premise:
Same energy absorption (area under the curve).

Result:
The reaction force transmitted by the ACE shock absorber is very much lower.

Benefit:
By installing the ACE shock absorber the machine wear and maintenance can be drastically reduced.

Stopping Time



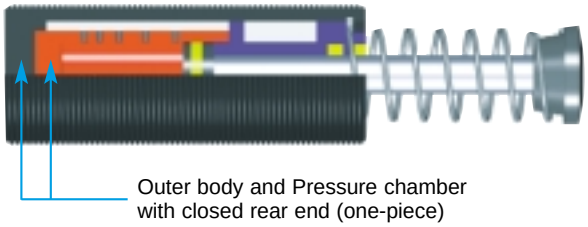
Premise:
Same energy absorption.

Result:
The ACE shock absorber stops the moving load in a much shorter time.

Benefit:
By installing an ACE shock absorber cycle times are reduced giving much higher production rates.

ACE pioneered the use of one piece / closed end bodies and inner pressure chambers in its range of shock absorbers. This design concept provides an extremely strong construction which can withstand much higher internal pressures and overload forces without mechanical damage. Consider what happens if the shock absorber is accidentally overloaded or in the unlikely event of partial oil loss due to excessive seal wear or damage. Compare the internal design used by ACE with that of some of its competitors:

ACE Shock Absorber

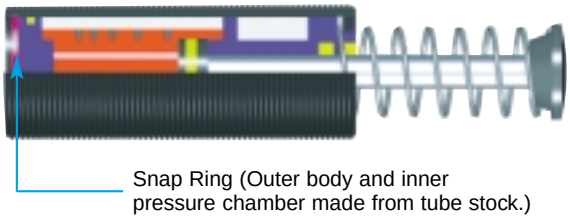


ACE builds its shock absorbers with closed end / one piece bodies and inner pressure chambers which greatly reduces the chance of sudden failure or machine damage in the event of an overload.

What happens with an overload or gradual oil loss?
Harder bottoming out force becomes apparent.
The shock absorber continues to work and can be replaced then or at the end of the shift.

Corrective Action:
Remove and replace the shock absorber. Refill with fresh oil or repair.

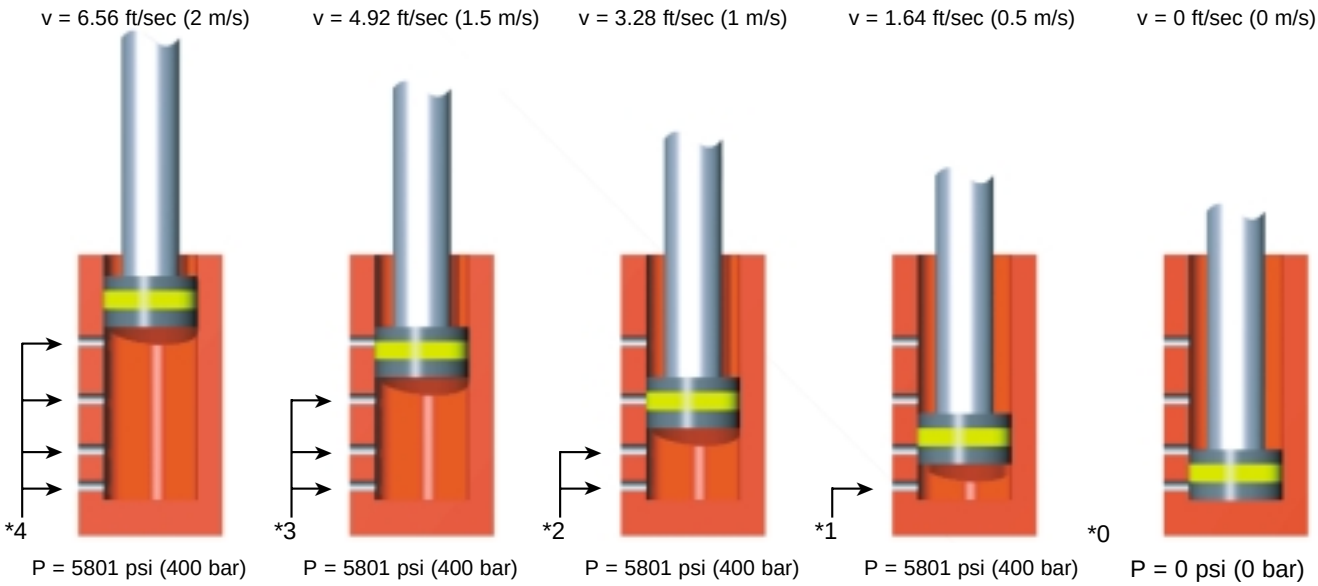
Other Shock Absorber



Some other manufacturers use bodies and inner pressure chambers made from tube stock.The internal parts are held in by a snap ring etc. which then takes all the load and can fail suddenly and catastrophically.

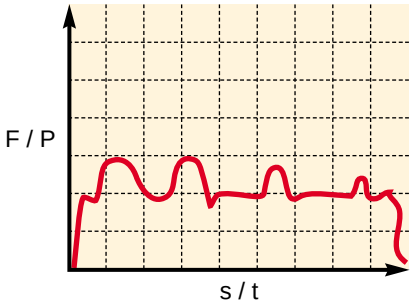
What happens with an overload or gradual oil loss?
The snap ring breaks or is extruded due to excessive force.
Machine damage!! Equipment Stops!!
Production Halted!! Emergency Repair!!

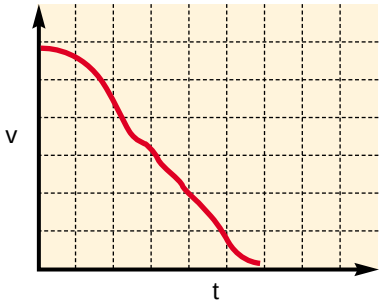
Corrective Action:
Remove and replace the shock absorber with new one (repair not possible).



* As a moving load impacts the shock absorber, the piston travels through stroke and forces hydraulic fluid through the multi-orifice inner tube. The total orifice area decreases at a rate consistent with the decay of impact velocity, resulting in true linear deceleration.

F = Force lbs (N)
P = Internal pressure psi (bar)
s = Stroke in (m)
t = Deceleration time (s)
v = Velocity ft/s (m/s)





Effective weight is an important factor in selecting shock absorbers. A shock absorber “sees” the impact of an object in terms of weight and velocity only; it does not ”see” any propelling force. The effective weight can be thought of as the weight that the shock absorber “sees” on impact. Effective weight includes the effect of the propelling force on the performance of the shock absorber.

Failing to consider the effective weight may result in improper selection and poor performance of the shock absorber. Under extreme conditions, an effective weight that is too low may result in high forces at the start of stroke (high on-set force). However, an effective weight that is too high for the shock absorber may cause high forces at the end of stroke (high set-down force).

Consider the following examples:

1.) A 5 lb (2.27 kg) weight travelling at 25 ft/sec (7.62 m/s) has 625 lbs (71 Nm) of kinetic energy (figure A). On this basis alone, a MA 3325 would be selected. However, because there is no propelling force, the calculated effective weight is five pounds – which is below the effective weight range of the standard MA 3325. This is a high on-set force at the start of the stroke (Figure B). The solution is to use a specially-orificed shock absorber to handle the load.

2.) A weight of 50 lbs (22.68 kg) has an impact velocity of 0.5 ft/sec (0.15 m/s) with a propelling force of 800 lbs (111N) (Figure C). The total impact energy is 802.5 inch-pounds. Again, a MA 3325 would be selected based just on the energy. The effective weight is calculated to be 16,050 pounds (7,280 kg). This is well above the range of the standard MA 3325. If this shock absorber is used, high-set-down forces will result (Figure D). In this case, the solution is to use a ML 3325, which is designed to work in low-velocity, high-effective weight applications.

Computer-Aided Simulation

By combining application data with a shock absorbers design parameters, ACE engineers can create a picture of how the shock will perform when impacted by the application load. Peak reaction force, peak deceleration (G’s), time through stroke, and velocity decay are identified with extreme accuracy. The user benefits by having the guesswork taken out of sizing decisions and by knowing before installation how his shock problem will be solved.

Simulation is also used to maximize the performance of ACE adjustable models by predicting the ideal adjustment setting for a particular group of conditions.

By using simulation software during product development stages, ACE has maximized the performance of its entire line of deceleration devices for over two decades.

Figure A

Figure B

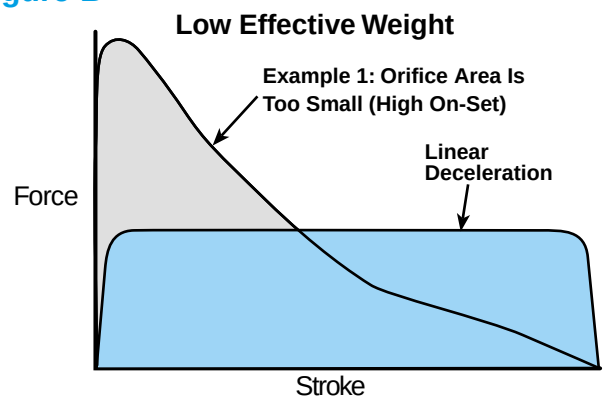


Figure C

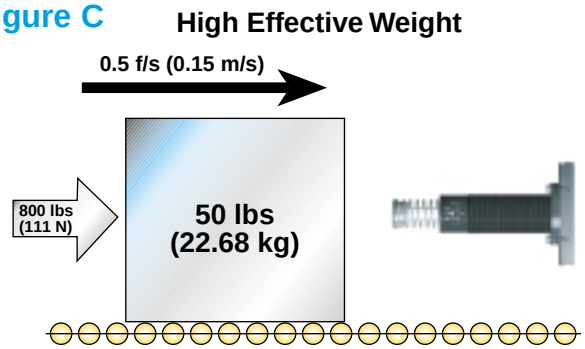
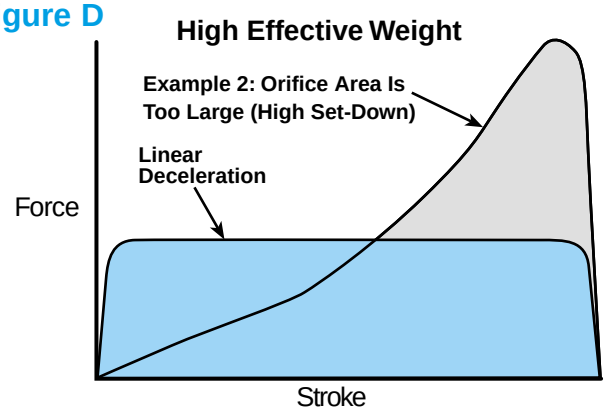


Figure D



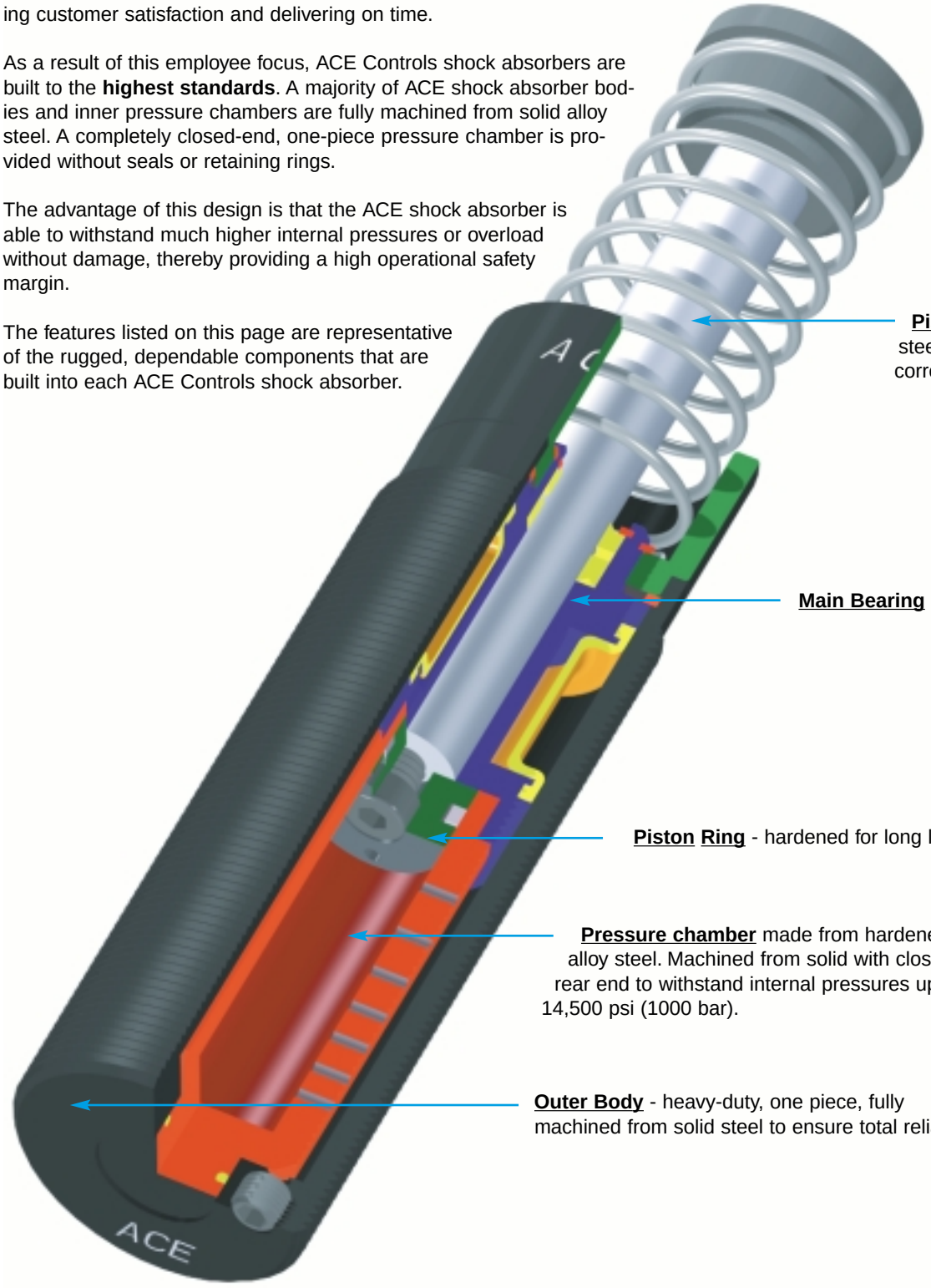
ACE Controls has not only established a reputation as the world leader in deceleration technology, but in quality as well. **ACE was awarded ISO 9001 quality status in 1994.**

The employees of ACE Controls are dedicated to building a quality product, assuring customer satisfaction and delivering on time.

As a result of this employee focus, ACE Controls shock absorbers are built to the **highest standards**. A majority of ACE shock absorber bodies and inner pressure chambers are fully machined from solid alloy steel. A completely closed-end, one-piece pressure chamber is provided without seals or retaining rings.

The advantage of this design is that the ACE shock absorber is able to withstand much higher internal pressures or overload without damage, thereby providing a high operational safety margin.

The features listed on this page are representative of the rugged, dependable components that are built into each ACE Controls shock absorber.



Piston Rod high tensile steel hardened and corrosion resistant.

Main Bearing - system lubricated

Piston Ring - hardened for long life

Pressure chamber made from hardened alloy steel. Machined from solid with closed rear end to withstand internal pressures up to 14,500 psi (1000 bar).

Outer Body - heavy-duty, one piece, fully machined from solid steel to ensure total reliability.

Self-Compensating Shock Absorbers

In cases where non-adjustability is beneficial but the features of an adjustable shock absorber are required, self-compensating shocks meet both needs. With a range of effective weight, a self-compensating shock absorber will provide acceptable deceleration under changing energy conditions.

The orifice profile, designed by a computer that constantly arranges the size and location of each orifice while inputting changing effective weights, neutralizes the effect of changing fluid coefficients, weight, velocity, temperature and fluid compressibility.

Figure A
A linear decelerator by definition decelerates a moving weight at a linear or constant rate of deceleration. The adjustable shock absorber is able to provide linear deceleration when operated within its energy capacity and effective weight range by dialing in the required orifice area. The resulting force-stroke curve (Figure A) shows optimum (lowest) stopping force.

Figure B
Figure B shows the force-stroke of a self-compensating shock absorber stopping a weight at the low end of its effective weight range. Note how the reaction forces are no longer constant but are still acceptable. The curve is skewed slightly higher at the beginning of the stroke and dips lower at the end.

Figure C
Figure C is a force-stroke curve of the same self-compensating shock absorber in Figure B but at the high end of its effective weight range. The energy curve is now skewed upward at the end of stroke and still yields acceptable deceleration.

Figure D
Figure D is a family of force-stroke curves:

a. Adjustable shock absorber properly tuned, or hydro shock perfectly matched.

b. Self-compensating shock absorber at the low end of its effective weight range.

c. Self-compensating shock absorber at the high end of its effective weight range.

d. Adjustable closed down, or hydro shock not matched (dashpot effect).

Figure A

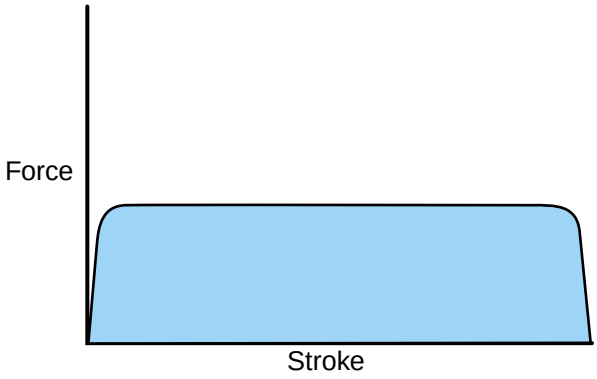


Figure B

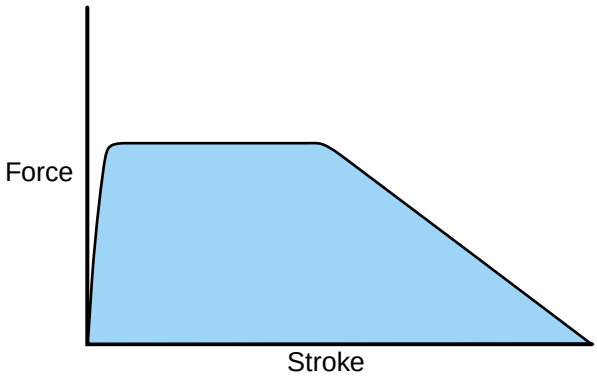


Figure C

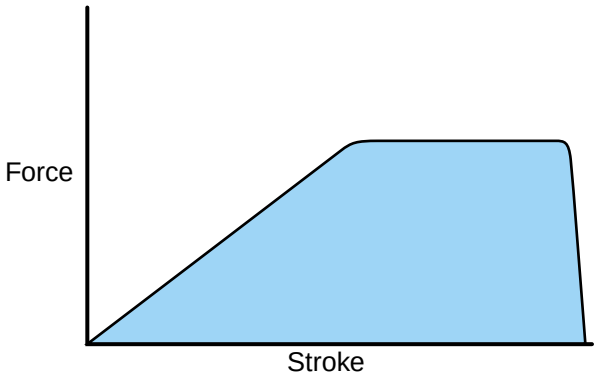
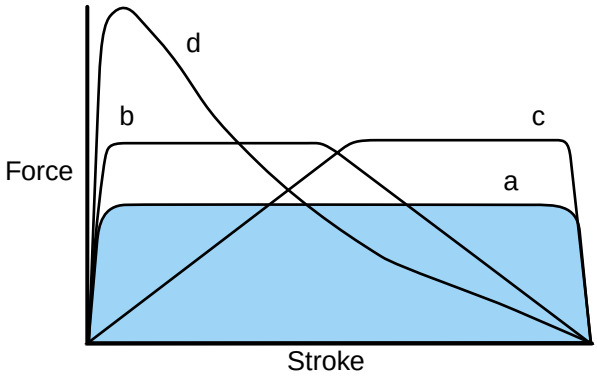


Figure D



ACE Controls offers industrial and safety shock absorber CAD Files for downloading from the ACE web site at www.acecontrols.com. The CAD File software is titled interfACE. ACE's Windows-based sizing software, ACESIZE, is also available for downloading. Both software packages, along with the CAD Files are also available on a CD-ROM. See page 73 for additional information.

The shock absorber selection procedure below has been made available for customers who prefer to select without the aid of computer-related technology.

To select the best shock absorber for your application, follow these steps:

1. Determine how the object will hit the shock absorber: horizontal motion, inclined or vertical motion, or rotary motion.

2. Use the example pages in this catalog to find the closest match to your application. Horizontal application examples are illustrated on page 10; inclined and vertical examples, page 11; and rotary examples, pages 12 and 13.

3. Select a stroke length from the Model Rating Charts on (pages 18 and 19). If you are uncertain what stroke length is most desirable for your application, use the weight of the object as a guide. For weights under 500 pounds, use a 1-inch stroke; for weights over 500 pounds, use a 2-inch stroke.

4. Use the equations shown to determine energy per cycle (E_3), energy per hour (E_4) and effective weight (We).

5. Refer to the Model Rating Charts on pages 18 and 19. Compare your step 4 results with the values in the Model Rating Charts columns 3, 4 and 5. A suitable shock absorber must have greater energy per cycle (column 3) and energy per hour (column 5) values than the results you calculated. For best results, keep E_3 between 20 and 80 percent of the energy per cycle. In addition, your calculated effective weight must lie within the shock absorber's range (column 4). Select a suitable shock absorber from the charts on pages 18 and 19.

6. Check the stroke in column 2.
   - If it matches the stroke in your calculation, the shock absorber you have selected can handle your application. Column 6 provides the page number where you will find further product information.
   - If the stroke does not match, proceed to step 7.

7. If a 1-inch stroke was originally chosen, replace it with a 2-inch stroke and return to step 4. If a 2-inch stroke was originally chosen, specify a 1-inch stroke and return to step 4.

   If you have unsuccessfully tried both the 1-inch and 2-inch stroke calculations, check the energy per cycle on your calculation sheet. If the energy per cycle is less than 225 inch-pounds when using a 1-inch stroke, your application is probably in the range of ACE's smallest shock absorbers. Study the Model Rating Chart between the MC 9 and the MC 225 H2 self-compensating models, or between the MA 35 and MA 225 adjustable models. Select a shock absorber that is close to the calculated energy per cycle, energy per hour and effective weight. Use the stroke in column 2, and return to step 4.

   If you have tried both 1-inch and 2-inch stroke, and the calculated energy per cycle is over 12,000 inch-pounds when using the 2-inch stroke, consider using a larger shock absorber. Study the Model Rating Chart list between MC 64100-1 and the CA 4 X 16-7 self-compensating models, or between the MA 64100 and A 3 X 12 adjustable models. Select a shock absorber that is close to the calculated energy per cycle, energy per hour and effective weight. Remember that in most cases E_3 will increase as the stroke increases. Use the stroke in column 2, and return to step 4.

8. If you are still unable to select a shock absorber and the impact velocity is below 1.5 feet/second, consider specifying an ML Series model. Using your calculations based on a 1-inch and 2-inch stroke, repeat step 5, this time using the ML chart on page 19. Be sure that the impact velocity is between .05 and 1.5 feet/second (0.01 and 0.46 m/sec.).

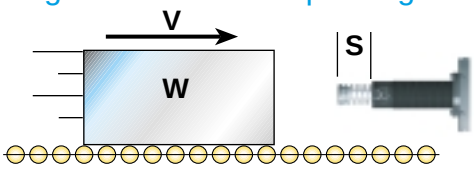
9. If you are uncertain of the proper shock absorber for your application, contact ACE's Applications Department at 800-521-3320.

NOTE: When using more than one shock absorber on an application, divide the quantity of shock absorbers into: We, E_3 and E_4.

W	=	Moving Weight	(lbs)	Hp	=	Motor Power	(horsepower)	E_1	=	Kinetic Energy	(in lbs)
V	=	Impact Velocity	(ft/sec)	Mu	=	Coefficient of Friction		E_2	=	Propelling Force Energy	(in lbs)
Fp	=	Known Propelling Force	(lbs)	C	=	Cycles per Hour	(/hour)	E_3	=	Energy per Cycle	(in lbs)
B	=	Propelling Cylinder Bore	(inches)	s	=	Stroke Length of Shock Absorber	(inches)	E_4	=	Energy per hour	(in lbs/hour)
R	=	Propelling Cylinder Rod	(inches)	F	=	Propelling Force at Shock Absorber	(lbs)	We	=	Effective Weight	(lbs)
P	=	Air Pressure	(psi)								

H1 Weight with No Propelling Force

Examples: Crash Testers, Emergency Stops



FORMULA

$E_1 = (0.186) \bullet (W) \bullet (V^2)$
$E_2 = (F) \bullet (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \bullet (C)$
$We = E_3 / (0.186) \bullet (V^2)$

EXAMPLE

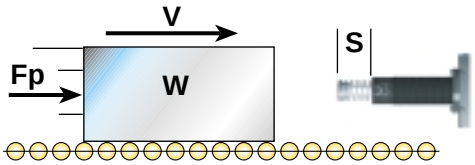
W = 500 lbs
V = 3 ft/sec
Fp = 0
C = 500/hour

$E_1 = (0.186) \bullet (500) \bullet (3^2) = 837$ in lbs
$E_2 = (0) \bullet (1) = 0$ in lbs
$E_3 = 900 + 0 = 837$ in lbs
$E_4 = (837) \bullet (500) = 418{,}500$ in lbs/h
$We = 837 / (0.186) \bullet (3^2) = 500$ lbs

H1 - Select from Model Rating Chart: MC 3325-3 or MA 3325

H2 Weight with Propelling Force

Transfer Devices, Safety Doors, Cutting Shears



$F = Fp$
$E_1 = (0.186) \bullet (W) \bullet (V^2)$
$E_2 = (F) \bullet (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \bullet (C)$
$We = E_3 / (0.186) \bullet (V^2)$

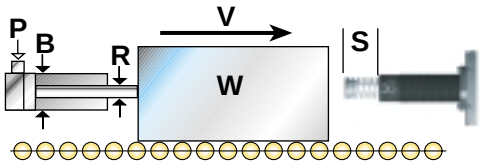
W = 14 lbs
V = 2.2 ft/sec
Fp = 30 lbs
C = 100/hour
s = 0.4 inches

$F = 30 = 30$ lbs
$E_1 = (0.186) \bullet (14) \bullet (2.2^2) = 12.6$ in lbs
$E_2 = (30) \bullet (0.4) = 12$ in lbs
$E_3 = 12.6 + 12 = 24.6$ in lbs
$E_4 = (24.6) \bullet (100) = 2{,}460$ in lbs/h
$We = 24.6 / (0.186) \bullet (2.2^2) = 27.3$ lbs

H2 - Select from Model Rating Chart: MC 75-3

H3 Weight with Propelling Cylinder

Pick-and Place Units, Linear Slides, Robotics



Note: R = 0 when using a rodless cylinder or a cylinder working in extension.

$F = 0.785 \bullet (B^2 - R^2) \bullet (P)$
$E_1 = (0.186) \bullet (W) \bullet (V^2)$
$E_2 = (F) \bullet (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \bullet (C)$
$We = E_3 / (0.186) \bullet (V^2)$

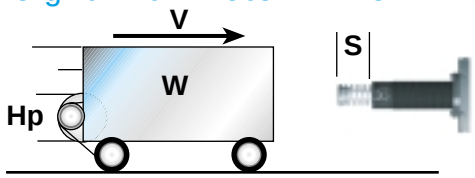
W = 120 lbs
V = 2 ft/sec
B = 1.5 inches
R = 0 inches
P = 60 psi
C = 60/hour
s = 0.75 inches

$F = 0.785 \bullet (1.5^2 - 0^2) \bullet 60 = 106$ lbs
$E_1 = (0.186) \bullet (120) \bullet (2^2) = 89.3$ in lbs
$E_2 = (106) \bullet (0.75) = 79.5$ in lbs
$E_3 = 89.3 + 79.5 = 168.8$ in lbs
$E_4 = (168.8) \bullet (60) = 10{,}128$ in lbs/h
$We = 168.8 / (0.186) \bullet (2^2) = 226.9$ lbs

H3 - Select from Model Rating Chart: MA 225 or SC 300-4

H4 Weight with Motor Drive

Lift Trucks, Stacker Units, Overhead Cranes



$F = (550) \bullet (ST) \bullet (Hp) / V$
$E_1 = (0.186) \bullet (W) \bullet (V^2)$
$E_2 = (F) \bullet (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \bullet (C)$
$We = E_3 / (0.186) \bullet (V^2)$

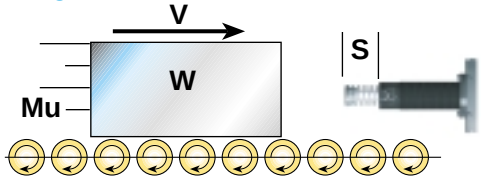
W = 2,100 lbs
V = 1 ft/sec
Hp = 2 hp
ST = 2.5
C = 20/hour
s = 2 inches

$F = (550) \bullet (2.5) \bullet (2) / 1 = 2{,}750$ lbs
$E_1 = (0.186) \bullet (2{,}100) \bullet (1^2) = 390.6$ in lbs
$E_2 = (2{,}750) \bullet (2) = 5{,}500$ in lbs
$E_3 = 390.6 + 5{,}500 = 5{,}890.6$ in lbs
$E_4 = (5{,}890.6) \bullet (20) = 117{,}812$ in lbs/h
$We = 5{,}890.6 / (0.186) \bullet (1^2) = 31{,}670$ lbs

H4 - Select from Model Rating Chart: ML 6450 or MC 6450-4

H5 Weight on Power Rollers/Conveyor

Pallet Line, Friction Conveyor Belt, Steel Tube Transfer



$F = (W) \bullet (Mu)$
$E_1 = (0.186) \bullet (W) \bullet (V^2)$
$E_2 = (F) \bullet (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \bullet (C)$
$We = E_3 / (0.186) \bullet (V^2)$

W = 250 lbs
V = 2.5 ft/sec
Mu = 0.2
C = 180/hour
s = 1 inches

$F = (250) \bullet (0.2) = 50$ lbs
$E_1 = (0.186) \bullet (250) \bullet (2.5^2) = 290.6$ in lbs
$E_2 = (50) \bullet (1) = 50$ in lbs
$E_3 = 290.6 + 50 = 340.6$ in lbs
$E_4 = (340.6) \bullet (180) = 61{,}308$ in lbs/h
$We = 340.6 / (0.186) \bullet (2.5^2) = 293$ lbs

H5 - Select from Model Rating Chart: MA 600 or SC 650-3

W =	Moving Weight	(lbs)	A =	Angle of Inclined Plane	(°)	E_1 =	Kinetic Energy	(in lbs)
V =	Impact Velocity	(ft/sec)	Wcw =	Counter Weight	(lbs)	E_2 =	Propelling Force Energy	(in lbs)
Fp =	Known Propelling Force	(lbs)	C =	Cycles per Hour	(/hour)	E_3 =	Energy per Cycle	(in lbs)
M =	Total Distance Moved by Weight	(inches)	s =	Stroke Length of Shock Absorber	(inches)	E_4 =	Energy per hour	(in lbs/hour)
D =	Distance Moved by Weight to Shock	(inches)	F =	Propelling Force at Shock Absorber	(lbs)	We =	Effective Weight	(lbs)

V1 Weight, Vertical Free Fall

Examples: Elevator Emergency Stops, Flying Shears, Test Equipment

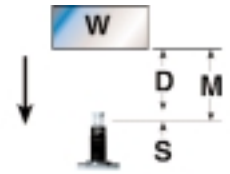
FORMULA

$D = \frac{(M) - (s)}{\sqrt{(5.4)\bullet(D)\bullet SIN(A)}}$
$V = \sqrt{(5.4)\bullet(D)\bullet SIN(A)}$
$F = (W)\bullet SIN(A)$
$E_1 = (0.186)\bullet(W)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

EXAMPLE

W = 200 lbs
M = 18 inches
C = 60/hour
s = 3 inches

$D = \frac{(18) - (3)}{\sqrt{(5.4)\bullet(15)}}$ = 15 inches
$V = \sqrt{(5.4)\bullet(15)}$ = 9 ft/sec
$F = 200$ = 200 lbs
$E_1 = (0.186)\bullet(200)\bullet(9^2)$ = 3,013.2 in lbs
$E_2 = (200)\bullet(3)$ = 600 in lbs
$E_3 = 3{,}013.2 + 600$ = 3,613.2 in lbs
$E_4 = (3{,}013.2)\bullet(60)$ = 216,792 in lbs/h
$We = 3{,}013.2 / (0.186)\bullet(9^2)$ = 239.8 lbs



V1 - Select from Model Rating Chart: MA 4575

V2 Weight Sliding Down Incline

Inclined Non-Powered Conveyor, Package Chute, Parts Transfer Ramp

$D = \frac{(M) - (s)}{\sqrt{(5.4)\bullet(D)\bullet SIN(A)}}$
$V = \sqrt{(5.4)\bullet(D)\bullet SIN(A)}$
$F = (W)\bullet SIN(A)$
$E_1 = (0.186)\bullet(W)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

W = 1,000 lbs
M = 15 inches
A = 30°
C = 190/hour
s = 2 inches

$D = \frac{(15) - (2)}{\sqrt{(5.4)\bullet(13)\bullet SIN(30)}}$ = 13 inches
$V = \sqrt{(5.4)\bullet(13)\bullet SIN(30)}$ = 5.9 ft/sec
$F = 500$ = 500 lbs
$E_1 = (0.186)\bullet(1{,}000)\bullet(5.9^2)$ = 6,474.7 in lbs
$E_2 = (500)\bullet(2)$ = 1,000 in lbs
$E_3 = 6{,}474.7 + 1{,}000$ = 7,474.7 in lbs
$E_4 = (7{,}474.7)\bullet(190)$ = 1,420,193 in lbs/h
$We = 7{,}474.7 / (0.186)\bullet(5.9^2)$ = 1,154.5 lbs

V2 - Select from Model Rating Chart: MCA 6450-1 or -2

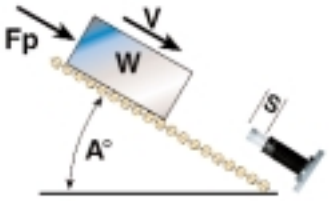
V3 Down Incline with Propelling Force

Inclined Conveyor Belt, High Speed Safety Doors

$F = (W)\bullet SIN(A)+(Fp)$
$E_1 = (0.186)\bullet(W)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

W = 100 lbs
V = 2 ft/sec
Fp = 50 lbs
A = 15°
C = 30/hour
s = 0.5 inches

$F = (100)\bullet SIN(15)+(50)$ = 75.9 lbs
$E_1 = (0.186)\bullet(100)\bullet(2^2)$ = 74.4 lbs
$E_2 = (75.9)\bullet(0.5)$ = 38 in lbs
$E_3 = 74.4 + 38$ = 112.4 in lbs
$E_4 = (112.4)\bullet(30)$ = 3,370.5 in lbs
$We = 112.4 / (0.186)\bullet(2^2)$ = 151.1 in lbs



V3 - Select from Model Rating Chart: MC 150H

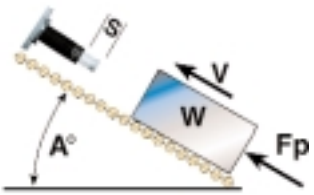
V4 Up Incline With Propelling Force

Elevator, Inclined Power Conveyor

$F = (Fp)-(W)\bullet SIN\ A$
$E_1 = (0.186)\bullet(W)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

W = 450 lbs
V = 1 ft/sec
Fp = 600 lbs
A = 90°
C = 60/hour
s = 1 inch

$F = (600)-(450)\bullet SIN(90)$ = 150 lbs
$E_1 = (0.186)\bullet(450)\bullet(1^2)$ = 83.7 in lbs
$E_2 = (150)\bullet(1)$ = 150 in lbs
$E_3 = 90 + 150$ = 234 in lbs
$E_4 = (240)\bullet(60)$ = 14,022 in lbs/h
$We = 240 / (0.2)\bullet(1^2)$ = 1,258.1 lbs



V4 - Select from Model Rating Chart: MA 600 or SC 650-4

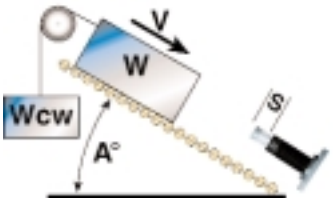
V5 Down Incline with Counter Weight

Lifting Door with Counter Balance

$F = (W)\bullet SIN\ (A)-Wcw$
$E_1 = (0.186)\bullet(W)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

W = 1,500 lbs
V = 0.5 ft/sec
A = 45°
Wcw = 500 lbs
C = 1/hour
s = 1 inch

$F = (1{,}500)\bullet SIN(45)-500$ = 560.7 lbs
$E_1 = (0.186)\bullet(1{,}500)\bullet(0.5^2)$ = 69.8 in lbs
$E_2 = (560.7)\bullet(1)$ = 560.7 in lbs
$E_3 = 69.8 + 560.7$ = 630.5 in lbs
$E_4 = (636)\bullet(1)$ = 630.5 in lbs/h
$We = 630.5 / (0.186)\bullet(0.5^2)$ = 13,559.1 lbs

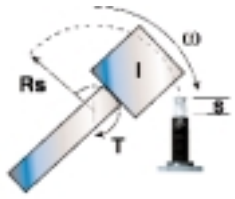


V5 - Select from Model Rating Chart: ML 3325

W	=	Moving Weight	(lbs)	T	=	Propelling Torque	(lbs-in)	C	=	Cycles per Hour	(/hour)
V	=	Impact Velocity	(ft/sec)	Rs	=	Mounting Radius of the Shock	(inches)	E_1	=	Kinetic Energy	(in lbs)
Wa	=	Apparent Weight at Shock Absorber	(lbs)	Rt	=	Radius to Edge of Turntable	(inches)	E_2	=	Propelling Force Energy	(in lbs)
ω	=	Angular Velocity	(°/sec)	s	=	Stroke length of Shock Absorber	(inches)	E_3	=	Energy per Cycle	(in lbs)
I	=	Moment of Inertia	(lb-ft-sec²)	H	=	Thickness of Object	(inches)	E_4	=	Energy per Hour	(in lbs/hour)
k	=	Radius of Gyration	(inches)	L	=	Length of Object	(inches)	We	=	Effective Weight	(lbs)

R1 Moment of Inertia, Horizontal Plane

Examples: Swing Bridges, Radar Antenna



FORMULA

$Wa = (4637 \cdot I)/Rs^2$
$V = (Rs) \cdot (\omega)/688$
$F = T/Rs$
$E_1 = (0.186) \cdot (Wa) \cdot (V^2)$
$E_2 = (F) \cdot (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \cdot (C)$
$We = E_3 / (0.186) \cdot (V^2)$

EXAMPLE

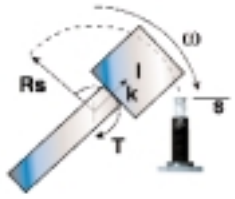
$I = 3{,}930$ lb-ft-sec²
$\omega = 172°/sec$
$T = 480{,}000$ lbs-in
$Rs = 40$ inches
$C = 30/hour$
$s = 6$ inches

$Wa = (4{,}637 \cdot 3{,}930)/(40^2) = 11{,}390$ lbs
$V = (40) \cdot (172)/688 = 10$ ft/sec
$F = 480{,}000/40 = 12{,}000$ lbs
$E_1 = (0.186) \cdot (11{,}390) \cdot (10^2) = 211{,}854$ in lbs
$E_2 = (12{,}000) \cdot (6) = 72{,}000$ in lbs
$E_3 = 211{,}854 + 72{,}000 = 283{,}854$ in lbs
$E_4 = (283{,}854) \cdot (30) = 8{,}515{,}620$ in lbs/h
$We = 283{,}854 / (0.186) \cdot (10^2) = 15{,}260.9$ lbs

R1 - Select from Model Rating Chart: CA 4 x 6-3

R2 Radius of Gyration, Horizontal Plane

Examples: Packaging Equipment, Pick-and-Place Robots



$Wa = (W) \cdot (k^2)/(Rs^2)$
$V = (Rs) \cdot (\omega)/688$
$F = T/Rs$
$E_1 = (0.186) \cdot (Wa) \cdot (V^2)$
$E_2 = (F) \cdot (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \cdot (C)$
$We = E_3 / (0.186) \cdot (V^2)$

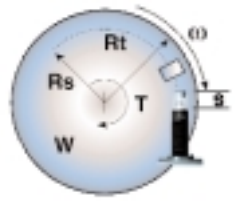
$W = 300$ lbs
$k = 2.5$ inches
$\omega = 180°/sec$
$T = 9{,}000$ lbs-in
$Rs = 25$ inches
$C = 1{,}200/hour$
$s = 1$ inches

$Wa = (300) \cdot (2.5^2))/(25^2) = 3$ lbs
$V = (25) \cdot (180)/688 = 6.54$ ft/sec
$F = 9{,}000/25 = 360$ lbs
$E_1 = (0.186) \cdot (3) \cdot (6.54^2) = 23.87$ in lbs
$E_2 = (360) \cdot (1) = 360$ in lbs
$E_3 = 23.87 + 360 = 383.87$ in lbs
$E_4 = (383.87) \cdot (1{,}200) = 460{,}644$ in lbs/h
$We = 383.87 / (0.186) \cdot (6.54^2) = 48.20$ lbs

R2 - Select from Model Rating Chart: MC 3325-1 or MA 3325

R3 Index Table

Examples: Index Table, Rotating Work Station



$Wa = (W \cdot Rt^2)/(2 \cdot Rs^2)$
$V = (Rs) \cdot (\omega)/688$
$F = T/Rs$
$E_1 = (0.186) \cdot (Wa) \cdot (V^2)$
$E_2 = (F) \cdot (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \cdot (C)$
$We = E_3 / (0.186) \cdot (V^2)$

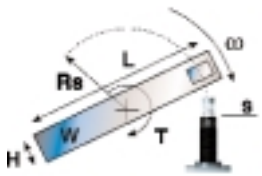
$W = 195$ lbs
$Rt = 20$ inches
$\omega = 85°/sec$
$T = 1{,}700$ lbs-in
$Rs = 15$ inches
$C = 60/hour$
$s = .75$ inches

$Wa = (195 \cdot 20^2))/(2 \cdot 15^2) = 173.3$ lbs
$V = (15) \cdot (85)/688 = 1.85$ ft/sec
$F = 1{,}700/15 = 113.3$ lbs
$E_1 = (0.186) \cdot (173.3) \cdot (1.85^2) = 110.3$ in lbs
$E_2 = (113.3) \cdot (0.75) = 85$ in lbs
$E_3 = 110.3 + 85 = 195.3$ in lbs
$E_4 = (195.3) \cdot (60) = 11{,}718$ in lbs/h
$We = 195.3 / (0.186) \cdot (1.85^2) = 306.8$ lbs

R3 - Select from Model Rating Chart: SC 300-4 or MC 225H

R4 Turnover

Examples: Roll-Over Device, Paint Booths, Crate Handling



$Wa = (W) \cdot (H^2 + L^2)/12 \cdot (Rs^2)$
$V = (Rs) \cdot (\omega)/688$
$F = T/Rs$
$E_1 = (0.186) \cdot (Wa) \cdot (V^2)$
$E_2 = (F) \cdot (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \cdot (C)$
$We = E_3 / (0.186) \cdot (V^2)$

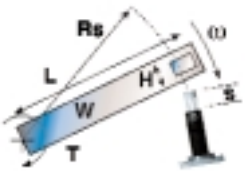
$W = 150$ lbs
$L = 38$ inches
$H = 1$ inch
$\omega = 70°/sec$
$T = 15{,}000$ lbs-in
$Rs = 12$ inches
$C = 500/hour$
$s = 1$ inches

$Wa = (150) \cdot (1^2 + 38^2))/(12 \cdot (12^2) = 125.43$ lbs
$V = (12) \cdot (70)/688 = 1.22$ ft/sec
$F = 15{,}000/12 = 1{,}250$ lbs
$E_1 = (0.186) \cdot (125.43) \cdot (1.22^2) = 34.72$ in lbs
$E_2 = (1{,}250) \cdot (1) = 1{,}250$ in lbs
$E_3 = 37.34 + 1{,}250 = 1{,}284.72$ in lbs
$E_4 = (1{,}287) \cdot (500) = 642{,}362$ in lbs/h
$We = 1{,}287 / (0.186) \cdot (1.22^2) = 4{,}640.6$ lbs

R4 - Select from Model Rating Chart: MC 4525-4 or MA 4525

R5 Uniform Bar, Horizontal Plane

Examples: Swinging Beam, Robotic Arm



$Wa = (W) \cdot (H^2 + 4 \cdot L^2)/12 \cdot (Rs^2)$
$V = (Rs) \cdot (\omega)/688$
$F = T/Rs$
$E_1 = (0.186) \cdot (Wa) \cdot (V^2)$
$E_2 = (F) \cdot (s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3) \cdot (C)$
$We = E_3 / (0.186) \cdot (V^2)$

$W = 75$ lbs
$L = 30$ inches
$H = 2$ inches
$\omega = 180°/sec$
$T = 9{,}000$ lbs-in
$Rs = 15$ inches
$C = 100/hour$
$s = 1$ inch

$Wa = (75) \cdot (2^2 + 4 \cdot 30^2)/12 \cdot (15^2) = 100.1$ lbs
$V = (15) \cdot (180)/688 = 3.92$ ft/sec
$F = 9{,}000/15 = 600$ lbs
$E_1 = (0.186) \cdot (100.1) \cdot (3.92^2) = 286.1$ in lbs
$E_2 = (600) \cdot (1) = 600$ in lbs
$E_3 = 307.64 + 600 = 886.1$ in lbs
$E_4 = (886.1) \cdot (100) = 88{,}610$ in lbs/h
$We = 886.1 / (0.186) \cdot (3.92^2) = 310$ lbs

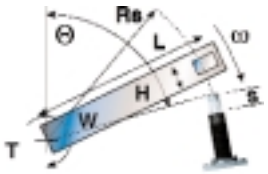
R5 - Select from Model Rating Chart: MC 4525-2 or MA 4525

W = Moving Weight	(lbs)	T = Propelling Torque	(lbs in)	E_1 = Kinetic Energy	(in lbs)
H = Thickness of Door or Arm	(inches)	Θ = Angle from the Vertical	(°)	E_2 = Propelling Force Energy	(in lbs)
L = Length of Door or Arm	(inches)	C = Cycles per Hour	(/hour)	E_3 = Energy per Cycle	(in lbs)
d = Distance from Pivot to c of g	(inches)	s = Stroke Length of Shock Absorber	(inches)	E_4 = Energy per Hour	(in lbs/hour)
Rs = Mounting Radius of Shock Absorbers	(inches)	F = Propelling Force at Shock Absorber	(lbs)	We = Effective Weight	(lbs)
ω = Rotational Speed of Weight	(°/sec)				

R6 Uniform Bar, Vertical Plane

Examples: Cross-Conveyor Transfer, Gantry Walkway

FORMULA	EXAMPLE		
$Wa = (W)•(H^2+4•L^2)/12•(Rs^2)$	W = 5 lbs	$Wa = (5)•(.25^2+4•6^2)/12•(6^2)$	= 1.7 lbs
V = (Rs)•(ω)/688	H = .25 inches	V = (6)•(360)/688	= 3.1 ft/sec
F = [T+.5•L•W•SIN(Θ)]/Rs	L = 6 inches	F = [20+.5•6•5•SIN(87.6)]/6	= 5.8 lbs
$E_1 = (0.186)•(Wa)•(V^2)$	Θ = 87.6°	$E_1 = (0.186)•(1.7)•(3.1^2)$	= 3.0 in lbs
$E_2 = (F)•(s)$	ω = 360°/sec	$E_2 = (5.8)•(.25)$	= 1.5 in lbs
$E_3 = E_1 + E_2$	T = 20 lbs-in	E_3 = 3.3 + 1.5	= 4.5 in lbs
$E_4 = (E_3)•(C)$	Rs = 6 inches	E_4 = 4.5•(1,800)	= 8,100 in lbs/h
$We = E_3 / (0.186)•(V^2)$	C = 1,800/hour	We = 4.5 / (0.186)•(3.1^2)	= 2.5 lbs
	s = .25 inches		

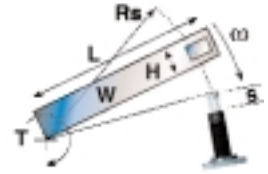


R6 - Select from Model Rating Chart: MC 25L

R7 Door, Horizontal Plane

Examples: Cabinet Doors, Machine Enclosures

$Wa = (W)•(H^2+L^2)/(3•Rs^2)$	W = 120 lbs	$Wa = (120)•(1^2+42^2)/(3•10^2)$	= 706 lbs
V = (Rs)•(ω)/688	H = 1 inch	V = (10)•(60)/688	= .9 ft/sec
F = t/Rs	L = 42 inches	F = 1,800/10	= 180 lbs
$E_1 = (0.186)•(Wa)•(V^2)$	ω = 60°/sec	$E_1 = (0.186)•(706)•(.9^2)$	= 106.4 in lbs
$E_2 = (F)•(s)$	T = 1,800 lbs-in	$E_2 = (180)•(.5)$	= 90 in lbs
$E_3 = E_1 + E_2$	Rs = 10 inches	E_3 = 106.4 + 90	= 196.4 in lbs
$E_4 = (E_3)•(C)$	C = 4/hour	$E_4 = (196.4)•(4)$	= 785 in lbs/h
$We = E_3 / (0.186)•(V^2)$	s = .5 inches	We = 196.4 / (0.186)•($.9^2$)	= 1,303.6 lbs

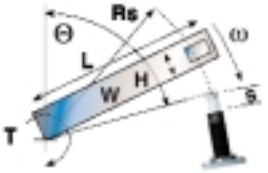


R7 - Select from Model Rating Chart: MC 225H2

R8 Door, Vertical Plane

Examples: Hatches, Lids, Hoods

$Wa = (W)•(H^2+L^2)/(3•Rs^2)$	W = 60 lbs	$Wa = (60)•(1^2+10^2)/(3•10^2)$	= 20.2 lbs
V = (Rs)•(ω)/688	H = 1 inch	V = (10)•(200)/688	= 2.9 ft/sec
F* = [T+.5•L•W•SIN(Θ)]/Rs	L = 10 inches	F = [45+.5•10•60•SIN(150)]/10	= 19.5 lbs
$E_1 = (0.186)•(Wa)•(V^2)$	Θ = 150°	$E_1 = (0.186)•(20.2)•(2.9^2)$	= 31.6 in lbs
$E_2 = (F)•(s)$	ω = 200°/sec	E_2 = (19.5)•(0.63)	= 12.3 in lbs
$E_3 = E_1 + E_2$	T = 45 lbs-in	E_3 = 34 + 12.3	= 43.9 in lbs
$E_4 = (E_3)•(C)$	Rs = 10 inches	E_4 = (43.9)•(1,900)	= 83,382 in lbs/h
$We = E_3 / (0.186)•(V^2)$	C = 1,900/hour	We = 43.9 / (0.186)•(2.9^2)	= 28.1 lbs
*Force is approximate	s = .63 inches		

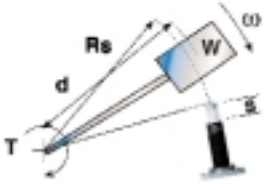


R8 - Select from Model Rating Chart: SC 190-2

R9 Weight at Radius, Horizontal Plane

Examples: Circuit Breakers, Swinging Gates

$Wa = (W)•(d^2)/(Rs^2)$	W = 40 lbs	$Wa = (40)•(8^2)/(7^2)$	= 52 lbs
V = (Rs)•(ω)/688	d = 8 inches	V = (7)•(110)/688	= 1.1 ft/sec
F = T/Rs	ω = 110°/sec	F = 150/7	= 21 lbs
$E_1 = (0.186)•(Wa)•(V^2)$	T = 150 lbs-in	$E_1 = (0.186)•(52)•(1.1^2)$	= 11.7 in lbs
$E_2 = (F)•(s)$	Rs = 7 inches	E_2 = (21)•(.5)	= 10.5 in lbs
$E_3 = E_1 + E_2$	C = 1,500/hour	E_3 = 11.7 + 10.5	= 22.2 in lbs
$E_4 = (E_3)•(C)$	s = .5 inches	E_4 = (22.2)•(1,500)	= 33,300 in lbs/h
$We = E_3 / (0.186)•(V^2)$		We = 22.2 / (0.186)•(1.1^2)	= 98.6 lbs

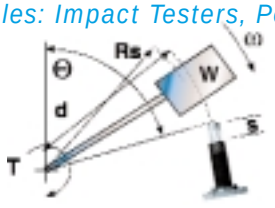


R9 - Select from Model Rating Chart: MA 35

R10 Weight at Radius, Vertical Plane

Examples: Impact Testers, Pendulums

$Wa = (W)•(d^2)/(Rs^2)$	W = 40 lbs	$Wa = (40)•(8^2)/(7^2)$	= 52 lbs
V = (Rs)•(ω)/688	d = 8 inches	V = (7)•(110)/688	= 1.1 ft/sec
F* = [T+W•d•SIN(Θ)]/Rs	Θ = 90°	F = [150+40•8•SIN(90)]/7	= 67 lbs
$E_1 = (0.186)•(Wa)•(V^2)$	ω = 110°/sec	$E_1 = (0.186)•(52)•(1.1^2)$	= 11.7 in lbs
$E_2 = (F)•(s)$	T = 150 lbs-in	E_2 = (67)•(.5)	= 33.5 in lbs
$E_3 = E_1 + E_2$	Rs = 7 inches	E_3 = 11.7 + 33.5	= 45.2 in lbs
$E_4 = (E_3)•(C)$	C = 1,500/hour	E_4 = (45.2)•(1,500)	= 67,800 in lbs/h
$We = E_3 / (0.186)•(V^2)$	s = .5 inches	We = 45.2 / (1.1^2)	= 200.8 lbs
*Force is approximate			

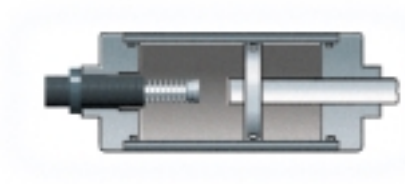


R10 - Select from Model Rating Chart: MC 150H

1 Ace Shock Absorbers for Pneumatic Cylinders

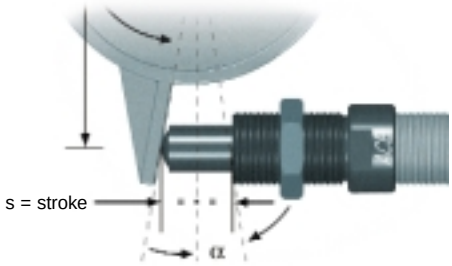
For: • optimum deceleration
• higher speeds
• smaller cylinders
• reduced air consumption
• smaller valves and pipework

Example: MA 3350 M-Z
-Z = cylinder mounting



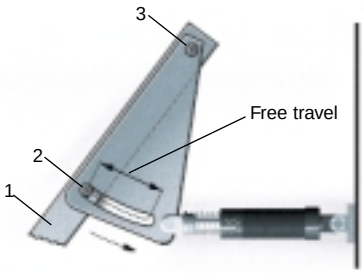
With heavy loads or high velocities normal cylinder cushions are often overloaded. This causes shock loading leading to premature cylinder failure or excessive maintenance. Using oversized cylinders to withstand this shock loading is not the best solution since this considerably increases air consumption and costs.

2 Side Load Adapter for High Side Load Angles



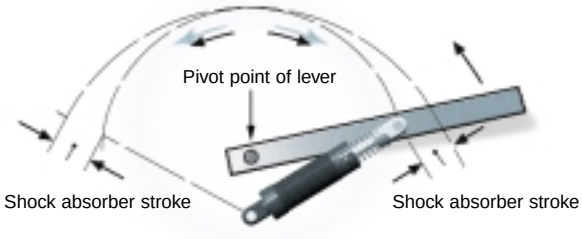
The side loading is removed from the shock absorber piston rod leading to considerably longer life. Wherever possible mount shock absorber so that impacting face is perpendicular to shock absorber axis half way through stroke.
See pages 32 and 33 for more details.

3 Undamped Free Travel with Damped End Extension



The lever 1 swings with the pin 2 in a slotted hole around pivot point 3. The lever is smoothly decelerated at the extreme end of its travel.

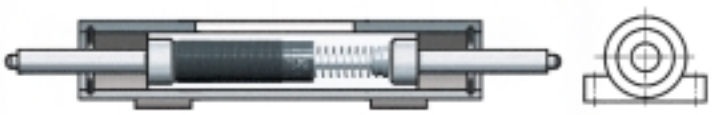
4 One Shock Absorber for Both Ends of Travel



It is possible to use only one shock absorber for both end positions by using different pivot points as shown.

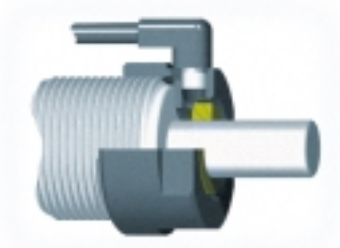
Tip: Leave approx. 0.06 in (1.5 mm) of shock absorber stroke free at each end of travel.

5 Double Acting Shock Absorber



With a little additional work a normal unidirectional shock absorber can be converted to work in 2 directions by using a mechanism as shown.

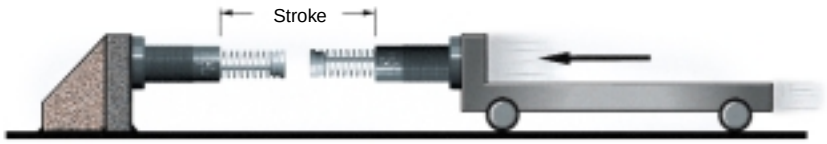
6 Air Bleed Collar



By using this air bleed collar the operating lifetime of shock absorbers in aggressive environments can be considerably increased. The adapter protects the shock absorber seals from cutting fluids, cleaning agents, cooking oils etc. by using a low pressure air bleed.

Available for VC and VCL feed controls and select shock absorbers.

7 Double Stroke Length



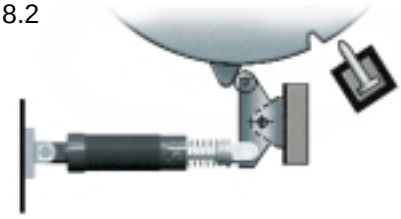
50 % lower reaction force (Q) 50 % lower deceleration (a)

By driving 2 shock absorbers against one another 'nose-to-nose', the effective stroke length can be doubled.

8 Ride Over Latch

8.1

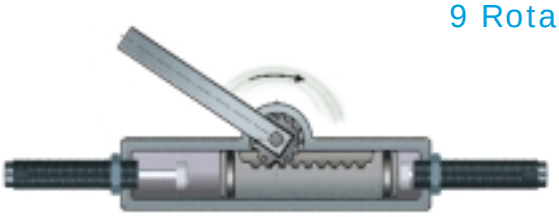
8.2



8.1 The latch absorbs the kinetic energy so that the object contacts the fixed stop gently.

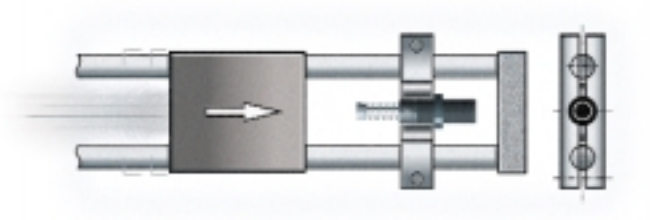
8.2 The latch absorbs the rotational energy of the turntable etc. The turntable can then be held in the datum position with a lock bolt or similar device.

9 Rotary Actuator or Rack and Pinion Drive



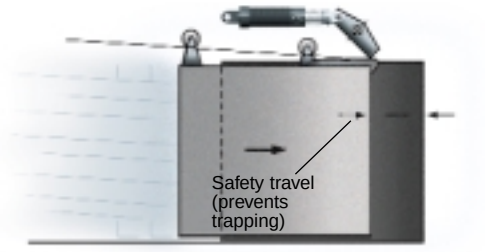
The use of ACE shock absorbers allows higher operating speeds and weights as well as protecting the drive mechanism and housing from shock loads.

10 Adjustable Stop Clamp e.g. for Handling Equipment



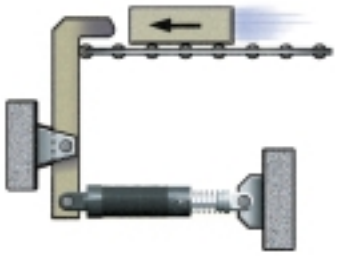
The gentle deceleration of ACE shock absorbers makes the use of adjustable stop clamps possible and removes any chance of the clamp slipping. The kinetic energy is completely removed before the mechanical stop is reached thus making high index speeds possible.

11 Ride-Over Latch e.g. Fire Door



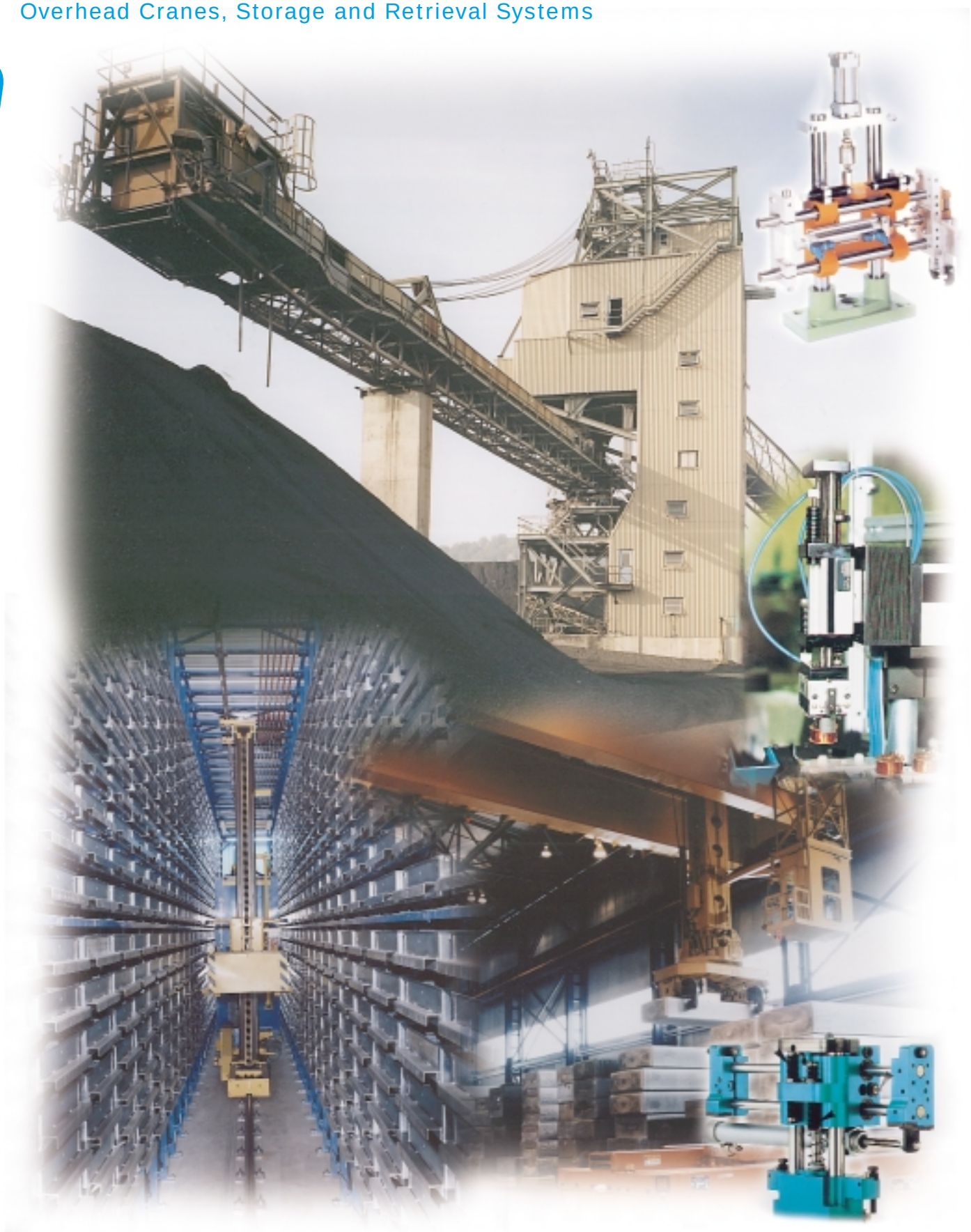
The fire door travels quickly until it reaches the lever. It is then gently decelerated by the lever mounted shock absorber and closes without shock or danger to personnel.

12 Increasing Stroke Length Mechanically

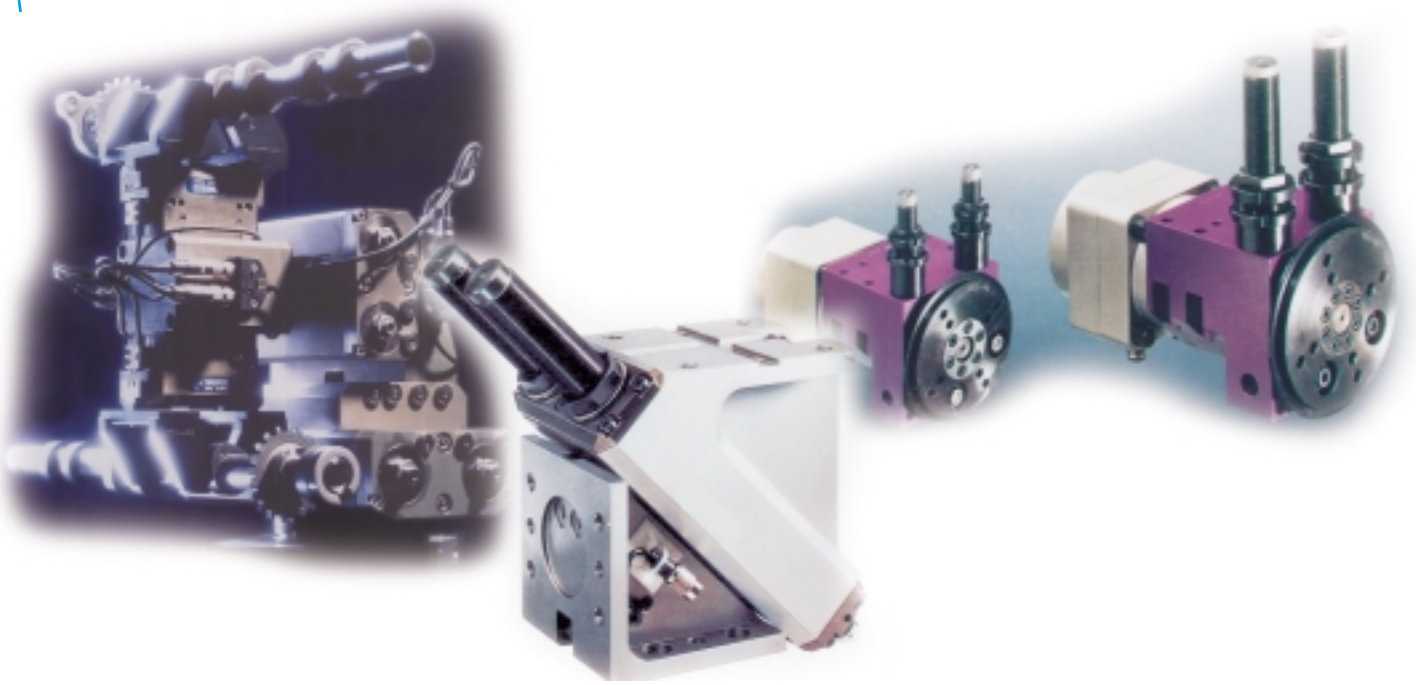


By means of a lever the effective stroke length can be increased and mounting space to the left reduced.

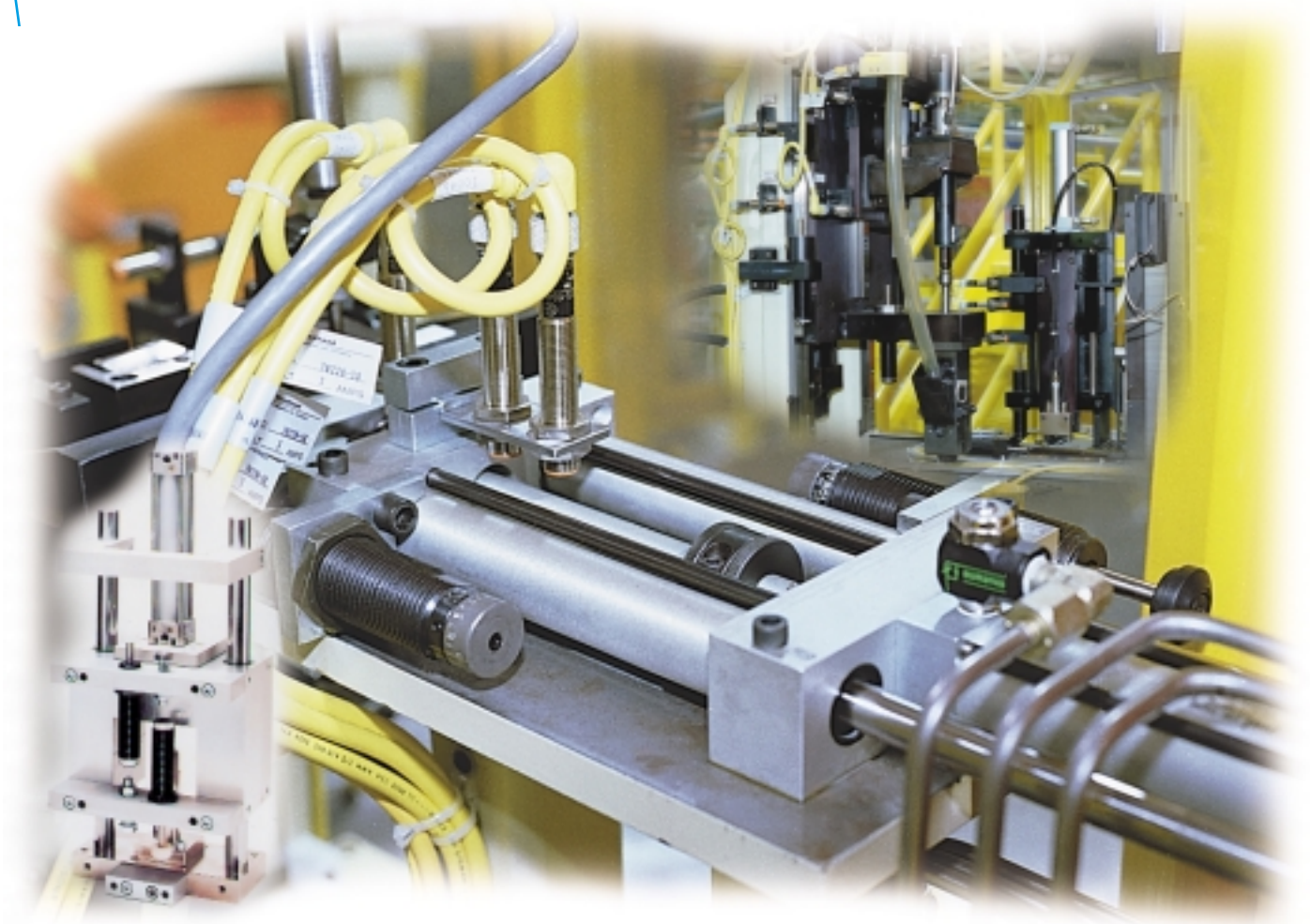
As System Components in Integrated Handling Equipment, Overhead Cranes, Storage and Retrieval Systems



Pneumatic Rotary Actuators with Integral Shock Absorbers



Slide Units



Industrial Shock Absorbers are rated by capacity for the purpose of selecting the proper unit for an application's energy requirements. Ratings are determined by the effective weight that the shock absorber can stop and the energy it can absorb per cycle and per hour. These ratings relate to the mechanical and thermal capacity of a shock absorber because the mechanical energy is converted to heat and dissipated.

Self-Compensating Models

Model Number	Stroke inches 1 inch = 25.4 mm	E3 Max Energy per Cycle, inch lbs 1 in lb = .11 Nm	We Effective Weight lbs, 1 lb = .45 kg	E4 Max Energy per hour, in lbs/hour 1 in lb/hour = .11 Nm/hour Self-Contained	A/O Tank	A/O Re-circulating	Product Catalog Page
MC 9-1	0.20	9	1.35-7.0	18,000			21
MC 9-2	0.20	9	1.75-9.0	18,000			21
MC 10 L	0.20	4	0.75-6.0	35,000			21
MC 10 H	0.20	7	1.5-11	35,000			21
MC 25 L	0.25	20	1.5-5	120,000			21
MC 25	0.25	20	4-12	120,000			21
MC 25 H	0.25	20	10-30	120,000			21
MC 75-1	0.40	75	0.5-2.5	250,000			21
MC 75-2	0.40	75	2-14	250,000			21
MC 75-3	0.40	75	6-80	250,000			21
MC 150	0.50	150	2-22	300,000			23
MC 150H	0.50	150	20-200	300,000			23
MC 150H2	0.50	150	150-450	300,000			23
MC 225	0.50	225	5-55	400,000			23
MC 225H	0.50	225	50-500	400,000			23
MC 225H2	0.50	225	400-2,000	400,000			23
MC 600	1.00	600	20-300	600,000			23
MC 600H	1.00	600	250-2,500	600,000			23
MC 600H2	1.00	600	880-5,000	600,000			23
SC 190-1	0.63	225	3-15	300,000			25
SC 190-2	0.63	225	8-40	300,000			25
SC 190-3	0.63	225	20-100	300,000			25
SC 190-4	0.63	225	50-225	300,000			25
SC 300-1	0.75	300	3-18	400,000			25
SC 300-2	0.75	300	10-60	400,000			25
SC 300-3	0.75	300	30-180	400,000			25
SC 300-4	0.75	300	70-450	400,000			25
SC 300-5	0.59	650	25-100	400,000			27
SC 300-6	0.59	650	75-300	400,000			27
SC 300-7	0.59	650	200-400	400,000			27
SC 300-8	0.59	620	300-1,500	400,000			27
SC 300-9	0.59	620	700-4,300	400,000			27
SC 650-1	1.00	650	17-100	600,000			25
SC 650-2	1.00	650	50-300	600,000			25
SC 650-3	1.00	650	150-900	600,000			25
SC 650-4	1.00	650	450-2,600	600,000			25
SC 650-5	0.91	1,860	50-250	600,000			27
SC 650-6	0.91	1,860	200-800	600,000			27
SC 650-7	0.91	1,860	700-2,400	600,000			27
SC 650-8	0.91	1,860	1,700-5,800	600,000			27
SC 650-9	0.91	1,860	4,000-14,000	600,000			27
SC 925-1	1.58	975	30-200	800,000			25
SC 925-2	1.58	975	90-600	800,000			25
SC 925-3	1.58	975	250-1,600	800,000			25
SC 925-4	1.58	975	750-4,600	800,000			25
MC 3325-1 MC 3325-2 MC 3325-3 MC 3325-4	0.91	1,350	20-80 68-272 230-920 780-3,120	670,000	1,100,000	1,500,000	37
MC 3350-1 MC 3350-2 MC 3350-3 MC 3350-4	1.91	2,700	40-160 136-544 460-1,840 1,560-6,240	760,000	1,200,000	1,600,000	37
MC 3625-1 MC 3625-2 MC 3625-3 MC 3625-4	0.91	1,350	20-80 68-272 230-920 780-3,120	670,000	1,100,000	1,500,000	37
MC 3650-1 MC 3650-2 MC 3650-3 MC 3650-4	1.91	2,700	40-160 136-544 460-1,840 1,560-6,240	760,000	1,200,000	1,600,000	37
MC 4525-1 MC 4525-2 MC 4525-3 MC 4525-4	0.91	3,000	50-200 170-680 575-2,300 1,950-7,800	950,000	1,400,000	1,700,000	39
MC 4550-1 MC 4550-2 MC 4550-3 MC 4550-4	1.91	6,000	100-400 340-1,360 1,150-4,600 3,900-15,600	1,000,000	1,700,000	2,200,000	39
MC 4575-1 MC 4575-2 MC 4575-3 MC 4575-4	2.91	9,000	150-600 510-2,040 1,730-6,920 5,850-23,400	1,300,000	2,000,000	2,500,000	39
MC 6450-1 MC 6450-2 MC 6450-3 MC 6450-4	1.91	15,000	300-1,200 1,020-4,080 3,460-13,840 11,700-46,800	1,300,000	2,600,000	3,400,000	41
MC 64100-1 MC 64100-2 MC 64100-3 MC 64100-4	3.91	30,000	600-2,400 2,040-8,160 6,920-27,680 23,400-93,600	1,700,000	3,400,000	4,400,000	41
MC 64150-1 MC 64150-2 MC 64150-3 MC 64150-4	5.91	45,000	900-3,600 3,060-12,240 10,380-41,520 35,100-140,400	2,200,000	4,400,000	5,700,000	41

Self-Compensating Models Continued

Model Number	Stroke inches 1 inch = 25.4 mm	E3 Max Energy per Cycle, inch lbs 1 in lb = .11 Nm	We Effective Weight lbs, 1 lb = .45 kg	E4 Max Energy per hour, in lbs/hour 1 in lb/hour = .11 Nm/hour Self-Contained	A/O Tank	A/O Re-circulating	Product Catalog Page
CA 2x2-1 CA 2x2-2 CA 2x2-3 CA 2x2-4	2.0	32,000	1,600-4,800 4,000-12,000 10,000-30,000 25,000-75,000	9,600,000	12,000,000	15,600,000	51
CA 2x4-1 CA 2x4-2 CA 2x4-3 CA 2x4-4	4.00	64,000	3,200-9,600 8,000-24,000 20,000-60,000 50,000-150,000	12,000,000	15,000,000	19,500,000	51
CA 2x6-1 CA 2x6-2 CA 2x6-3 CA 2x6-4	6.00	96,000	4,800-14,400 12,000-36,000 30,000-90,000 75,000-225,000	14,400,000	18,000,000	23,500,000	51
CA 2x8-1 CA 2x8-2 CA 2x8-3 CA 2x8-4	8.00	128,000	6,400-19,200 16,000-48,000 40,000-120,000 100,000-300,000	16,800,000	21,000,000	27,000,000	52
CA 2x10-1 CA 2x10-2 CA 2x10-3 CA 2x10-4	10.00	160,000	8,000-24,000 20,000-60,000 50,000-150,000 125,000-375,000	19,200,000	24,000,000	31,000,000	52
CA 3x5-1 CA 3x5-2 CA 3x5-3 CA 3x5-4	5.00	125,000	6,400-19,200 16,000-48,000 40,000-120,000 100,000-300,000	20,000,000	25,000,000	32,500,000	52
CA 3x8-1 CA 3x8-2 CA 3x8-3 CA 3x8-4	8.00	200,000	10,240-30,720 25,600-76,800 64,000-192,000 160,000-480,000	32,000,000	40,000,000	52,000,000	52
CA 3x12-1 CA 3x12-2 CA 3x12-3 CA 3x12-4	12.00	300,000	15,360-46,080 38,400-115,200 96,000-288,000 240,000-720,000	48,000,000	60,000,000	78,000,000	52
4x6-3	6.00	420,000	8,000-19,000	27,000,000	45,000,000	58,000,000	55
4x6-5	6.00	420,000	19,000-41,000	27,000,000	45,000,000	58,000,000	55
4x6-7	6.00	420,000	41,000-94,000	27,000,000	45,000,000	58,000,000	55
4x8-3	8.00	560,000	11,000-25,000	30,000,000	50,000,000	65,000,000	55
4x8-5	8.00	560,000	25,000-55,000	30,000,000	50,000,000	65,000,000	55
4x8-7	8.00	560,000	55,000-125,000	30,000,000	50,000,000	65,000,000	55
4x16-3	16.00	1,120,000	22,000-50,000	50,000,000	85,000,000	110,000,000	55
4x16-5	16.00	1,120,000	50,000-110,000	50,000,000	85,000,000	110,000,000	55
4x16-7	16.00	1,120,000	110,000-250,000	50,000,000	85,000,000	110,000,000	55

Adjustable Models

MA 35	0.40	35	13-125	53,000			29
MA 150	0.50	150	2-200	300,000			29
MA 225	0.75	225	5-500	400,000			29
MA 600	1.00	600	20-3,000	600,000			29
MA 900	1.58	900	30-4,500	800,000			29
MA 3325	0.91	1,500	20-3,800	670,000	1,100,000	1,500,000	37
MA 3350	1.91	3,000	28-5,400	760,000	1,200,000	1,600,000	37
MA 3625	0.91	1,500	20-3,800	670,000	1,100,000	1,500,000	37
MA 3650	1.91	3,000	28-5,400	760,000	1,200,000	1,600,000	37
MA 4525	0.91	3,450	95-22,000	950,000	1,400,000	1,700,000	39
MA 4550	1.91	6,900	150-32,000	1,000,000	1,700,000	2,200,000	39
MA 4575	2.91	10,350	155-33,000	1,300,000	2,000,000	2,500,000	39
MA 6450	1.91	18,000	480-110,000	1,300,000	2,600,000	3,400,000	41
MA 64100	3.91	36,000	600-115,000	1,700,000	3,400,000	4,400,000	41
MA 64150	5.91	54,000	730-175,000	2,200,000	4,400,000	5,700,000	41
1-1/2x2	2.00	16,000	430-70,000	3,200,000	4,000,000	5,200,000	46
1-1/2x3-1/2	3.50	28,000	480-80,000	5,600,000	7,000,000	9,100,000	46
1-1/2x5	5.00	40,000	500-90,000	8,000,000	10,000,000	13,000,000	46
1-1/2x6-1/2	6.50	52,000	680-100,000	10,400,000	13,000,000	17,000,000	46
A 2x2	2.00	32,000	560-170,000	9,600,000	12,000,000	15,600,000	52
A 2x4	4.00	80,000	510-160,000	12,000,000	15,000,000	19,500,000	52
A 2x6	6.00	120,000	570-190,000	14,400,000	18,000,000	23,500,000	52
A 2x8	8.00	170,000	580-200,000	16,800,000	21,000,000	27,000,000	52
A 2x10	10.00	210,000	720-250,000	19,200,000	24,000,000	31,000,000	52
A 3x5	5.00	140,000	1,050-340,000	20,000,000	25,000,000	32,500,000	52
A 3x8	8.00	250,000	1,200-400,000	32,000,000	40,000,000	52,000,000	52
A 3x12	12.00	390,000	1,350-450,000	48,000,000	60,000,000	78,000,000	52

Low Velocity Adjustable Models

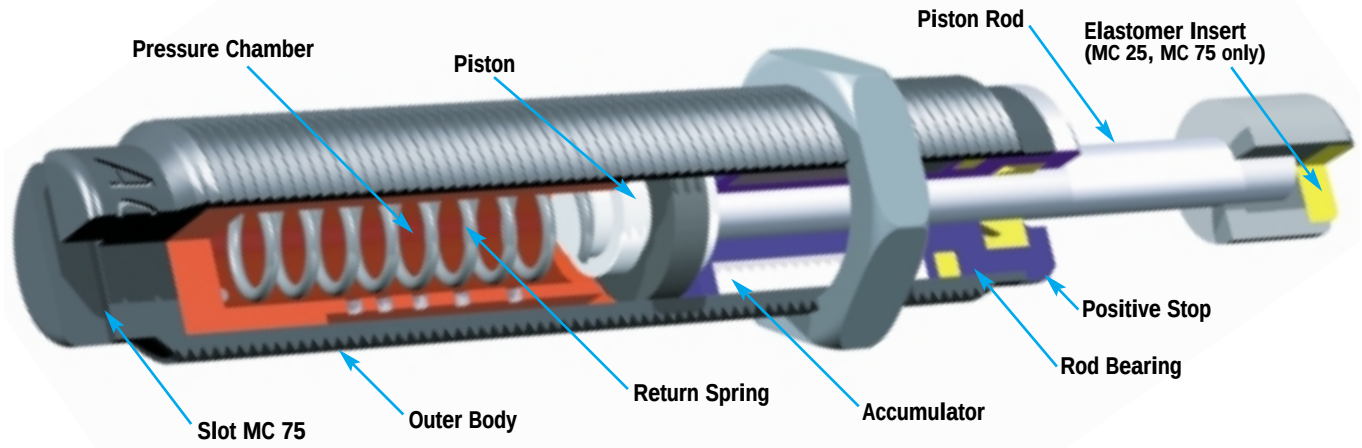
ML 3325	0.91	1,500	.05-1.5	670,000	1,100,000	1,500,000	37
ML 3350	1.91	3,000	.05-1.5	760,000	1,200,000	1,600,000	37
ML 3625	0.91	1,500	.05-1.5	670,000	1,100,000	1,500,000	37
ML 3650	1.91	3,000	.05-1.5	760,000	1,200,000	1,600,000	37
ML 4525	0.91	3,450	.05-1.5	950,000	1,400,000	1,700,000	39
ML 4550	1.91	6,900	.05-1.5	1,000,000	1,700,000	2,200,000	39
ML 6425	0.91	9,000	.05-1.5	1,100,000	2,200,000	2,900,000	41
ML 6450	1.91	18,000	.05-1.5	1,300,000	2,600,000	3,400,000	41

ACE Miniature Shock Absorbers
are self-contained hydraulic units. The MC 9 to MC 75 model range has a very short overall length and low return force. Its small size allows for high energy absorption in confined spaces, while the wide effective weight ranges accommodate a variety of load conditions. With threaded outer bodies and multiple accessories, MC models can be mounted in numerous configurations.

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

Miniature Shock Absorbers MC 9 to MC 75

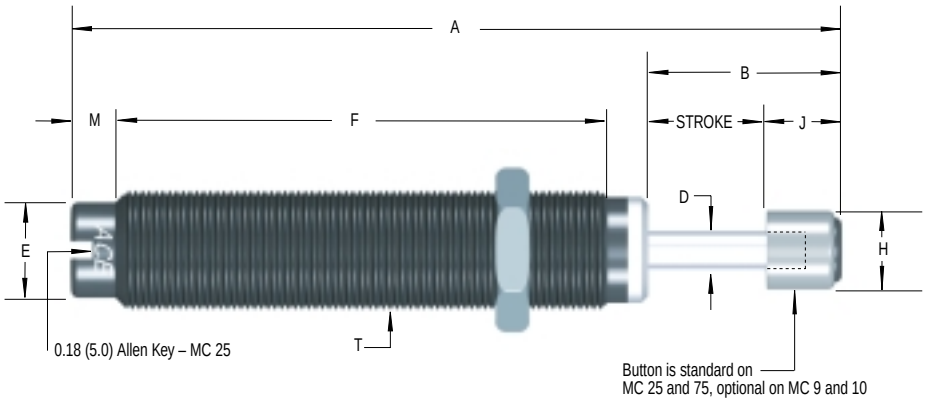
Self-Compensating



Ordering Information

MC 75 -1 __

MC Series	Model Number	Mounting Thread	Effective Weight	Button Options
	9	**MC 9**	**MC 9**	**MC 9 and 10**
	10	M M6 x 0.5 metric	-1 Light	Standard No Button
	25	**MC 10**	-2 Medium	-B Delrin Button
	75	M M8 x 1.0 metric	**MC 10**	**MC 25 and 75**
		E M8 x 0.75 metric	L Light Range	Standard with Button
		MC 25	H Heavy Range	-NB *No button, short rod
		Standard (UNEF)	**MC 25**	-880 No button, standard rod
		M Metric	L Light Range	
		MC 75	Standard Range	*Consult factory for
		Standard (UNF)	H Heavy Range	dimensional options
		M Metric	**MC 75**	
			-1 Light	
			-2 Medium	
			-3 Heavy	



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	F	H	J	M	T	E E	F F
MC 9M	.20 (5.0)	1.42 (36.0)	.40 (10.0)	N/A	.08 (2.0)	.20 (5.0)	.83 (21.1)	.19 (4.7)	.20 (5.0)	.10 (2.5)	M6x0.5	N/A	N/A
MC 10E **MC 10M**	.20 (5.0)	1.52 (38.6)	.40 (10.0)	N/A	.08 (2.0)	.25 (6.4)	.83 (21.1)	.19 (4.7)	.20 (5.0)	.19 (4.8)	M8x0.75 M8x1	N/A	N/A
MC 25 **MC 25M**	.26 (6.6)	2.27 (57.7)	.57 (14.5)	N/A	.13 (3.3)	.33 (8.4)	1.3 (33.0)	.30 (7.6)	.32 (8.1)	.20 (5.0)	3/8-32 UNEF M10x1	N/A	N/A
MC 75 **MC 75M**	.40 (10.2)	2.76 (70.1)	.72 (18.1)	N/A	.13 (3.3)	.41 (10.4)	1.74 (44.2)	.30 (7.6)	.32 (8.1)	.18 (4.6)	1/2-20 UNF M12x1	N/A	N/A

Specifications

Model	Effective Weight lbs	(kg)	Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MC 9M-1 **MC 9M-2**	1.35-7.0 1.75-9.0	(0.6 - 3.2) (0.8 - 4.1)	9.0 (1.0)	18,000 (2,000)	0.31 - 0.85 (1.38 - 3.78)	0.30	0.01 (0.004)
MC 10L **MC 10H**	0.75 - 6.0 1.5 - 11	(0.34 - 3) (0.68 - 5)	4.0 (0.45) 7.0 (0.79)	35,000 (3,950)	0.5 - 1.0 (2.22 - 4.45)	0.20	0.2 (0.01)
MC 25L **MC 25** **MC 25H**	1.5 - 5.0 4 - 12 10 - 30	(0.34 - 2) (2 - 5) (5 - 14)	20 (2)	120,000 (13,550)	0.8 - 1.7 (3.56 - 7.56)	0.20	0.6 (0.03)
MC 75-1 **MC 75-2** **MC 75-3**	.5 - 2.5 2 - 14 6 - 80	(0.23 - 1) (0.91 - 6) (3 - 36)	75 (8)	250,000 (28,240)	1.0 - 2.5 (4.45 - 11.12)	0.30	0.9 (0.04)

Technical Data

Impact velocity range:

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

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

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

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

Operating temperature:

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

MC 25: 32° to 150°F (0° to 66°C)

MC 75: 32° to 150°F (0° to 66°C)

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

Oil type: Silicone

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

Technical data applies to standard and metric threaded models.

Maximum side load depends on application. For additional information contact ACE Controls' Applications Department.

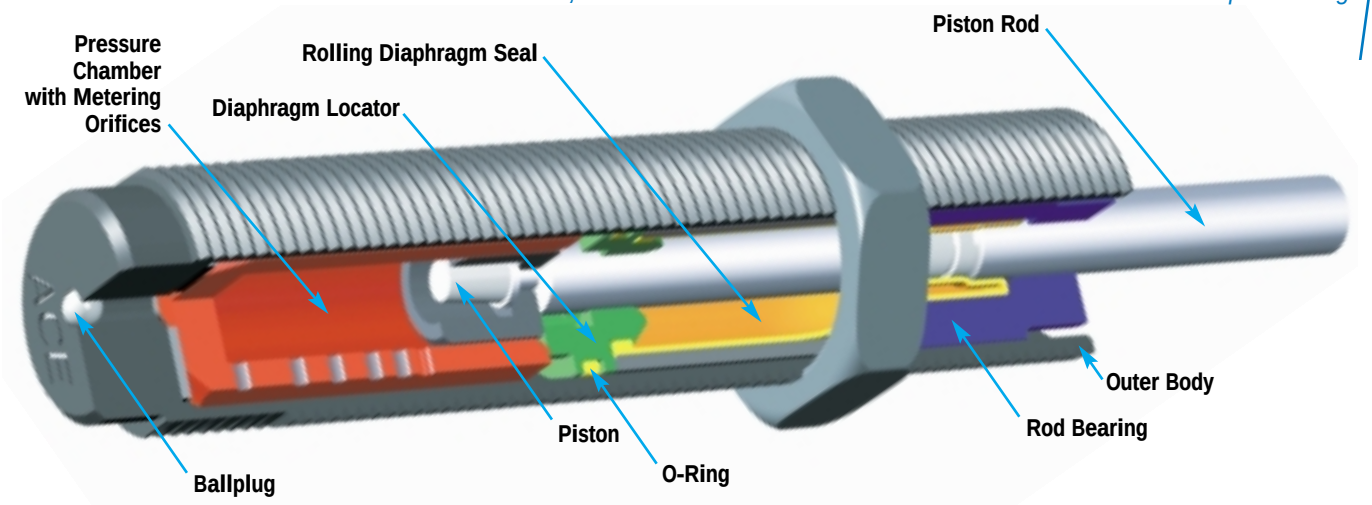
Lock nut included with each shock absorber.

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

ACE Miniature Shock Absorbers
MC 150 to MC 600 model range, feature a hermetically sealed rolling diaphragm seal system that provides the highest possible cycle lifetime and an extremely low rod return force. These models can be directly mounted into the end cover of pneumatic cylinders to provide superior damping compared to normal cylinder cushions. Use of the optional stop collar is recommended to provide a positive mechanical stop. By adding the optional side load adapter (metric threaded models only), it is possible to accept side loads up to 25° from the axis.

Applications for the durable MC Series include: material handling, medium robotics, machine tools, pick and place systems, as well as packaging equipment.

Miniature Shock Absorbers MC 150, MC 225 and MC 600 *Self-Compensating*

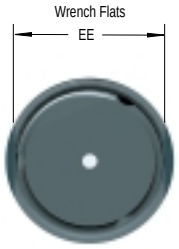


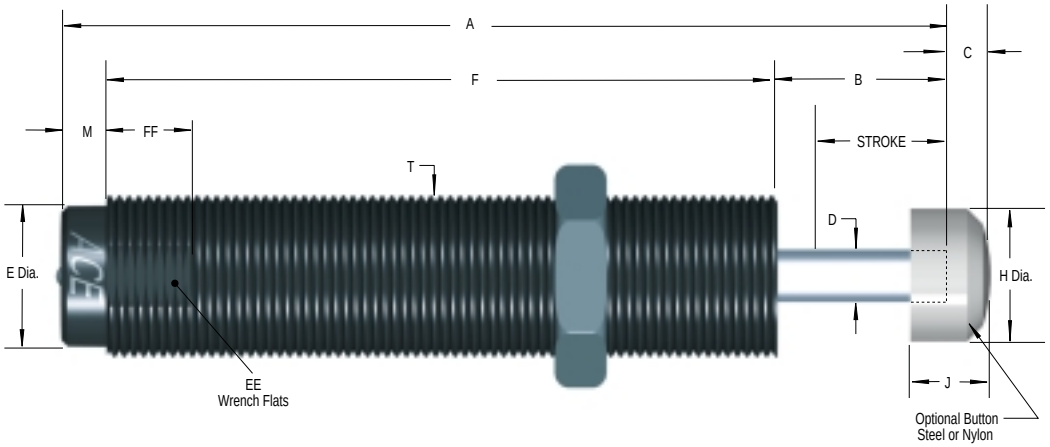
Ordering Information

MC 225 _ _ _ _

MC Series	Model Number	Mounting Thread	Effective Weight	Button Options
	150	Standard (UNF)	**MC 150, 225, 600**	Standard No Button
	225	M Metric	Standard Range	-B Nylon Button
	600	ME* Fine Metric	H Heavy Range	-BS Steel Button
		ML** Coarse Metric	H2 Extra Heavy Range	

* *MC 150 only*
** *MC 600 only*





See page 31 for steel button dimensions.

Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	F	H	J	M	T	E E	F F
MC 150 **MC 150M** **MC 150ME**	.50 (12.8)	3.41 (86.6)	.69 (17.5)	.18 (4.6)	.19 (4.8)	.46 (11.6)	2.44 (62.0)	.47 (11.9)	.39 (9.9)	.28 (7.1)	9/16-18 UNF M14x1.5 M14x1	.500 (12.0)	.50 (12.7)
MC 225 **MC 225M** **MC 225ME**	.50 (12.8)	3.81 (96.8)	.69 (17.5)	.16 (4.1)	.25 (6.4)	.66 (16.7)	2.84 (72.1)	.66 (16.8)	.36 (9.1)	.28 (7.1)	3/4-16 UNF M20x1.5 M20x1	.687 (18.0)	.50 (12.7)
MC 600 **MC 600M** **MC 600ML**	1.00 (25.4)	5.58 (141.8)	1.24 (31.6)	.23 (5.8)	.31 (7.9)	.87 (22.0)	4.06 (103.1)	.89 (22.6)	.47 (11.9)	.28 (7.1)	1-12 UNF M25x1.5 M27x3	.875 (23.0)	.50 (12.7)

Specifications

Model	We Effective Weight lbs (kg)	E_3 Energy per Cycle in lbs (Nm)	E_4 Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MC 150 **MC 150H** **MC 150H2**	2 - 22 (0.91 - 10) 20 - 200 (9 - 91) 150 - 450 (68 - 204)	150 (17) 280* (32)*	300,000 (33,890)	0.70 - 1.20 (3.11 - 5.34)	0.40	.12 (0.05)
MC 225 **MC 225H** **MC 225H2**	5 - 55 (2 - 25) 50 - 500 (23 - 227) 400 - 2,000 (181 - 907)	225 (25) 380* (43)*	400,000 (45,190)	1.00 - 1.50 (4.45 - 6.67)	0.30	.34 (0.15)
MC 600 **MC 600H** **MC 600H2**	20 - 300 (9 - 136) 250 - 2,500 (113 - 1,134) 880 - 5,000 (399 - 2,268)	600 (68) 1,300* (147)*	600,000 (67,790)	1.00 - 2.00 (4.45 - 8.90)	0.60	.57 (0.26)

** Hydro shock energy ratings. Consult factory.*

Technical Data

Impact velocity range: 0.26 to 19.7 ft/sec (0.08 to 6 m/sec)

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

Mechanical stop: Must be provided 0.02 to 0.04 inch (0.5 to 1 mm) before end of stroke.

Oil type: Silicone

Materials: Steel body with black oxide finish. Hardened stainless steel piston rod. Rolling seal EPDM, (note: seal not compatible with petroleum based fluids). If unit is to be used in contact with such fluids, specify neoprene rolling seal or use air bleed adapter type SP (metric threaded models only). Consider the SC² Series as an alternative.

To prevent damage to the rolling seal in MC 150, 225 and 600 models, do not twist or turn the piston rod.

Technical data applies to standard and metric threaded models.

Maximum side load depends on application. For additional information contact ACE Controls' Applications Department.

Lock nut included with each shock absorber.

Note: MC 150 to MC 600 models may be mounted into pressure chambers of pneumatic actuators.

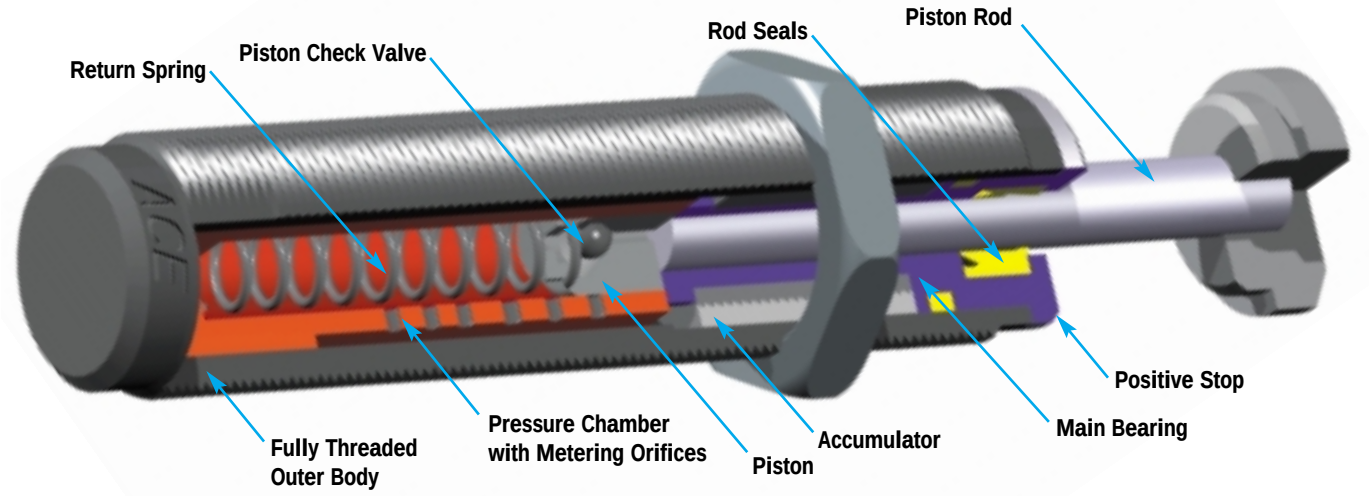
ACE SC² Series Miniature Shock Absorbers provide dual performance benefits. They offer **soft contact deceleration** where initial impact reaction forces are very low, with the advantages of **self-compensation** to react to changing energy conditions, without adjustment. They have long stroke lengths, **SC² 925 with 1.58 inch (40 mm) superstroke**, to provide smooth deceleration and low reaction forces.

With the addition of the **optional side load adapter** (SC² 190M, 300M, and 650M models only), SC² Series shock absorbers can handle side loads up to 25°. SC² Series shock absorbers are fully interchangeable with the adjustable MA range.

Applications include: material handling, medium robotics, machine tools, pick and place systems, rodless cylinders and packaging equipment.

Miniature Shock Absorbers SC 190 to SC 925

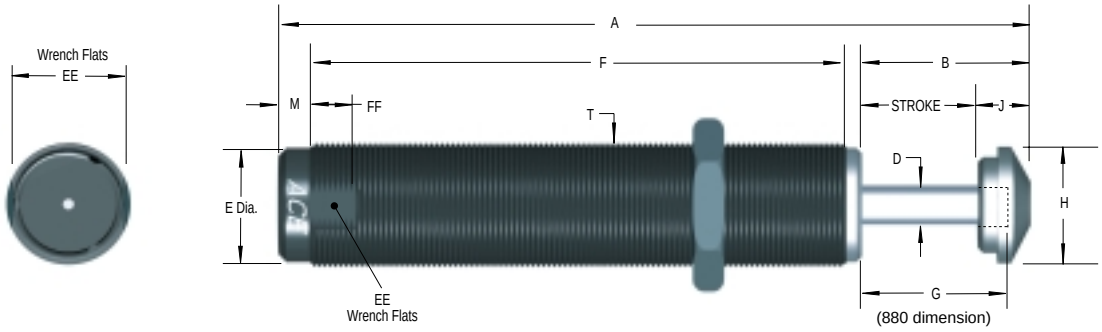
Soft Contact and Self-Compensating



Ordering Information

SC 300 - 1

SC² Series	Model Capacity	Mounting Thread	Effective Weight	Button Options
Soft Contact Self-Compensating	190 300 650 925	- Standard (UNF) M Metric	-1 Ultra Light -2 Light -3 Medium -4 Heavy	- Standard with Button -NB No Button, Short Rod -880 No Button, Standard Rod



Dimensions in inches (millimeters)

Model	Stroke	A	B	D	E	F	G	H	J	M	T	E E	F F
SC 190 **SC 190M**	.63 (16.0)	4.50 (114.3)	1.06 (26.9)	.16 (4.1)	.46 (11.7)	3.00 (76.2)	.88 (22.4)	.47 (11.9)	.43 (11.0)	.28 (7.1)	9/16-18 UNF M14x1.5	1/2 (12.0)	.50 (12.7)
SC 300 **SC 300M**	.75 (19.1)	4.62 (117.5)	1.18 (30.0)	.19 (4.8)	.66 (16.8)	3.09 (78.5)	1.00 (25.4)	.66 (16.8)	.43 (11.0)	.28 (7.1)	3/4-16 UNF M20x1.5	11/16 (18.0)	.50 (12.7)
SC 650 **SC 650M**	1.00 (25.4)	5.62 (142.6)	1.43 (36.3)	.25 (6.3)	.87 (22.1)	3.83 (97.3)	1.25 (31.8)	.90 (22.9)	.43 (11.0)	.28 (7.1)	1-12 UNF M25x1.5	7/8 (23.0)	.50 (12.7)
SC 925 **SC 925M**	1.58 (40.0)	7.44 (189.1)	2.01 (51.1)	.25 (6.3)	.87 (22.1)	5.1 (129.5)	1.82 (46.4)	.90 (22.9)	.43 (11.0)	.28 (7.1)	1-12 UNF M25x1.5	7/8 (23.0)	.50 (12.7)

Specifications

Model	Soft Contact We Effective Weight lbs (kg)	Self-Compensating We Effective Weight lbs (kg)	E_3 Energy per Cycle in lbs (Nm)	E_4 Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
SC 190-1 **SC 190-2** **SC 190-3** **SC 190-4**	5 - 13 (2 - 6) 12 - 36 (5 - 16) 30 - 90 (14 - 41) 75 - 200 (34 - 91)	3 - 15 (1.4 - 7) 8 - 40 (4 - 18) 20 - 100 (9 - 45) 50 - 225 (23 - 102)	225 (25) *300 (33)	300,000 (34,000)	0.90 - 1.90 (4.00 - 8.95)	0.25	0.18 (0.08)
SC 300-1 **SC 300-2** **SC 300-3** **SC 300-4**	5 - 15 (2 - 7) 15 - 50 (7 - 23) 50 - 150 (23 - 68) 150 - 400 (68 - 181)	3 - 18 (1.4 - 8) 10 - 60 (5 - 27) 30 - 180 (14 - 82) 70 - 450 (32 - 204)	300 (33) *500 (56)	400,000 (45,000)	1.05 - 2.15 (4.67 - 9.56)	0.10	0.25 (0.11)
SC 650-1 **SC 650-2** **SC 650-3** **SC 650-4**	24 - 80 (11 - 36) 75 - 250 (34 - 113) 240 - 800 (109 - 363) 800 - 2400 (363 - 1089)	17 - 100 (8 - 45) 50 - 300 (23 - 136) 150 - 900 (68 - 408) 450 - 2600 (204 - 1180)	650 (73) *1,000 (113)	600,000 (68,000)	2.40 - 6.87 (10.67 - 30.55)	0.20	0.67 (0.31)
SC 925-1 **SC 925-2** **SC 925-3** **SC 925-4**	50 - 160 (22 - 72) 130 - 460 (59 - 208) 400 - 1,350 (181 - 612) 1200 - 4300 (544 - 1952)	30 - 200 (14 - 90) 90 - 600 (40 - 272) 250 - 1,600 (113 - 726) 750 - 4600 (340 - 2088)	975 (110) *1,700 (192)	800,000 (90,000)	2.40 - 7.40 (10.67 - 30.55)	0.40	0.87 (0.39)

** Hydro shock energy ratings. Consult factory.*

Technical Data

Impact velocity range: 0.5 to 12 ft/sec (0.15 to 3.66 m/sec)

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

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

Oil type: ACE #5

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

Technical data applies to standard and metric threaded models.

Maximum side load depends on application. For additional information contact ACE Controls' Applications Department.

Lock nut included with each shock absorber.

SC² Heavyweight Series... Named One of Best Products of the Year in Fluid Power by Design News.

ACE's award winning SC² 300 and SC² 650 Heavyweight Series Shock Absorbers deliver up to 950% of the effective weight capacity and 280% of the energy absorption capability of standard models. These durable units are ideal for decelerating heavy weights moving at low velocities. The Heavyweight Series design combines the piston and the inner tube into a single component, the piston tube. It acts as both the pressure creating and pressure controlling device.

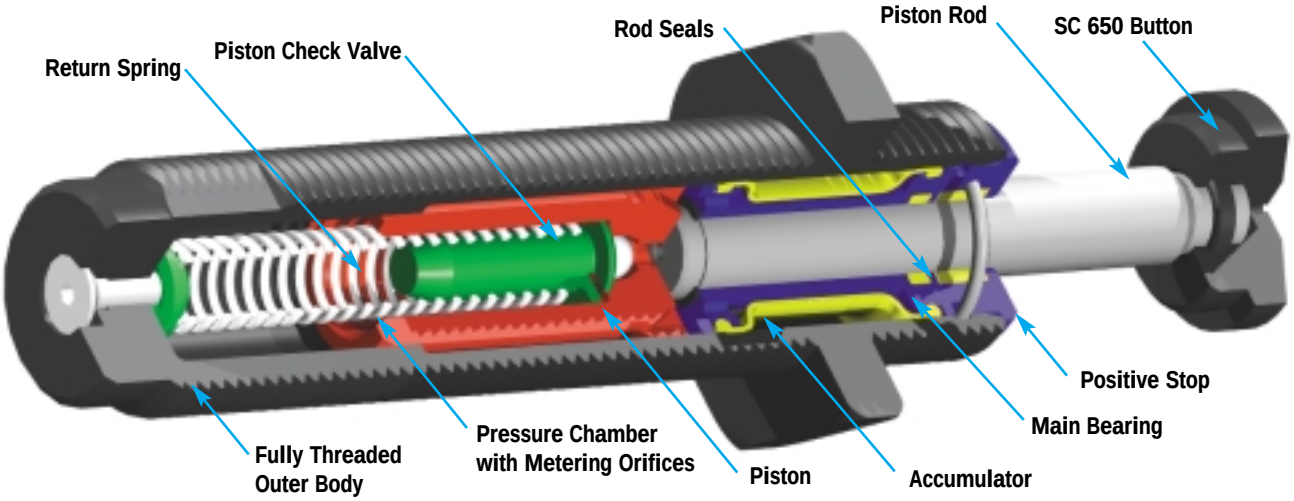
ACE's SC² 300 and SC² 650 Heavyweight Series Shock Absorbers offer expanded effective weight ranges and dramatic increases in energy absorption capability, for handling a wider range of applications.

These revolutionary shock absorbers provide dual performance benefits. They offer **soft contact** deceleration where initial impact reaction forces are very low with the advantages of **self-compensation** to cope with changing input energy conditions without adjustment.

Applications include: rotary actuators, rodless cylinders, conveyors, pick and place operations, slides as well as operations turning heavy weights at slow speeds.

Heavyweight Shock Absorbers SC 300 and SC 650

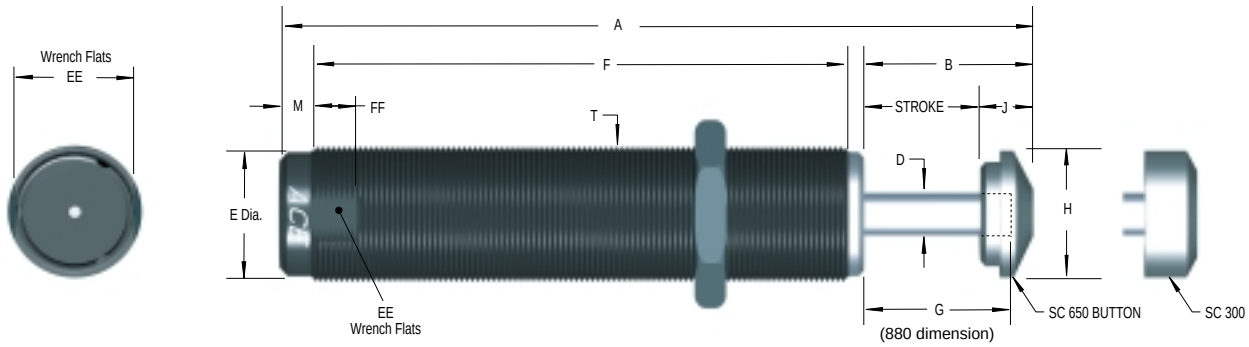
Soft Contact and Self-Compensating



Ordering Information

SC 300 - 5

SC² Series	Model Number	Mounting Thread	Effective Weight	Button Options
Soft Contact Self-Compensating	300 650	- Standard (UNF) M Metric	-5 Heavy -6 Heavy Plus -7 Heavy Duty -8 Extra Heavy -9 Ultra Heavy	- Standard with Button -NB No Button, Short Rod -880 No Button, Standard Rod



Heavyweight Series Dimensions in inches (millimeters)

Model	Stroke	A	B	D	E	F	G	H	J	M	T	E E	F F
SC 300-5 SC 300-6 SC 300-7 SC 300-8 SC 300-9 SC 300M-5 SC 300M-6 SC 300M-7 SC 300M-8 SC 300M-9	.59 (15.0)	4.15 (105.4)	1.02 (25.9)	.25 (6.4)	.66 (16.8)	2.78 (70.6)	.84 (21.3)	.67 (17.0)	.43 (11.0)	.28 (7.1)	3/4-16 UNF M20x1.5	11/16 (17.5)	.50 (12.7)
SC 650-5 SC 650-6 SC 650-7 SC 650-8 SC 650-9 SC 650M-5 SC 650M-6 SC 650M-7 SC 650M-8 SC 650M-9	.91 (23.1)	5.51 (140.0)	1.33 (33.8)	.38 (9.6)	.87 (22.1)	3.83 (97.3)	1.16 (29.5)	.88 (22.4)	.43 (11.0)	.28 (7.1)	1-12 UNF M25x1.5	7/8 (22.2)	.50 (12.7)

Specifications

Model	Soft Contact We Effective Weight lbs (kg)	Self-Compensating We Effective Weight lbs (kg)	E_3 Energy per Cycle in lbs (Nm)	E_4 Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
SC 300-5 SC 300-6 SC 300-7	38 - 90 (17 - 41) 115 - 270 (52 - 123) 300 - 360 (136 - 163)	25 - 100 (11 - 45) 75 - 300 (34 - 136) 200 - 400 (91 - 181)	650 (73)	400,000 (45,194)	1.70 - 4.00 (7.56 - 17.79)	0.20	0.33 (0.15)
SC 300-8 SC 300-9	450 - 1,350 (204 - 612) 1,050 - 3,900 (476 - 1,769)	300 - 1,500 (136 - 680) 700 - 4,300 (318 - 1,950)	620 (70)	400,000 (45,194)	1.70 - 4.00 (7.56 - 17.79)	0.20	0.33 (0.15)
SC 650-5 SC 650-6 SC 650-7	75 - 225 (34 - 102) 300 - 720 (136 - 327) 1,050-2,150 (476-975)	50 - 250 (23 - 113) 200 - 800 (91 - 363) 700 - 2400 (317 - 1089)	1,860 (210)	600,000 (67,791)	2.40 - 7.30 (10.68 - 32.99)	0.30	0.76 (0.34)
SC 650-8 SC 650-9	2,500 - 5,200 (1,134 - 2,359) 6,000 - 12,500 (2,722 - 5,670)	1,700 - 5,800 (771 - 2,631) 4,000 - 14,000 (1,814 - 6,350)	1,860 (210)	600,000 (67,791)	2.40 - 7.30 (10.68 - 32.47)	0.30	0.76 (0.34)

Technical Data

Impact velocity range: .30 to 12.0 ft/sec (0.09 to 3.66 m/sec)

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

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

Oil type: ACE #5

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

Technical data applies to standard and metric threaded models.

Maximum side load depends on application. For additional information contact ACE Controls' Applications Department.

Lock nut included with each shock absorber.

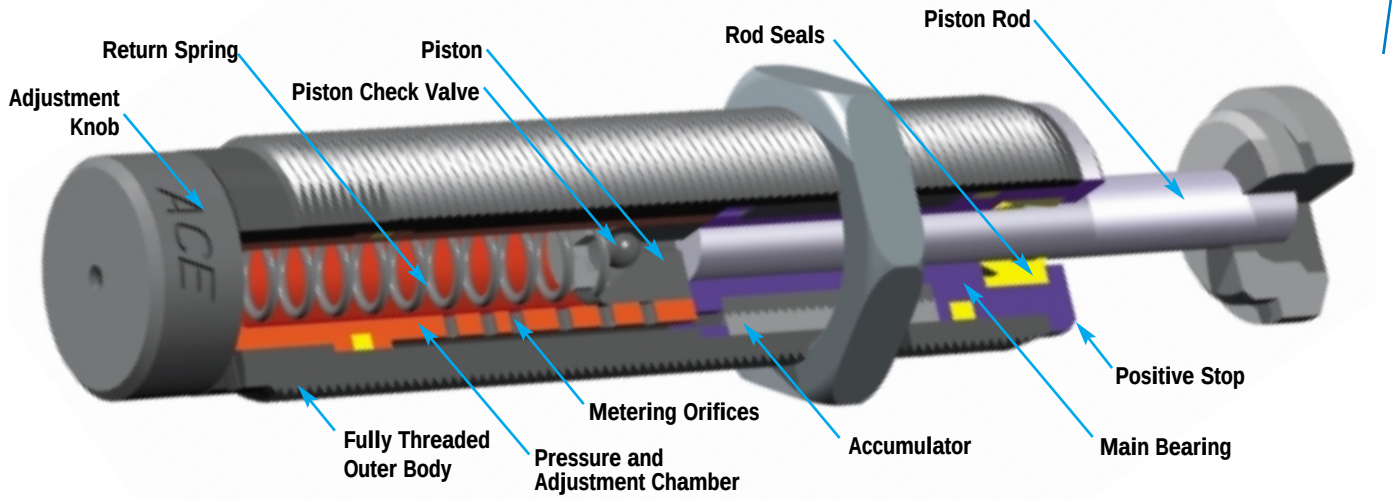
ACE MA Series miniature shock absorbers offer a compact design with true linear deceleration, and are adjustable over a wide range of conditions. If your preference is a fully adjustable shock absorber rather than a self-compensating model on your application, then the MA Series provides a directly interchangeable alternative.

These adjustable models feature long stroke lengths, **MA 900 with 1.58 inch (40 mm) superstroke**, to provide smooth deceleration and low reaction forces. The MA 150 incorporates the proven rolling diaphragm seal (used on the MC 150 to MC 600 range) and shares all the advantages of that technology.

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

MA Series

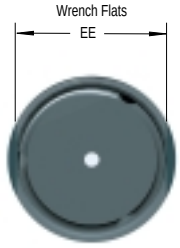
Adjustable

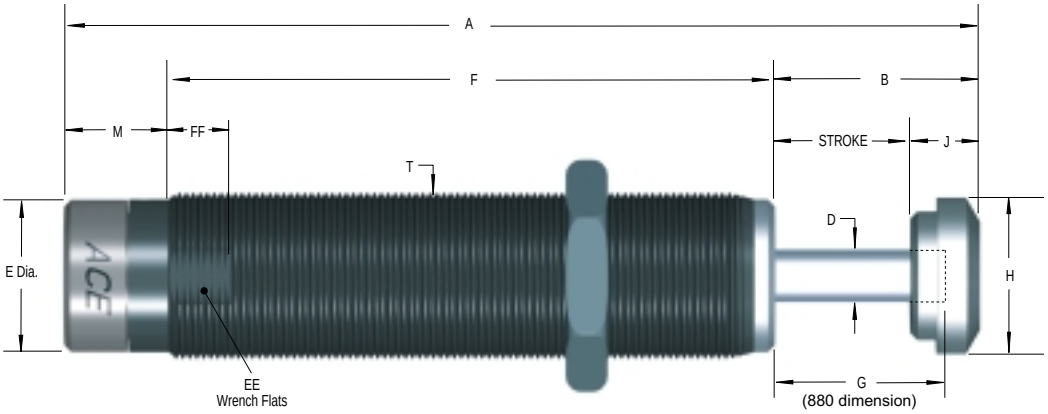


Ordering Information

MA 225 -

MA Series	Model Number	Mounting Thread	Button Options
MA = Miniature Adjustable	35 150 225 600 900	Standard (UNF) M Metric ME Fine Metric (MA 150 only)	**MA 35** Standard with Button -NB No Button, Short Rod **MA 150** Standard No Button -B Nylon Button -BS Steel Button **MA 225-900** Standard Steel Button -NB No Button, Short Rod -880 No Button, Standard Rod





Dimensions in inches (millimeters)

Model	Stroke	A	B	D	E	F	G	H	J	M	T	E E	F F
MA 35 **MA 35M**	.40 (10.1)	3.31 (84.1)	.72 (18.3)	.13 (3.3)	.42 (10.6)	2.41 (61.2)	N/A	.30 (7.6)	.32 (8.0)	.18 (4.6)	1/2-20 UNF M12x1	N/A	N/A
MA 150 **MA 150M** **MA 150ME**	.49 (12.4)	3.64 (92.5)	.92 (23.4)	.19 (4.8)	.46 (11.6)	2.44 (62.0)	.69 (17.5)	.47 (11.9)	.43 (11.0)	.28 (7.1)	9/16-18 UNF M14x1.5 M14x1	.49 (12.7)	.50 (12.7)
MA 225 **MA 225M**	.75 (19.1)	4.67 (118.6)	1.18 (30.0)	.19 (4.8)	.66 (16.8)	2.94 (74.7)	1.00 (25.3)	.66 (16.8)	.43 (11.0)	.55 (14.0)	3/4-16 UNF M20x1.5	11/16 (18.0)	.50 (12.7)
MA 600 **MA 600M**	1.00 (25.4)	5.62 (142.7)	1.43 (36.3)	.25 (6.3)	.88 (22.4)	3.54 (90.0)	1.25 (31.8)	.90 (22.9)	.43 (11.0)	.65 (16.5)	1-12 UNF M25x1.5	7/8 (23.0)	.50 (12.7)
MA 900 **MA 900M**	1.58 (40.0)	7.44 (189.0)	2.01 (51.1)	.25 (6.3)	.88 (22.4)	4.78 (121.4)	1.85 (46.4)	.90 (22.9)	.43 (11.0)	.65 (16.5)	1-12 UNF M25x1.5	7/8 (23.0)	.50 (12.7)

Specifications

	We	E_3	E_4			
	Effective Weight lbs (kg)	Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MA 35	13 - 125 (6 - 57)	35 (4)	53,000 (5,988)	1.20 - 2.60 (5.33 - 11.56)	.17	.10 (0.04)
MA 150	2 - 200 (0.91 - 91)	150 (17)	300,000 (33,890)	0.70 - 1.20 (3.12 - 5.34)	.40	.12 (0.05)
MA 225	5 - 500 (2 - 227)	225 (25)	400,000 (45,190)	1.05 - 2.15 (4.67 - 9.56)	.10	.28 (0.13)
MA 600	20 - 3,000 (9 - 1,361)	600 (68)	600,000 (67,790)	2.40 - 6.87 (10.67 - 30.56)	.20	.67 (0.30)
MA 900	30 - 4,500 (14 - 2,041)	900 (102)	800,000 (90,380)	2.40 - 7.40 (10.67 - 32.92)	.40	.87 (0.39)

Technical Data

Impact velocity range

MA 35: 3.3 ft/sec (1.0 m/sec)

MA 150, 225, 600, 900: 0.5 to 12 ft/sec (0.15 to 3.66 m/sec)

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

Mechanical Stop

MA 35: Integral

MA 150: Must be provided 0.02 to 0.04 inch (0.5 to 1 mm) before end of each stroke.

MA 225, 600, 900: Integral mechanical stop built into front of units.

Oil type

MA 35: ACE #5

MA 150: Silicone

MA 225, 600, 900: ATF

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

Adjustment: On models MA 35 up to MA 150: by turning the adjustment screw at rear. On the larger sizes: by turning the adjustment knob against the scale marked 0 to 9. After installation, cycle the machine a few times and turn the adjustment knob until optimum deceleration is achieved (i.e. smooth deceleration throughout stroke).

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

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

Technical data applies to standard and metric threaded models.

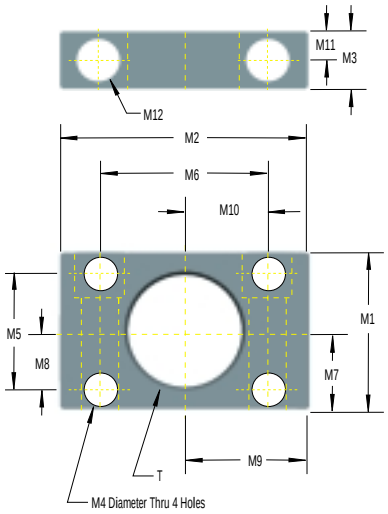
Maximum side load depends on application. For additional information contact ACE Controls' Applications Department.

Note: MA 150 models may be mounted into pressure chambers of pneumatic actuators.

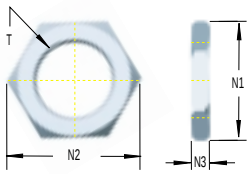
Lock nut included with each shock absorber.

MA 35 and MA 150 models can be utilized as velocity controls.

Mounting Block

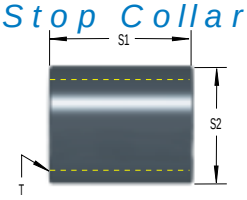


Lock Nut



One lock nut included with each shock absorber where appropriate.

Stop Collar



Side load adapters are available for select models, see pages 32 and 33.

Mounting Block in inches (millimeters)

Used With	Part #	T	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12
MC 10E MC 10M	N/A	M8x0.75 M8x1												
MC 25	250-0306	3/8-32 UNF	1.00 (25.4)	1.50 (38.1)	.56 (14.2)	See DIM M12	0 (0)	1.00 (25.4)	.50 (12.7)	0 (0)	.75 (19.1)	.50 (12.7)	.28 (7.1)	.18 Dia.Thru .31 C'Bore x .20 Deep #8-32 Soc. Hd. Screw
MC 25M	250-0307	M10x1												(4.5) Dia.Thru (8) C'Bore x (5) Deep M4x7 Soc. Hd. Screw
MA 35 MC 75	250-0308	1/2-20 UNF	1.00 (25.4)	1.50 (38.1)	.56 (14.2)	See DIM M12	0 (0)	1.00 (25.4)	.50 (12.7)	0 (0)	.75 (19.1)	.50 (12.7)	.28 (7.1)	.18 Dia.Thru .31 C'Bore x .20 Deep #8-32 Soc. Hd. Screw
MA 35M MC 75M	250-0309	M12x1												(4.5) Dia.Thru (8) C'Bore x (5) Deep M4x7 Soc. Hd. Screw
MA 150 MC 150 SC 190	250-0318	9/16-18 UNF	1.37 (34.8)	1.81 (46.0)	.62 (15.7)	.22 (5.6)	1.00 (25.4)	1.38 (35.1)	.69 (17.5)	.50 (12.7)	.91 (23.1)	.69 (17.5)	.31 (7.9)	.21 Dia.Thru .32 C'Bore x .32 Deep #10-32 Soc. Hd. Screw
MA 150M MC 150M SC 190M	250-0352	M14x1.5	1.10 (28.0)	1.77 (45.0)	.63 (16.0)	.18 (4.5)	0 (0)	1.38 (35.0)	.55 (14.0)	0 (0)	.89 (22.5)	.69 (17.5)	.31 (7.9)	(4.5) Dia.Thru (8) C'Bore x (5) Deep M4x7 Soc. Hd. Screw
MC 225 MA 225 MVC 225 SC 300	250-0401	3/4-16 UNF	1.50 (38.1)	2.00 (50.8)	.62 (15.7)	.22 (5.6)	1.12 (28.4)	1.50 (38.1)	.75 (19.1)	.56 (14.2)	1.00 (25.4)	.75 (19.1)	.31 (7.9)	.22 Dia.Thru .33 C'Bore x .45 Deep #10-32 Soc. Hd. Screw
MC 225M MA 225M MVC 225M SC 300M	250-0353	M20x1.5	1.38 (35.0)	1.85 (47.0)	.63 (16.0)	.22 (5.6)	1.00 (25.4)	1.38 (35.0)	.69 (17.5)	.50 (12.7)	.93 (23.5)	.69 (17.5)	.31 (7.9)	(5.5) Dia.Thru (10) C'Bore x (10) Deep M5x8 Soc. Hd. Screw
MC 600 MA 600 MVC 600 SC 650 MA 900 MVC 900 SC 925	250-0402	1-12 UNF	1.50 (38.1)	2.00 (50.8)	.62 (15.7)	.22 (5.6)	1.12 (28.4)	1.50 (38.1)	.75 (19.1)	.56 (14.2)	1.00 (25.4)	.75 (19.1)	.31 (7.9)	.22 Dia.Thru .33 C'Bore x .45 Deep #10-32 Soc. Hd. Screw
MC 600ML	N/A													
MC 600M MA 600M MVC 600M SC 650M MA 900M MVC 900M SC 925M	250-0044	M25x1.5	1.38 (35.0)	1.85 (47.0)	.63 (16.0)	.22 (5.6)	1.00 (25.4)	1.38 (35.0)	.69 (17.5)	.50 (12.7)	.93 (23.5)	.69 (17.5)	.31 (7.9)	(5.5) Dia.Thru (10) C'Bore x (10) Deep M5x8 Soc. Hd. Screw

Lock Nut

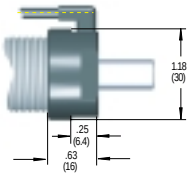
Part#	N1	N2	N3
250-0362 250-0482	.43 (11)	.49 (12.5)	.12 (3.0)
250-0404	.50 (12.7)	.56 (14.2)	.09 (2.3)
250-0315	.55 (14.0)	.59 (15.0)	.12 (3.0)
250-0405	.62 (16.5)	.70 (17.8)	.13 (3.3)
250-0317	.55 (14.0)	.63 (16.0)	.16 (4.0)
250-0231	.88 (22.4)	1.00 (25.4)	.31 (7.9)
250-0233	.67 (17.0)	.77 (19.6)	.20 (5.0)
250-0399	1.00 (25.4)	1.15 (29.2)	.25 (6.4)
250-0207	.94 (24.0)	1.10 (28.0)	.24 (6.0)
250-0400	1.25 (31.8)	1.44 (36.6)	.25 (6.4)
250-0239	1.25 (31.8)	1.44 (36.6)	.31 (7.9)
250-0040	1.18 (30.0)	1.36 (34.6)	.31 (7.9)

Stop Collar

Part#	S1	S2
N/A		
250-0406	.81 (20.6)	.56 (14.2)
250-0408	.79 (20.0)	.56 (14.3)
250-0407	.81 (20.6)	.62 (15.7)
250-0409	.79 (20.0)	.63 (16.0)
250-0271	.75 (19.1)	.69 (17.5)
250-0272	.79 (20.0)	.69 (17.5)
250-0403	1.25 (38.1)	1.00 (25.4)
250-0410	.98 (25.0)	.98 (25.0)
250-0275	1.75 (44.5)	1.25 (31.8)
250-0263	1.77 (45.0)	1.26 (32.0)
250-0276	1.77 (45.0)	1.26 (32.0)

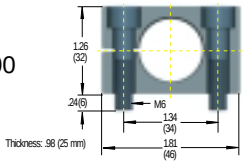
Air Bleed Collar

Used With	Model	Part#
MC 150 M	SP-14	10781-000
MC 225 M	SP-20	10782-000
MC 600 M	SP-25	10783-000

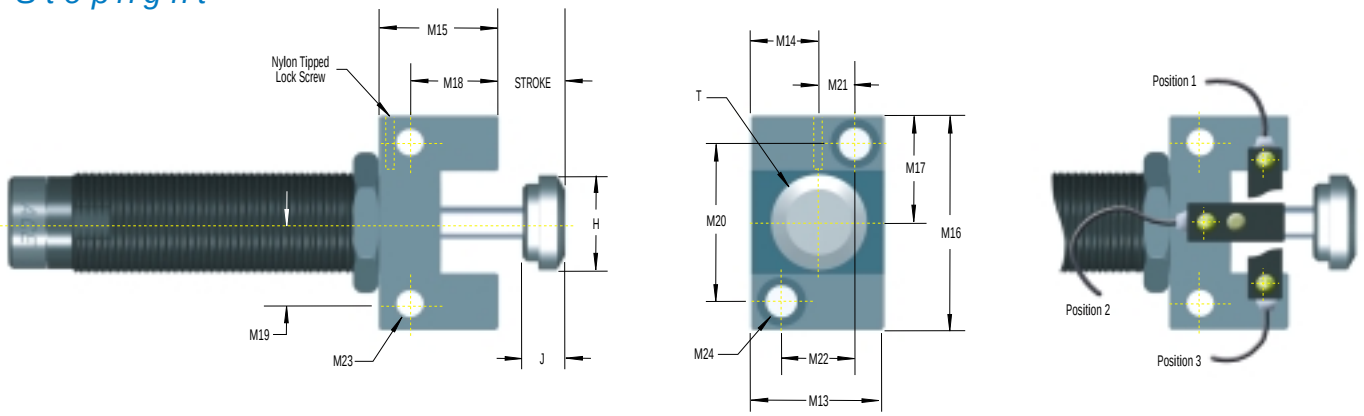


Clamp

Used With	Model	Part#
MC 600 M	MB-25	10780-000



Stoplight



Mounting Block in inches (millimeters)

Used With	Part #	T	H	J	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22	M23	M24
MA 150* MC 150* SC 190	250-0377	9/16-18 UNF	.47 (11.9)	.43 (10.9)	.75 (19.0)	.38 (22.3)	.88 (22.3)	1.25 (31.8)	.63 (15.9)	.57 (14.5)	.44 (11.1)	.88 (22.2)	.19 (4.7)	.38 (9.5)	.180 (4.6)	.315 (8.0)
MC 150M* SC 190M	250-0378	M14x1.5														
MC 225* MA 225 MVC 225 SC 300	250-0379	3/4-16 UNF	.66 (16.8)	.43 (10.9)	.94 (23.8)	.47 (11.9)	.94 (23.8)	1.56 (39.6)	.78 (19.8)	.63 (16.0)	.55 (14.0)	1.10 (28.0)	.24 (6.0)	.47 (12.0)	.216 (5.5)	.394 (10.0)
MC 225M* MA 225M MVC 225M SC 300M	250-0380	M20x1.5														
MC 600* MA 600 MVC 600 MA 900 MVC 900 SC 650 SC 925	250-0381	1-12 UNF	.90 (22.9)	.43 (10.9)	1.18 (30.0)	.59 (15.0)	1.00 (25.4)	1.75 (44.5)	.88 (22.3)	.63 (16.0)	.63 (16.0)	1.26 (32.0)	.31 (8.0)	.63 (16.0)	.216 (5.5)	.394 (10.0)
MC 600M* MA 600M MVC 600M MA 900M MVC 900M SC 650M SC 925M	250-0382	M25x1.5														

StopLight™ Switches are available in both NPN and PNP styles. Part numbers are 250-3 NPN and 250-3 PNP, respectively. The switches can be used with any StopLight mounting blocks.

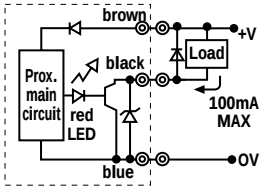
** A complete StopLight assembly includes mounting block, proximity switch and steel button. Steel buttons are an integral part of MA and SC² Series shock absorbers and MVC units.*

Use the table below to order steel buttons for the MC Series and MA 150 shock absorbers.

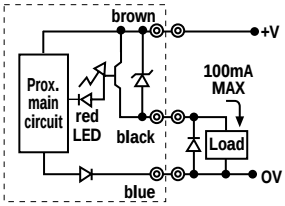
Model	Steel Button Part #
MA 150, MA 150M	250-0383
MC 150, MC 150M	250-0111
MC 225, MC 225M	250-0112
MC 600, MC 600M	250-0113

Specifications

250-3 NPN
NPN-type Proximity Switch



250-3 PNP
PNP-type Proximity Switch

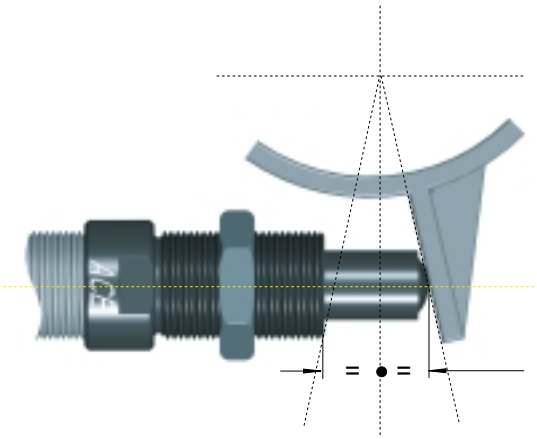


Supply Voltage:	10 to 27 VDC Ripple p to p 10% max
Current Consumption:	15mA max (at 24 VDC)
Control Output:	• 3-Wire Output: 100mA max • Voltage Impression: 30 VDC max • Residual Voltage: 1 VDC max
Operator Indicator:	Red LED. Power off = dark. Stand By = Dim Light. Detection = Bright Light.
Operating Temperature:	14° to 140° F, -10° to 60° C (At holding: 86° to 176° F; 30° to 80° C)
Humidity:	45 to 85% RH (At holding: 35 to 95% RH)
Variation Due To Temperature Fluctuation:	±20% max of detecting distance at 68° F (20° C) with a temperature range of 14° to 140° F (-10° to 60° C)
Variation Due To Voltage Fluctuation:	±5% max of detecting distance at 12/24/VDC when operated within 10 to 27 VDC
Residual Voltage:	1V max (Load current at 100mA)
Insulation Resistance:	10M Ω min (at 500 VDC)
Dielectric Resistance:	1,000VAC 50/60Hz for 1 minute
Degree of Protection:	IP67 (IEC144)

For Side Load in Excess of 3°

With side load impact angles of more than 3° the operating lifetime of the shock absorber reduces rapidly due to increased wear of the rod bearings. The optional side load adapter provides a long lasting solution.

Material: Threaded body and plunger, hardened high tensile steel



Problem: Rotary motion of the striking surface creates side load, which develops a bending moment on the piston rod. This can bend the rod in some cases. In all cases, side load will reduce seal and bearing life.

Solution: Use side load adapter.

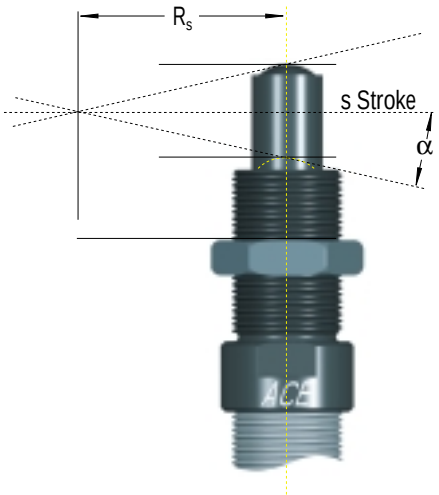
Formula: $\alpha = \tan^{-1}\left(\frac{s}{2 \cdot Rs}\right)$ $R_{smin} = \frac{s}{2 \cdot \tan\alpha max}$

Example: s = **.98** (25mm) α max = **25**° (adapter 250-0560)

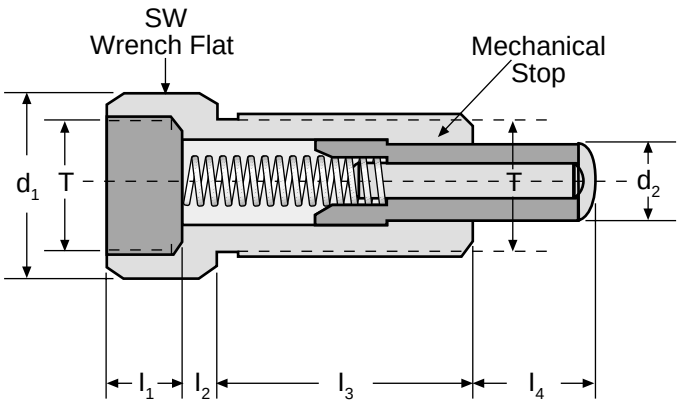
R_s = **3.94** (100mm) $R_{smin} = \frac{.98}{2 \cdot \tan 25}$

$\alpha = \tan^{-1}\left(\frac{.98}{2 \cdot 3.94}\right)$ R_{smin} = **1.05** (27mm)

$\alpha = (7.09)°$



α	=	angle of impact
α max	=	maximum angle of impact
s	=	stroke
R_s	=	radius
R_{smin}	=	minimum radius



Dimensions in inches (millimeters)

MC, MVC Series Model	SC Series Model	MA Series Model	Side Load Adapter	T	d_1	d_2	l_1	l_2	l_3	l_4	SW	Maximum Side Load (α)
MC 150M	**N/A**	**MA 150M**	**250-0558**	M14 x 1.5	0.70 (18)	0.35 (9)	0.31 (8)	0.15 (4)	0.78 (20)	0.49 (12.5)	0.62 (16)	25°
MC 225M	**N/A**	**N/A**	**250-0559**	M20 x 1.5	0.94 (24)	0.47 (12)	0.39 (10)	0.15 (4)	0.78 (20)	0.49 (12.5)	0.86 (22)	25°
MC 600M	**N/A**	**N/A**	**250-0560**	M25 x 1.5	1.18 (30)	0.62 (16)	0.39 (10)	0.23 (6)	1.50 (38)	0.98 (25)	1.06 (27)	25°
N/A	**SC 190M-880***	**N/A**	**250-0080**	M14 x 1.5	0.70 (18)	0.35 (9)	0.39 (10)	0.15 (4)	1.02 (26)	0.62 (16)	0.62 (16)	25°
MVC 225M -880*	**SC 300M -880***	**MA 225M -880***	**250-0081**	M20 x 1.5	0.94 (24)	0.47 (12)	0.39 (10)	0.15 (4)	1.25 (32)	0.75 (19)	0.86 (22)	25°
MVC 600M -880*	**SC 650M -880***	**MA 600M -880***	**250-0082**	M25 x 1.5	1.18 (30)	0.62 (16)	0.39 (10)	0.23 (6)	1.50 (38)	0.98 (25)	1.06 (27)	25°

* The -880 = No button, standard rod

Note: ACE Controls recommends that side load not exceed 5°. Maximum side load depends on application, shock absorber model, and stroke length. For additional information consult ACE's Applications Department.
Note: The side load adapter can only be installed on select metric shock absorbers without rod end button.

Magnum Group...
Named One of Best Products of the Year in Fluid Power by Design News.

ACE Controls presents the ultimate in industrial shock absorber design...the Magnum Group. These versatile performers offer you the capability to mount shock absorbers that contain the highest energy capacity ratings in the industry. **Up to 150% of the energy per cycle** of previous models in the same package size, means increased safety factors in a wider range of applications.

Up to 390% of the effective weight capacity of previous models, may allow a smaller, lower priced shock absorber to be mounted, to meet your application requirements.

All Magnum Group shock absorbers are **fully threaded** for ease of installation. **Incorporation of high strength materials** along with an **integral stop collar** translates to extended shock absorber life and cost savings for you.

Applications include: automotive manufacturing and production equipment, large robotics, heavy conveyors, packaging and glass bottling equipment, rotary actuators, theme park rides, and lumber industry equipment.

Technical Data

Impact velocity range:

MC Models: 0.5 to 16.5 ft/sec (0.15 to 5 m/sec)

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

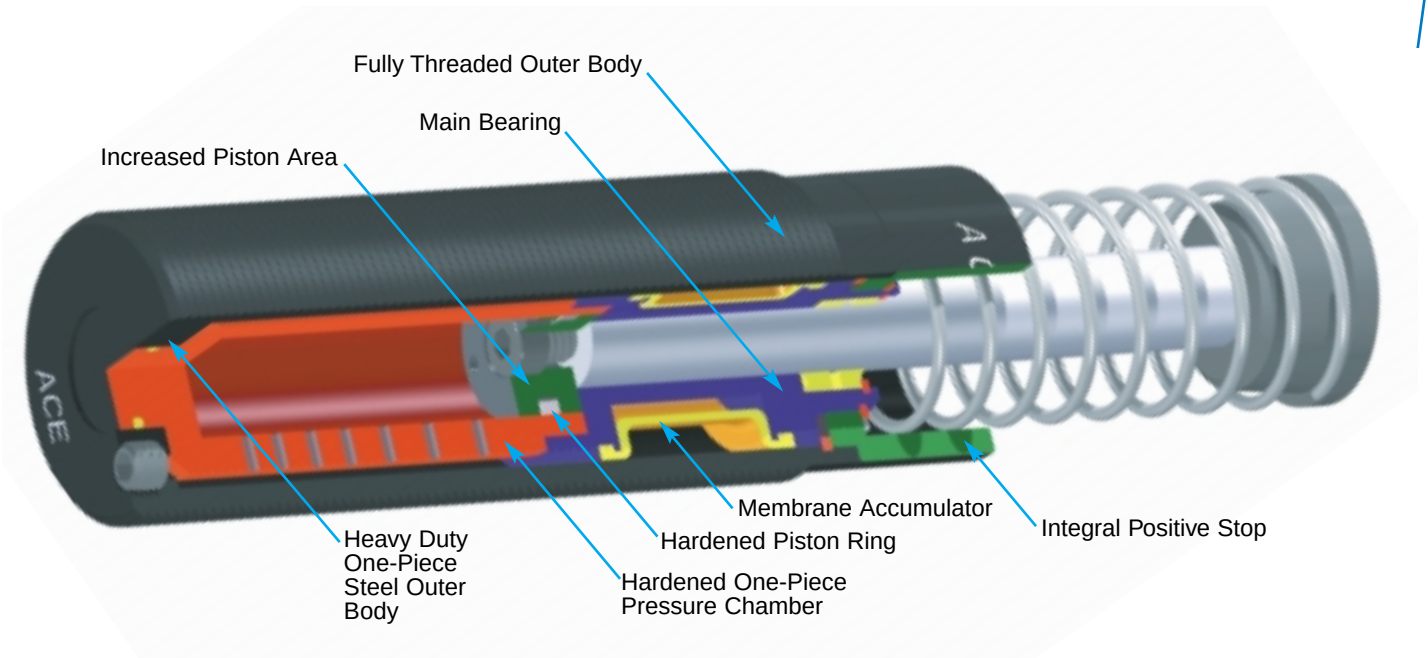
Oil type: ATF

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

Technical data applies to standard and metric threaded models.

Lock nut included with each shock absorber.

Magnum Group MC 33 to MC 64 *Self-Compensating*



ACE Magnum Group adjustable shock absorbers feature the latest seal technology, a **hardened piston ring, pressure chamber and outer body** for increased operating life. Additionally, these rugged units offer the unique feature of **front or rear adjustment** along with a fully threaded outer body for ease of installation.

Magnum Group adjustable shock absorbers are **directly interchangeable** with previous ACE and competitor models.

Along with the self-compensating models, the adjustable range offers unprecedented increases in energy and effective weight capacity.

Applications are the same as self-compensating models.

Technical Data

Impact velocity range:

MA Models: 0.5 to 16.5 ft/sec (0.15 to 5 m/sec)

ML Models: 0.06 to 1.5 ft/sec (0.02 to 0.46 m/sec)

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

Oil type: ATF

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

Adjustment: After installation of the Magnum Group shock absorber, cycle the machine a number of times. Turn the front stop collar or the rear adjuster against the scale marked 0 to 9 until optimum deceleration is achieved (i.e. smooth deceleration throughout the stroke).

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

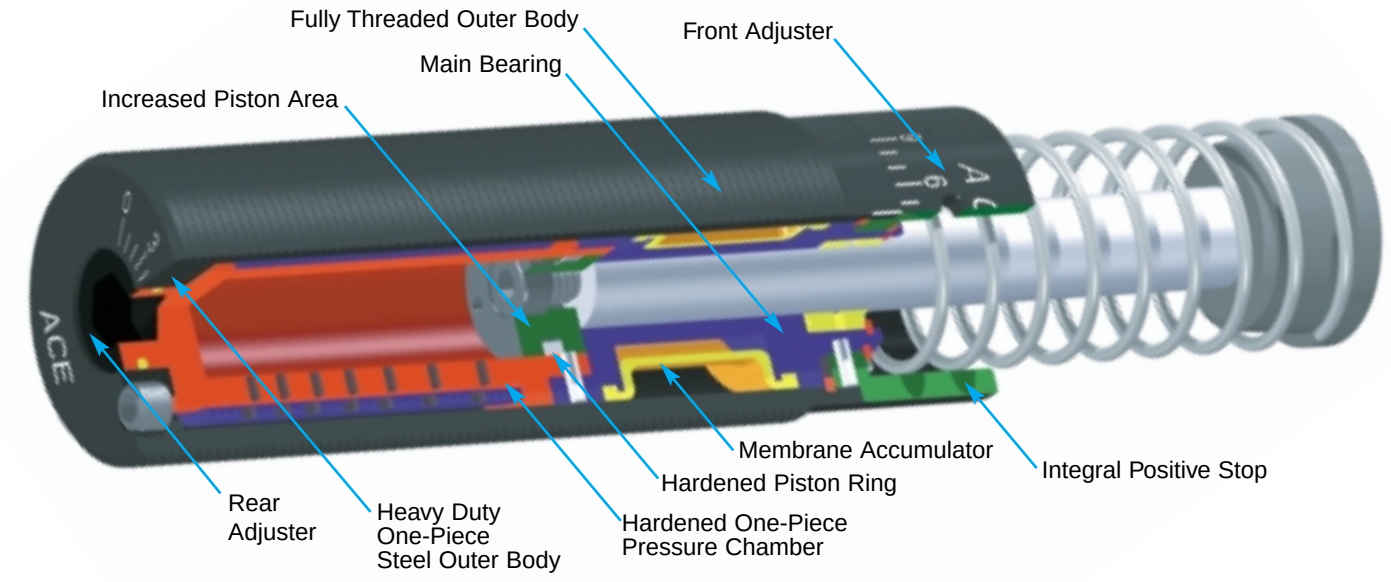
Hard set-down at end of stroke-turn adjuster toward 0.

Technical data applies to standard and metric threaded models.

ACE Controls recommends that side load not exceed 5°. Maximum side load depends on application. For additional information consult ACE's Applications Department.

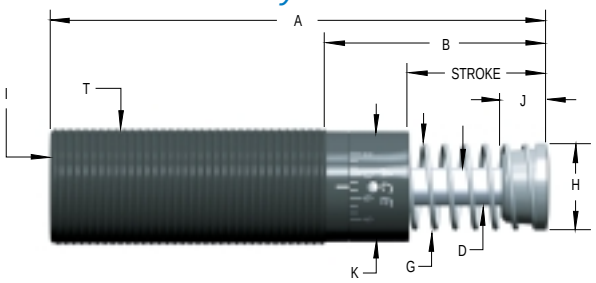
Lock nut included with each shock absorber.

Magnum Group MA and ML 33 to 64
Adjustable

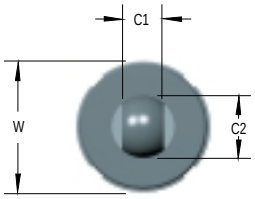


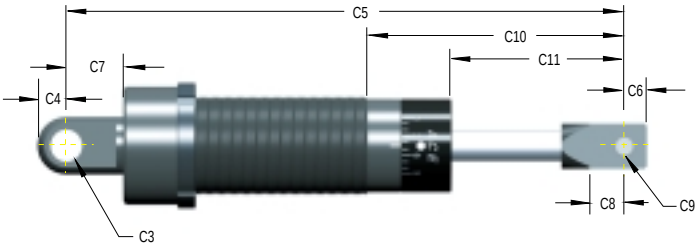
Primary Mount

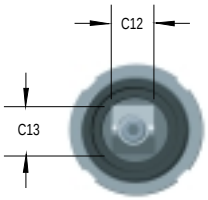
Adjuster (MA and ML only)



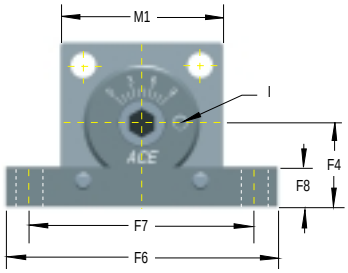
Clevis Mount

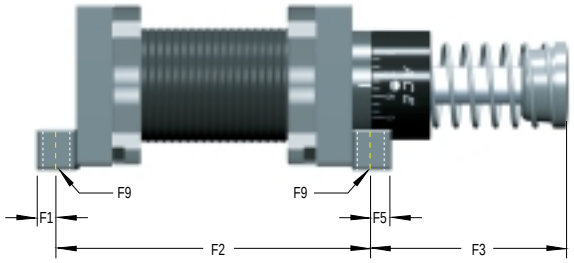






Side-Foot Mount





33 Model Dimensions in inches (millimeters)

Model	Stroke	A	B	D	G	H	I*	J	K	T	W	C1	C2	C3	C4
MC, MA, ML 3325	0.91 (23.1)	5.44 (138.1)	2.19 (55.6)	0.375 (9.5)	0.99 (25.1)	1.00 (25.4)	1/8 NPT MALE	0.75 (19.1)	1.15 (29.2)	1-1/4-12 M33x1.5	1.50 (38.10)	0.50 (12.7)	0.76 (19.3)	.2505 (6.40)	0.32 (8.1)
MC, MA, ML 3350	1.91 (48.5)	7.44 (189)	3.19 (81)								1.56 (39.71)				

Model	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	F1	F2	F3	F4	F5
MC, MA, ML 3325	6.58 (167)	0.25 (6.4)	0.48 (12.2)	0.50 (12.7)	.2505 (6.4)	2.64 (67.1)	1.36 (34.5)	0.50 (12.7)	0.75 (19.1)	N/A	0.25 (6.4)	3.75 (95.3)	1.94 (49.3)	0.87 (22.1)	0.25 (6.4)
MC, MA, ML 3350	8.58 (217.8)					3.64 (92.5)	2.36 (60)					4.75 (120.7)	2.94 (74.7)		

Model	F6	F7	F8	F9
MC, MA, ML 3325	2.75 (69.9)	2.37 (60)	0.50 (12.7)	0.23 (5.9)
MC, MA, ML 3350				

***For models MAA and MAS 33 the 1/8-27 female fitting is shipped with the shock. MAA and MAS 45 and 64 have pipe plugs. Note: A side port can be adapted to Magnum 33 MAA, MLA and MCA models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.25 inches (6.3 mm) in the area of the ring. The side port centerline is located 0.81 inches (20.7 mm) from the front of the outer tube. Add (-P) to the model ordering code if a side port is desired, see page 45.**
Note: M 36 and 1-3/8 thread is optional. **Note: Poly pad available on 33 models only – part no. 250-0011.**

Lock nut included with each shock absorber. See page 43 for dimensions.

36 Model Dimensions in inches (millimeters)

Model	Stroke	A	B	D	G	H	I*	J	K	T	W	C1	C2	C3	C4
MC, MA, ML 3625	0.91 (23.1)	5.44 (138.1)	2.19 (55.6)	0.375 (9.5)	0.99 (25.1)	1.00 (25.4)	1/8 NPT MALE	0.75 (19.1)	1.15 (29.2)	1-3/8-12 M36x1.5	1.75 (44.5)	N/A	N/A	N/A	N/A
MC, MA, ML 3650	1.91 (48.5)	7.44 (189)	3.19 (81)												

Model	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	F1	F2	F3	F4	F5
MC, MA, ML 3625	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MC, MA, ML 3650															

Model	F6	F7	F8	F9
MC, MA, ML 3625	N/A	N/A	N/A	N/A
MC, MA, ML 3650				

Specifications...MC Series, Self-Compensating

Model	Effective Weight lbs (kg)	We	E_3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E_4 Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MC 3325-1 MC 3325-2 MC 3325-3 MC 3325-4	20-80 68-272 230-920 780-3,120	(9-36) (31-123) (104-417) (354-1,415)	1,350 (153)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.00 (0.45)
MC 3350-1 MC 3350-2 MC 3350-3 MC 3350-4	40-160 136-544 460-1,840 1,560-6,240	(18-73) (62-247) (209-835) (708-2,830)	2,700 (305)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.2 (0.54)
MC 3625-1 MC 3625-2 MC 3625-3 MC 3625-4	20-80 68-272 230-920 780-3,120	(9-36) (31-123) (104-417) (354-1,415)	1,350 (153)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.23 (0.56)
MC 3650-1 MC 3650-2 MC 3650-3 MC 3650-4	40-160 136-544 460-1,840 1,560-6,240	(18-73) (62-247) (209-835) (708-2,830)	2,700 (305)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.51 (0.68)

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

Specifications...MA Series, Adjustable

MA 3325	20-3,800	(9-1,724)	1,500 (169)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.0 (0.45)
MA 3350	28-5,400	(13-2,449)	3,000 (339)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.2 (0.54)
MA 3625	20-3,800	(9-1,724)	1,500 (169)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.23 (0.56)
MA 3650	28-5,400	(13-2,449)	3,000 (339)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.51 (0.68)

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

Specifications...ML Series, Low velocity Adjustable

ML 3325	1,500 (169)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.00 (0.45)
ML 3350	3,000 (339)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.2 (0.54)
ML 3625	1,500 (169)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.23 (0.56)
ML 3650	3,000 (339)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.51 (0.68)

Impact velocity range: 0.06 to 1.5 ft/sec (0.02 to 0.46 m/sec).

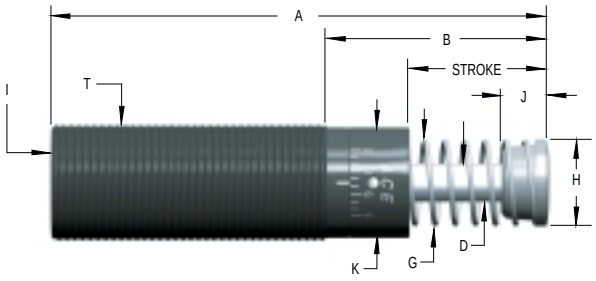
Note: ACE Controls recommends that side load not exceed 5°. Maximum side load depends on application. For additional information consult ACE's Applications Department.

See page 45 for ordering information.

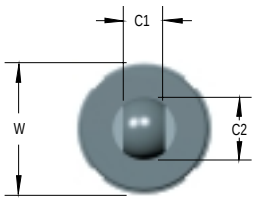
*ACE Controls Inc. · **800-521-3320** · **(248) 476-0213** · Fax (248) 476-2470 · www.acecontrols.com · email: shocks@acecontrols.com*

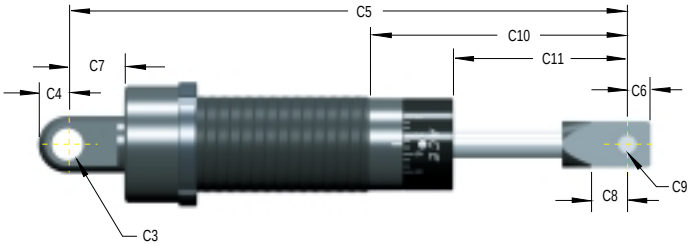
Primary Mount

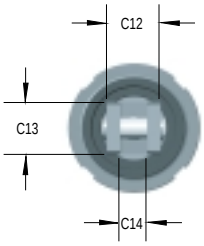
Adjuster (MA and ML only)



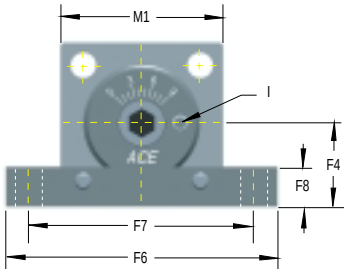
Clevis Mount

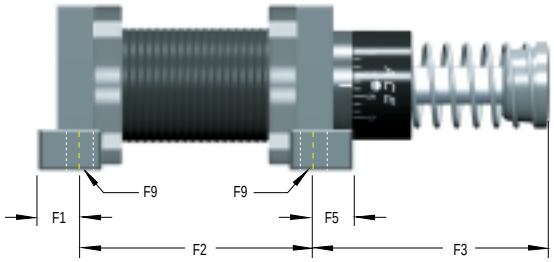






Side-Foot Mount





45 Model Dimensions in inches (millimeters)

Model	Stroke	A	B	D	G	H	I*	J	K	T	W	C1	C2	C3	C4
MC, MA, ML 4525	0.91 (23.1)	5.69 (144.5)	1.97 (50)												
MC, MA, ML 4550	1.91 (48.5)	7.69 (195.3)	2.97 (75.4)	0.50 (12.7)	1.36 (34.5)	1.38 (34.9)	1/8 NPT	0.87 (22.1)	1.65 (41.9)	1-3/4-12 M45x1.5	2.25 (57.20)	0.75 (19.1)	1.00 (25.4)	.5005 (12.7)	0.50 (12.7)
MC, MA 4575	2.91 (73.9)	9.69 (246.1)	3.97 (100.8)												

Model	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	F1	F2	F3	F4	F5
MC, MA, ML 4525	7.85 (199.4)					2.57 (65.3)	1.51 (38.4)					3.50 (88.9)	1.94 (49.3)		
MC, MA, ML 4550	9.85 (250.2)	0.50 (12.7)	1.06 (26.9)	0.69 (17.5)	.3755 (9.6)	3.57 (90.7)	2.51 (63.8)	1.00 (25.4)	1.00 (25.4)	.505 (12.8)	0.50 (12.7)	4.38 (111.8)	3.06 (77.7)	1.16 (29.5)	0.37 (9.5)
MC, MA 4575	11.85 (301)					4.57 (116.1)	3.51 (89.2)					5.38 (137.8)	4.06 (103.1)		

Model	F6	F7	F8	F9
MC, MA, ML 4525				
MC, MA, ML 4550	3.75 (95.3)	3.00 (76.2)	0.56 (14.2)	0.35 (8.9)
MC, MA 4575				

***For models MAA and MAS 33 the 1/8-27 female fitting is shipped with the shock. MAA and MAS 45 and 64 have pipe plugs.**

Specifications...MC Series, Self-Compensating

Model	We Effective Weight lbs (kg)		E_3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E_4 Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MC 4525-1	50-200	(23-91)							
MC 4525-2	170-680	(77-300)	3,000	950,000	1,400,000	1,700,000	15.1-22.8	0.03	2.5
MC 4525-3	575-2,300	(261-1,043)	(339)	(107,000)	(158,000)	(192,000)	(67-101)		(1.13)
MC 4525-4	1,950-7,800	(885-3,538)							
MC 4550-1	100-400	(45-181)							
MC 4550-2	340-1,360	(154-617)	6,000	1,000,000	1,700,000	2,200,000	15.1-32.2	0.08	3.0
MC 4550-3	1,150-4,600	(522-2,087)	(678)	(112,000)	(192,000)	(248,000)	(67-143)		(1.36)
MC 4550-4	3,900-15,600	(1,769-7,076)							
MC 4575-1	150-600	(136-544)							
MC 4575-2	510-2,040	(231-925)	9,000	1,300,000	2,000,000	2,500,000	11.7-40.3	0.11	3.5
MC 4575-3	1,730-6,920	(785-3,139)	(1,017)	(146,000)	(225,000)	(282,000)	(52-179)		(1.59)
MC 4575-4	5,850-23,400	(2,654-10,614)							

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

Specifications...MA Series, Adjustable

MA 4525	95-22,000	(43-9,979)	3,450 (390)	950,000 (107,000)	1,400,000 (158,000)	1,700,000 (192,000)	15.1-22.8 (67-101)	0.03	2.5 (1.13)
MA 4550	150-32,000	(68-14,515)	6,900 (780)	1,000,000 (112,000)	1,700,000 (192,000)	2,200,000 (248,000)	15.1-32.2 (67-143)	0.08	3.0 (1.36)
MA 4575	155-33,000	(70-14,968)	10,350 (1,169)	1,300,000 (146,000)	2,000,000 (225,000)	2,500,000 (282,000)	11.7-40.3 (52-179)	0.11	3.5 (1.59)

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

Specifications...ML Series, Low velocity Adjustable

ML 4525	3,450 (390)	950,000 (107,000)	1,400,000 (158,000)	1,700,000 (192,000)	15.1-22.8 (67-98)	0.03	2.5 (1.13)
ML 4550	6,900 (780)	1,000,000 (112,000)	1,700,000 (192,000)	2,200,000 (248,000)	15.1-32.2 (67-143)	0.08	3.0 (1.36)

Impact velocity range: 0.06 to 1.5 ft/sec (0.02 to 0.46 m/sec).

Note: A side port can be adapted to Magnum 45 MAA, MLA and MCA models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.5 inches (12.7 mm) in the area of the ring. The side port centerline is located 1.04 inches (26.4 mm) from the front of the outer tube. Add (-P) to the model ordering code if a side port is desired, see page 45.

Note: ACE Controls recommends that side load not exceed 5°. Maximum side load depends on application. For additional information consult ACE's Applications Department.

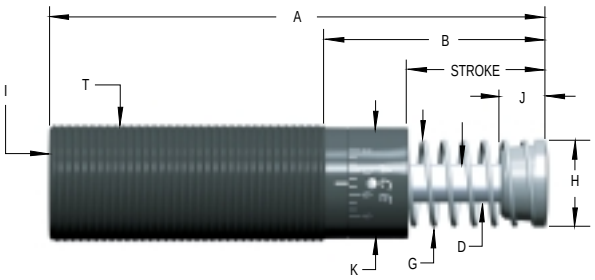
Lock nut included with each shock absorber. See page 43 for dimensions.

See page 45 for ordering information.

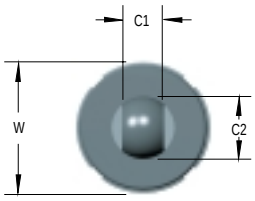
Note: All dimensions and tolerance values listed in this catalog are nominal and subject to change without prior notice.

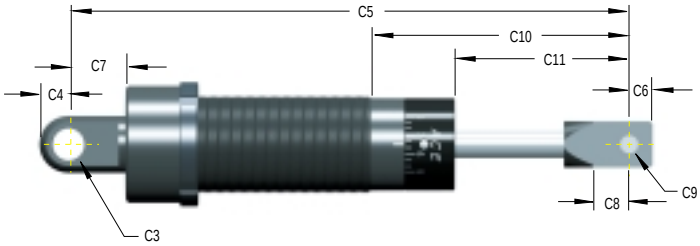
Primary Mount

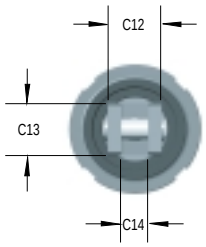
Adjuster (MA and ML only)



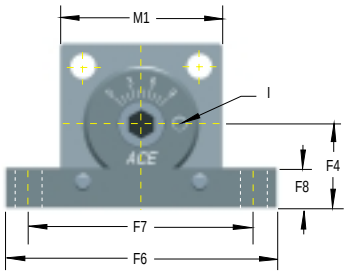
Clevis Mount

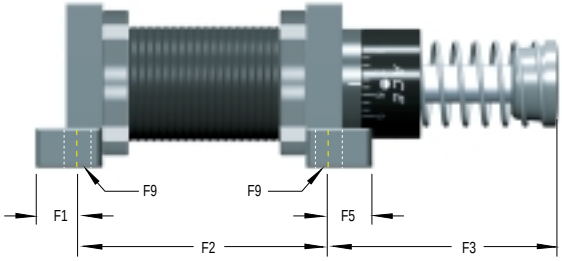






Side-Foot Mount





64 Model Dimensions in inches (millimeters)

Model		Stroke	A	B	D	G	H	I*	J	K	T	W	C1	C2	C3	C4
ML	6425	0.91 (23.1)	6.85 (174)	2.35 (59.7)												
MC, MA, ML	6450	1.91 (48.6)	8.85 (224.8)	3.35 (85.1)												
MC, MA	64100	3.91 (99.4)	12.85 (326.4)	5.35 (135.9)	0.75 (19.1)	1.86 (47.2)	1.90 (48.3)	1/4 NPT	1.06 (26.9)	2.37 (60.2)	2-1/2-12 M64x2	3.00 (76.20)	1.25 (31.8)	1.50 (38.1)	.7505 (19.1)	0.75 (19.1)
MC, MA	64150	5.91 (150.1)	17.73 (450.4)	8.23 (209)		2.31 (58.7)	2.38 (60.3)		1.25 (31.8)							
MCA, MAA	64150	5.91 (150.1)	17.60 (447)	8.10 (205.7)		N/A	1.90 (48.3)		1.06 (26.9)			N/A	N/A	N/A	N/A	N/A

Model		C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	F1	F2	F3	F4	F5
ML	6425	10.12 (257.1)					3.75 (95.2)	2.31 (58.7)					4.00 (101.6)	2.56 (65.0)		
MC, MA, ML	6450	12.12 (307.9)					4.75 (120.7)	3.31 (84.1)					5.00 (127.0)	3.56 (90.4)		
MC, MA	64100	16.12 (409.5)	0.63 (16.0)	1.29 (32.8)	1.40 (35.6)	.7505 (19.1)	6.75 (171.5)	5.31 (134.9)	1.50 (38.1)	1.25 (31.8)	.625 (15.9)	0.69 (17.5)	7.00 (177.8)	5.56 (141.2)	1.78 (45.2)	0.69 (17.5)
MC, MA	64150	20.87 (530.1)					9.50 (241.3)	8.06 (204.7)					9.00 (228.6)	8.44 (214.4)		
MCA, MAA	64150	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			8.31 (211.1)		

Model		F6	F7	F8	F9
ML	6425				
MC, MA, ML	6450				
MC, MA	64100	5.62 (142.8)	4.88 (124.0)	0.75 (19.1)	0.42 (10.7)
MC, MA	64150				
MCA, MAA	64150				

Specifications...MC Series, Self-Compensating

Model	We Effective Weight lbs (kg)		E_3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E_4 Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MC 6450-1	300-1,200	(136-544)							
MC 6450-2	1,020-4,080	(463-1,851)	15,000	1,300,000	2,600,000	3,400,000	20.1-34.9	0.12	6.4
MC 6450-3	3,460-13,840	(1,569-6,278)	(1,695)	(146,000)	(293,000)	(384,000)	(89-155)		(2.90)
MC 6450-4	11,700-46,800	(5,307-21,228)							
MC 64100-1	600-2,400	(272-1,089)							
MC 64100-2	2,040-8,160	(925-3,701)	30,000	1,700,000	3,400,000	4,400,000	23.5-61	0.34	8.15
MC 64100-3	6,920-27,680	(3,139-12,556)	(3,390)	(192,000)	(384,000)	(497,000)	(104-271)		(3.70)
MC 64100-4	23,400-93,600	(10,614-42,457)							
MC 64150-1	900-3,600	(408-1,633)							
MC 64150-2	3,060-12,240	(1,388-5,552)	45,000	2,200,000	4,400,000	5,700,000	16.9-82.2	0.48	11.25
MC 64150-3	10,380-41,520	(4,708-18,833)	(5,084)	(248,000)	(497,000)	(644,000)	(75-366)		(5.10)
MC 64150-4	35,100-140,400	(15,921-63,685)							

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

Specifications...MA Series, Adjustable

MA 6450	480-110,000	(218-49,895)	18,000 (2,034)	1,300,000 (146,000)	2,600,000 (293,000)	3,400,000 (384,000)	20.1-34.9 (89-155)	0.12	6.4 (2.90)
MA 64100	600-115,000	(272-52,163)	36,000 (4,067)	1,700,000 (192,000)	3,400,000 (384,000)	4,400,000 (497,000)	23.5-61 (104-271)	0.34	8.15 (3.70)
MA 64150	730-175,000	(331-79,379)	54,000 (6,101)	2,200,000 (248,000)	4,400,000 (497,000)	5,700,000 (644,000)	16.9-82.2 (75-366)	0.48	11.25 (5.10)

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

Specifications...ML Series, Low velocity Adjustable

ML 6425	9,000 (1,017)	1,100,000 (124,000)	2,200,000 (248,000)	2,900,000 (328,000)	26.7-34.9 (119-155)	0.06	5.5 (2.49)
ML 6450	18,000 (2,034)	1,300,000 (146,000)	2,600,000 (293,000)	3,400,000 (384,000)	20.1-34.9 (89-155)	0.12	6.4 (2.90)

Impact velocity range: 0.06 to 1.5 ft/sec (0.02 to 0.46 m/sec).

***For models MAA and MAS 33 the 1/8-27 female fitting is shipped with the shock. MAA and MAS 45 and 64 have pipe plugs. Note: A side port can be adapted to Magnum 64 MAA, MLA and MCA models and is a special adder item. A side port adapter ring is molded onto the outer tube and increases the overall diameter by 0.5 inches (12.7 mm) in the area of the ring. The side port centerline is located 1.47 inches (37.3 mm) from the front of the outer tube. Add (-P) to the model ordering code if a side port is desired, see page 45.**

Note: MA and MC 64150 models include an intregral, non-removable stop block, not a stop collar. Adjustable models can be adjusted from front or rear.
Note: MAA and MCA 64150 models include a stop collar, 0.75 inches (19 mm) longer than the standard 64 model stop collar.

Note: ACE Controls recommends that side load not exceed 5°. Maximum side load depends on application.
For additional information consult ACE's Applications Department.

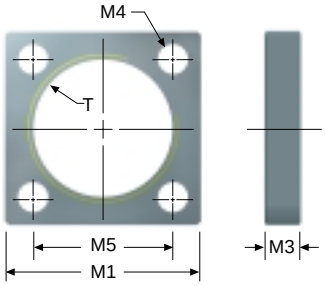
Lock nut included with each shock absorber. See page 43 for dimensions.

See page 45 for ordering information.

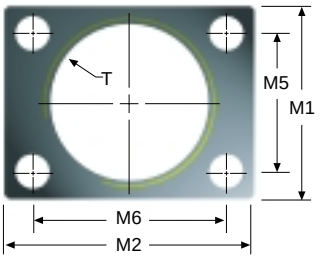
Square and Rectangular Flanges in inches (millimeters)

Used With	Square Flange	Rect Flange	T	M1	M2	M3	M4	M5	M6
MA 33 ML 33 MC 33	N/A	250-0016	1-1/4-12 UNF	1.50 (38.1)	2.00 (50.8)	0.38 (9.5)	.219 (5.6)	1.12 (28.4)	1.62 (41.2)
MA 33M ML 33M MC 33M		250-0293	M33x1.5	1.62 (41.1)	2.12 (53.8)	0.38 (9.5)	.278 (7.1)	1.10 (28.0)	1.65 (42.0)
MA 36 ML 36 MC 36	N/A	250-0633	1-3/8-12 UNF	1.75 (44.4)	2.00 (50.8)	0.38 (9.5)	.219 (5.6)	1.12 (28.4)	1.62 (41.2)
MA 36M ML 36M MC 36M		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MA 45 ML 45 MC 45	250-0023	250-0024	1-3/4-12 UN	2.25 (57.2)	3.00 (76.2)	0.50 (12.7)	0.34 (8.7)	1.62 (41.2)	2.38 (60.5)
MA 45M ML 45M MC 45M	250-0298	250-0299	M45x1.5	2.25 (57.2)	3.00 (76.2)	0.50 (12.7)	0.35 (8.8)	1.62 (41.2)	2.38 (60.5)
MA 64 ML 64 MC 64	250-0028	N/A	2-1/2-12 UN	3.50 (88.9)	N/A	0.62 (15.9)	0.41 (10.4)	2.75 (69.6)	N/A
MA 64M ML 64M MC 64M	250-0302	N/A	M64x2	3.50 (88.9)	N/A	0.62 (15.9)	0.41 (10.4)	2.75 (69.6)	N/A

Square Flange

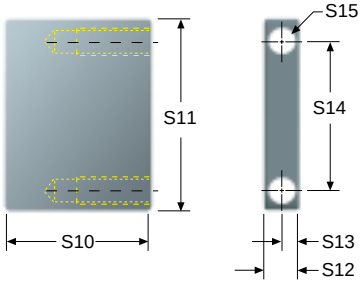


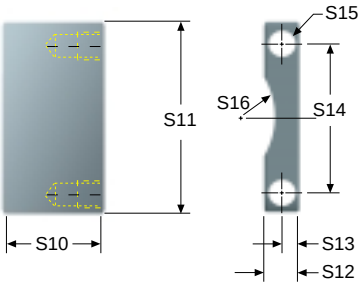
Rectangular Flange



Stop Bars in inches (millimeters)

Used With	Part #	S10	S11	S12	S13	S14	S15	S16
MA 33 ML 33 MC 33	250-0426	1.28 (32.5)	1.50 (38.1)	0.38 (9.7)	0.19 (4.8)	1.12 (28.4)	10-32 UNF	N/A
MA 33M ML 33M MC 33M	250-0427	1.28 (32.5)	1.50 (38.1)	0.38 (9.7)	0.19 (4.8)	1.12 (28.4)	M5x0.8	N/A
MA 36 ML 36 MC 36	250-0426	1.28 (32.5)	1.50 (38.1)	0.38 (9.7)	0.19 (4.8)	1.12 (28.4)	10-32 UNF	N/A
MA 36M ML 36M MC 36M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MA 45 ML 45 MC 45	250-0428	1.03 (26.2)	2.25 (57.2)	0.63 (16.0)	0.31 (7.9)	1.62 (41.3)	5/16-24 UNF	N/A
MA 45M ML 45M MC 45M	250-0639	1.03 (26.2)	2.25 (57.2)	0.63 (16.0)	0.31 (7.9)	1.62 (41.3)	M8x1.25	N/A
MA 6450 MA 64100 ML 6425 ML 6450 MC 6450 MC 64100	250-0430	1.44 (36.5)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	3/8-24 UNF	1.37 (34.8)
MA 6450M MA 64100M ML 6425M ML 6450M MC 6450M MC 64100M	250-0640	1.44 (36.5)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	M10x1.5	1.37 (34.8)
MA 64150 MC 64150	250-0432	2.31 (57.7)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	3/8-24 UNF	1.37 (34.8)
MA 64150M MC 64150M	250-0641	2.31 (57.7)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	M10x1.5	1.37 (34.8)
MAA 64150 MCA 64150	250-0435	2.18 (55.4)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	3/8-24 UNF	1.37 (34.8)
MAA 64150M MCA 64150M	250-0649	2.18 (55.4)	3.50 (88.9)	0.50 (12.7)	0.25 (6.4)	2.75 (69.8)	M10x1.5	1.37 (34.8)





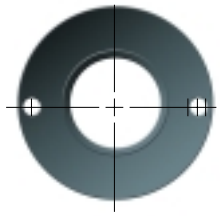
Hard metric stop bars available upon request.

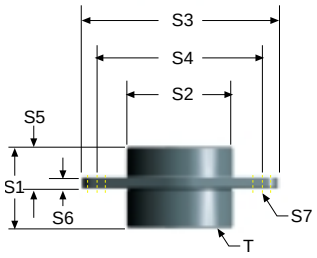
Stop bars come in pairs, two bars per package.

Flanged Stop Collars

in inches (millimeters)

Used With	Part #	T	S1	S2	S3	S4	S5	S6	S7
MA 33 ML 33 MC 33	250-0070	1-1/4-12 UNF	2.00 (50.8)	1.50 (38.1)	2.50 (63.5)	2.00 (50.8)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 33M ML 33M MC 33M	250-0071	M33x1.5	2.00 (50.8)	1.50 (38.1)	2.50 (63.5)	2.00 (50.8)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 36 ML 36 MC 36 MA 36M ML 36M MC 36M	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MA 45 ML 45 MC 45	250-0072	1-3/4-12 UN	1.85 (47.0)	2.25 (57.2)	3.25 (82.6)	2.75 (69.9)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 45M ML 45M MC 45M	250-0073	M45x1.5	1.85 (47.0)	2.25 (57.2)	3.25 (82.6)	2.75 (69.9)	0.88 (22.4)	0.25 (6.4)	0.282 (7.16)
MA 6450 MA 64100 ML 6425 ML 6450 MC 6450 MC 64100	250-0074	2-1/2-12 UN	2.25 (57.2)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)
MA 6450M MA 64100M ML 6425M ML 6450M MC 6450M MC 64100M	250-0075	M64x2	2.25 (57.2)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)
MA 64150 MC 64150	250-0076	2-1/2-12 UN	3.13 (79.4)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)
MA 64150M MC 64150M	250-0077	M64x2	3.13 (79.4)	3.00 (76.2)	4.25 (108.0)	3.50 (88.9)	1.00 (25.4)	0.38 (9.7)	0.282 (7.16)

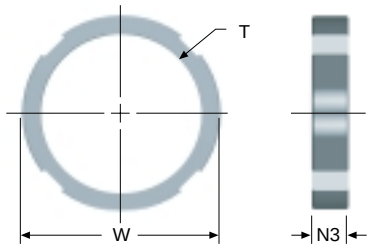




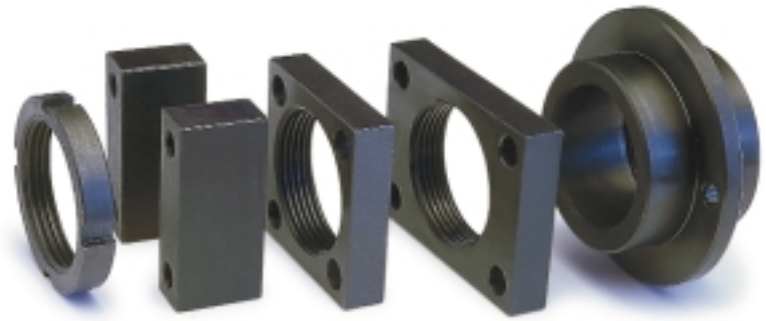
Lock Nuts

in inches (millimeters)

Used With	Part #	T	W	N3
MA 33 ML 33 MC 33	250-0038	1-1/4-12 UN	1.50 (38.1)	0.25 (6.4)
MA 33M ML 33M MC 33M	250-0292	M33x1.5	1.56 (39.6)	0.25 (6.4)
MA 36 ML 36 MC 36	250-0631	1-3/8-12 UNF	1.75 (44.5)	0.25 (6.4)
MA 36M ML 36M MC 36M	250-0537	M36x1.5	1.75 (44.5)	0.25 (6.4)
MA 45 ML 45 MC 45	250-0041	1-3/4-12 UN	2.25 (57.2)	0.37 (9.4)
MA 45M ML 45M MC 45M	250-0297	M45x1.5	2.25 (57.2)	0.37 (9.4)
MA 64 ML 64 MC 64	250-0042	2-1/2-12 UN	3.00 (76.2)	0.37 (9.4)
MA 64M ML 64M MC 64M	250-0301	M64x2	3.00 (76.2)	0.37 (9.4)



One lock nut included with each shock absorber where appropriate.



Side-Foot Mount Assembly

Used With	Part #
MA 33 ML 33 MC 33	250-0015
MA 33M ML 33M MC 33M	250-0294
MA 36 ML 36 MC 36	N/A
MA 36M ML 36M MC 36M	N/A
MA 45 ML 45 MC 45	250-0025
MA 45M ML 45M MC 45M	250-0300

Used With	Part #
MA 6450 MA 64100 ML 6425 ML 6450 MC 6450 MC 64100	250-0030
MA 6450M MA 64100M ML 6425M ML 6450M MC 6450M MC 64100M	250-0304
MA 64150 MC 64150	250-0030
MA 64150M MC 64150M	250-0304

Note: See pages 36, 38 and 40 for Magnum Group side-foot mount drawings and dimensions.

Clevis Mount Assembly

Used With	Part #
MA 33 ML 33 MC 33 MAS MLS MCS	250-0225
MA 33M ML 33M MC 33M MAS 33M MLS 33M MCS 33M	250-0323
MAN 33 MLN 33 MCN 33 MAA 33 MLA 33 MCA 33	250-0018
MAN 33M MLN 33M MCN 33M MAA 33M MLA 33M MCA 33M	250-0322
MA 45 ML 45 MC 45	250-0324
MA 45M ML 45M MC 45M	250-0325

Used With	Part #
ML 6425	250-0625
ML 6425M	250-0626
MA 6450 ML 6450 MC 6450	250-0625
MA 6450M ML 6450M MC 6450M	250-0626
MA 64100 MC 64100	250-0625
MA 64100M MC 64100M	250-0626
MAN 64150 MCN 64150 MAA 64150 MCA 64150	250-0625
MAN 64150M MCN 64150M MAA 64150M MCA 64150M	250-0626
MA 64150 MCA 64150 MAS 64150 MCS 64150	250-0627
MA 64150M MCA 64150M MAS 64150M MCS 64150M	250-0628

Note: See pages 36, 38 and 40 for Magnum Group clevis mount drawings and dimensions.

MC Series, Self-Compensating

MC 3325 - 1 C

Return Method and Accumulator Style
MC = Self-Contained Spring Return, Internal Accumulator
MCA = Air Return, External Accumulator
MCS = Spring Return, External Accumulator
MCN = Self Return (Clevis), Internal Accumulator

Model Number
3325 4525 6450
3350 4550 64100
3625 4575 64150
3650

Mounting Thread
- Standard
M Metric

Effective Weight
-1 Light Range
-2 Medium Range
-3 Heavy Range
-4 Heavier Range

Mounting Options
Standard Mount
Flanged Stop Collar
Rectangular Flange*
Square Flange*
-C Clevis Mount**
-S Side-Foot Mount**
-P Side Port
-Z Within Air Cylinder
* Welded versions available upon request.
**Not available on MC 3625 and 3650 models.

MA Series, Adjustable

MA 3325 - C

Return Method and Accumulator Style
MA = Self-Contained Spring Return, Internal Accumulator
MAA = Air Return, External Accumulator
MAS = Spring Return, External Accumulator
MAN = Self Return (Clevis), Internal Accumulator

Model Number
3325 4525 6450
3350 4550 64100
3625 4575 64150
3650

Mounting Thread
- Standard
M Metric

Mounting Options
Standard Mount
Flanged Stop Collar
Rectangular Flange*
Square Flange*
-C Clevis Mount**
-S Side-Foot Mount**
-P Side Port
-Z Within Air Cylinder
* Welded versions available upon request.
**Not available on MA 3625 and 3650 models.

ML Series, Low Velocity Adjustable

ML 3325 - C

Return Method and Accumulator Style
ML = Self-Contained Spring Return, Internal Accumulator
MLA = Air Return, External Accumulator
MLS = Spring Return, External Accumulator
MLN = Self Return (Clevis), Internal Accumulator

Model Number
3325 4525 6425
3350 4550 6450
3625
3650

Mounting Thread
- Standard
M Metric

Mounting Options
Standard Mount
Flanged Stop Collar
Rectangular Flange*
Square Flange*
-C Clevis Mount**
-S Side-Foot Mount**
-P Side Port
-Z Within Air Cylinder
* Welded versions available upon request.
**Not available on ML 3625 and 3650 models.

Note: Poly pad available on 33 models only...part no. 250-0011.
Note: Flanges and flanged stop collars are packaged separately from shock absorbers.

ACE 1-1/2" bore series shock absorbers are designed for the toughest environments. These durable adjustable models provide outstanding deceleration over a wide range of effective weight conditions. Large energy capacities stop heavy loads set into motion by high propelling forces, without damage.

Applications include: Automotive manufacturing and production equipment, large robotics, heavy conveyors, foundries and steel industry equipment.

Technical Data

Impact velocity range: 0.5 to 15 ft/sec (0.15 to 4.5 m/sec)

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

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

Oil type: American 46

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

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

Hard impact at the start of stroke-turn adjuster toward 9.
Hard set-down at the end of stroke-turn adjuster toward 0.

Poly pad: Optional

Specifications

	We	E_3	Energy per Hour in lbs/hour (Nm/hour) E_4				
Model	**Effective Weight lbs (kg)**	**Energy per Cycle in lbs (Nm)**	**Internal Accumulator (Self-Contained)**	**External Accumulator (A/O) Tank**	**Return Force lbs (N)**	**Return Time sec**	**Shipping Weight lbs (kg)**
1-1/2 x 2	430 - 70,000 (195 - 31,750)	16,000 (1,800)	3,200,000 (361,550)	4,000,000 (451,900)	34.9 - 47.6 (155 - 210)	.10	16.4 (7.44)
1-1/2 x 3-1/2	480 - 80,000 (218 - 36,280)	28,000 (3,160)	5,600,000 (632,700)	7,000,000 (790,890)	25.4 - 47.6 (113 - 210)	.25	19.4 (8.80)
1-1/2 x 5	500 - 90,000 (227 - 40,800)	40,000 (4,500)	8,000,000 (903,870)	10,000,000 (1,129,840)	20.7 - 52.5 (92 - 230)	.40	22.7 (10.30)
1-1/2 x 6-1/2	680 - 100,000 (308 - 45,350)	52,000 (5,870)	10,400,000 (1,175,000)	13,000,000 (1,468,800)	20.7 - 97.4 (92 - 430)	.40	25.0 (11.34)

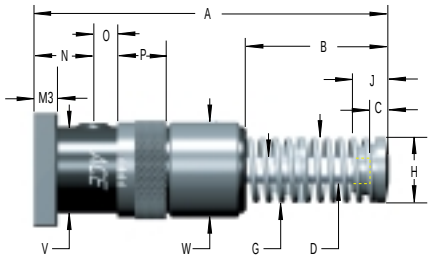
Ordering Information

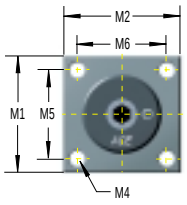
A 1-1/2 x 6-1/2 - F

Return Method and Accumulator Style	Bore Size	Stroke Length	Mounting Style
A = Spring Return, Internal Accumulator	1-1/2	2	-F Front Flange
AA = Air Return, External Accumulator		3-1/2	-R Rear Flange
SA = Spring Return, External Accumulator		5	-RF Front Rectangular Flange
NA = Self (Clevis) Return, Internal Accumulator		6-1/2	-RR Rear Rectangular Flange
			-S Side Foot Mount
			-C Clevis Mount

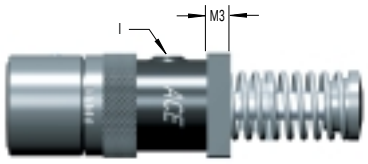
Note: All body mounting hardware welded in place.

Rear Flange

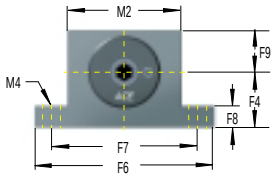


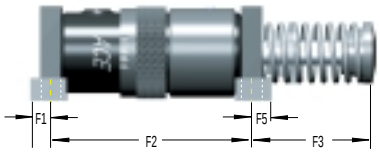


Front Flange

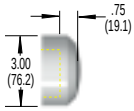


Side-Foot Mount



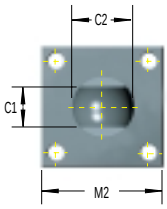


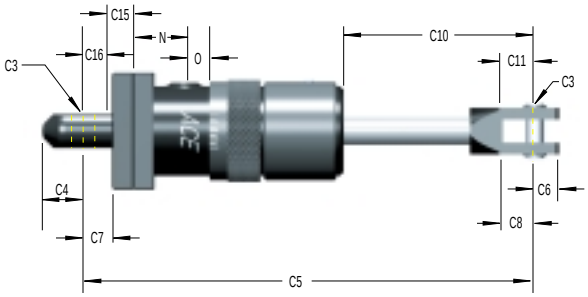
Poly Pad

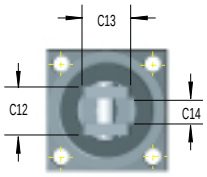


Part No. 250-0003

Clevis Mount







1-1/2" Bore Series Dimensions in inches (millimeters)

Size	Stroke	A	B	C	D	G	H	I	J	N	O	P	V	W	C1	C2	C3	C4	C5	C6	C7
1-1/2 x 2	2.00 (50.8)	9.69 (246.1)	4.13 (104.8)							1.38 (35.0)	0.28 (7.1)								12.94 (328.6)		
1-1/2 x 3-1/2	3.50 (88.9)	12.69 (322.3)	5.63 (142.9)	0.81 (20.6)	1.00 (25.4)	2.69 (68.3)	2.75 (69.9)	1/2 NPT	1.38 (35.1)	2.00 (50.8)	0.28 (7.1)	1.25 (31.8)	3.00 (76.2)	4.00 (101.6)	1.25 (31.8)	1.50 (38.1)	0.7525 (19.11)	0.75 (19.1)	15.97 (405.6)	0.63 (16.0)	1.25 (31.8)
1-1/2 x 5	5.00 (127.0)	15.69 (398.5)	7.13 (181.0)							2.00 (50.8)	1.03 (26.2)								18.97 (481.8)		
1-1/2 x 6-1/2	6.50 (165.1)	19.44 (493.7)	9.38 (238.1)							2.00 (50.8)	1.78 (45.2)								22.72 (577.1)		

Size	C8	C10	C11	C12	C13	C14	C15	C16	F1	F2	F3	F4	F5	F6	F7	F8	F9	M1	M2	M3	M4	M5	M6
1-1/2 x 2		5.41 (137.3)								**5.18 (131.6)	**4.31 (109.5)												
1-1/2 x 3-1/2	1.41 (35.7)	6.91 (175.4)	1.40 (35.6)	1.50 (38.1)	1.25 (31.8)	5/8	0.94 (23.9)	1.06 (27.0)	0.63 (15.9)	6.69 (169.9)	5.81 (147.6)	2.00 (50.8)	0.63 (16.0)	6.50 (165.1)	5.50 (139.7)	0.75 (19.1)	2.03 (51.6)	4.00 (101.6)	4.00 (101.6)	0.75 (19.0)	0.53 (13.5)	3.00 (76.2)	3.00 (76.2)
1-1/2 x 5		8.41 (213.5)								8.19 (208.0)	7.31 (185.7)												
1-1/2 x 6-1/2		10.66 (270.7)								9.69 (246.1)	9.56 (242.8)							* 5.00 (127.0)				* 4.00 (101.6)	

*Rectangular flange dimension
**Note: 1-1/2 x 2 shock absorbers available with side-foot mount in AA and SA models only.

ACE's durable CA 2, CA 3 and 4" Bore Series of self-compensating shock absorbers are designed for extremely heavy duty applications and provide smooth deceleration under changing conditions. High energy capacities combined with wide effective weight ranges qualify these units to perform in the most demanding environments.

The new **CA 2 offers up to 170% of the energy per cycle capacity** of former models. The rugged new **CA 3 offers up to 125% of the energy capacity** of former models. You can select the correct model for your application by utilizing the ACESIZE sizing program or the capacity charts. Replacing existing shock absorbers with the new CA Series is easy-just provide us the type and adjustment setting of your existing units and we will, do the rest. These dependable units are available self-contained or for use with an external air/oil tank.

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

Technical Data

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

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

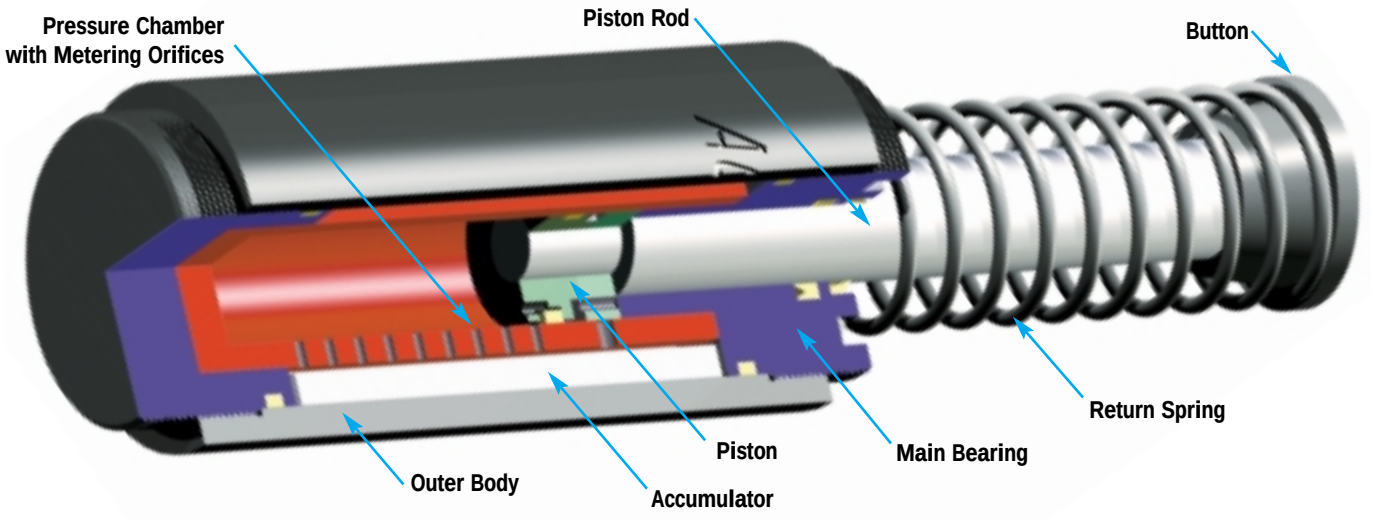
Mechanical stop:
2", 3" bore: Must be provided .09 inch (2.3 mm) before end of stroke.
4" bore: Must be provided 0.09 inch (2.3mm) before end of stroke.
Oil type: ATF

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

Note: See pages 54 and 55 for CA 4" Bore dimensions and specifications.

Heavy Industrial Shock Absorbers CA 2 to CA 4
Self-Compensating

Illustration depicts CA 2 and CA 3 design only.



ACE's rugged A2 and A3 Series adjustable shock absorbers are capable of decelerating heavy duty loads. These reliable units replace the former 2" and 3" large bore adjustable shock absorbers.

Energy capacity ratings are 228% of former models. In addition, effective weight ranges have increased dramatically, resulting in the capability of handling a wider range of applications and increases in velocity. The units are easily adjusted by means of a 5/16 inch (8 mm) hex socket adjuster located at the bottom of the outer body. These dependable shock absorbers are maintenance free and are available self-contained or for use with an external air/oil tank.

Features include a considerably reduced outer diameter, internal accumulator and threaded mounting brackets, easily adaptable to the front or rear of the outer body.

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

Technical Data

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

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

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

Oil type: ATF

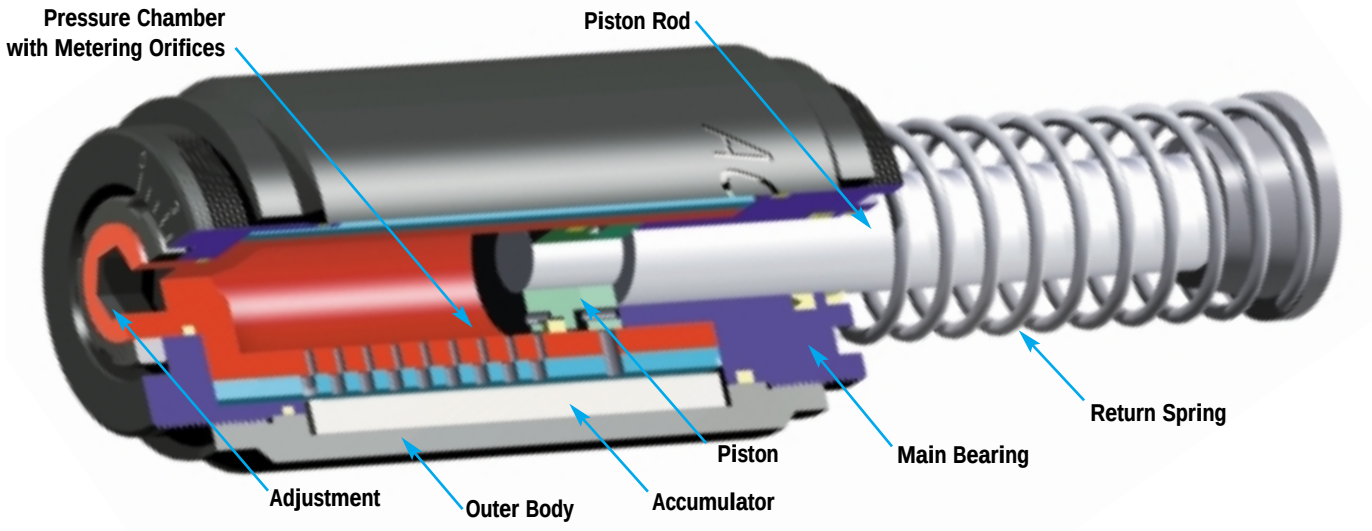
Materials: Steel body with black oxide finish. Piston rod high tensile steel, hardened and chrome plated. Return spring zinc plated. To avoid reducing heat dissipation, do not paint.

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

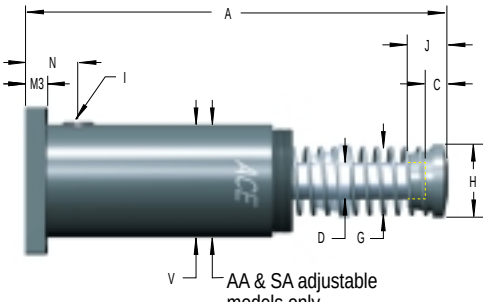
Hard impact at the start of stroke-turn adjuster toward 9.

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

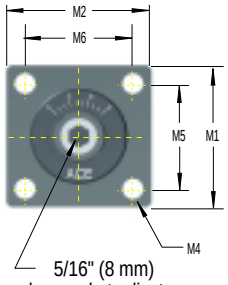
Heavy Industrial Shock Absorbers A 2 and A 3 *Adjustable*



Rear Flange

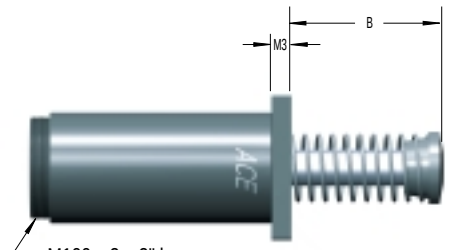


AA & SA adjustable models only
4.25 (108.0 mm) — 2" bore
5.50 (139.7 mm) — 3" bore



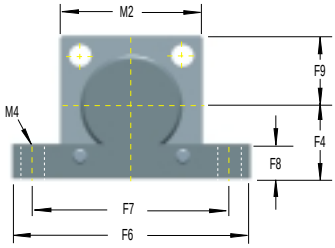
5/16" (8 mm) hex socket adjuster adjustable models only

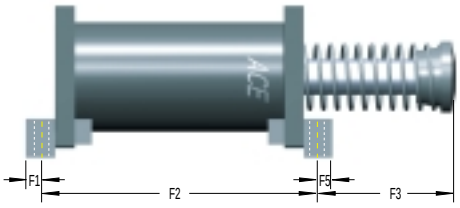
Front Flange



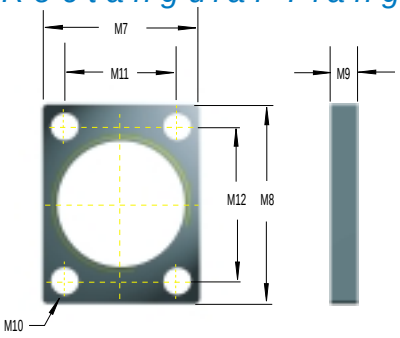
M100 x 2 – 2" bore
M130 x 2 – 3" bore

2" Bore Foot Mount

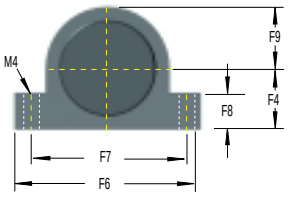


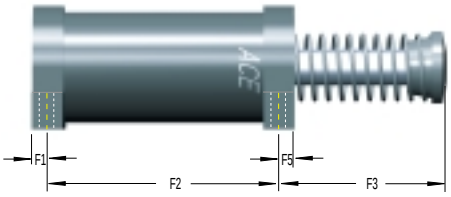


Rectangular Flange

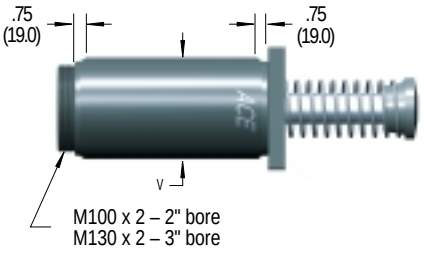


3" Bore Foot Mount



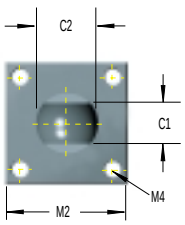


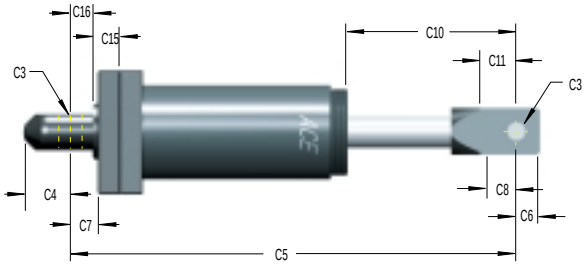
(A) Adjustable
2" & 3" Bore Models

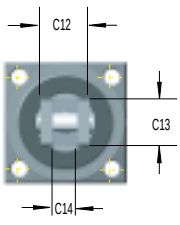


M100 x 2 – 2" bore
M130 x 2 – 3" bore

Clevis Mount







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

Size	Stroke	A	B	C	D	G	H	I	J	N	V	C1	C2	C3	C4	C5	C6	C7	C8	C10	C11
CA 2x2 A 2x2	2.00 (50.8)	12.31 (312.7)	4.31 (109.5)	0.82 (20.8)		3.06 (77.7)	2.75 (69.9)		1.38 (35.1)							17.00 (431.8)				6.05 (153.7)	2.06 (52.3)
CA 2x4 A 2x4	4.00 (101.6)	16.31 (414.0)	6.31 (160.3)	0.82 (20.8)		3.06 (77.7)	2.75 (69.9)		1.38 (35.1)		CA 4.25 (108.0)					21.00 (533.4)				8.05 (204.4)	2.06 (52.3)
CA 2x6 A 2x6	6.00 (152.4)	20.31 (515.9)	8.31 (211.1)	0.82 (20.8)	1.38 (35.1)	3.63 (92.2)	2.75 (69.9)	3/4 NPT	1.38 (35.1)	3.50 (88.9)		1.50 (38.1)	2.25 (57.2)	1.005 (25.5)	1.00 (25.4)	25.00 (635)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	10.05 (255.2)	2.06 (52.3)
CA 2x8 A 2x8	8.00 (203.2)	25.31 (642.9)	11.31 (287.3)	1.82 (46.2)		4.00 (101.6)	3.63 (92.2)		2.38 (60.5)		A* 4.63 (118.0)					29.00 (736.6)				12.05 (306.1)	0.75 (19)
CA 2x10 A 2x10	10.00 (254)	29.31 (744.5)	13.31 (338.1)	1.82 (46.2)		4.50 (114.3)	4.25 (108.0)		2.38 (60.5)							33.00 (838.2)				14.05 (356.9)	1.06 (26.9)
CA 3x5 A 3x5	5.00 (127)	19.25 (489.0)	8.25 (209.6)			4.75 (120.7)					CA 5.50 (139.7)					23.00 (584.2)				9.05 (229.9)	
CA 3x8 A 3x8	8.00 (203.2)	25.25 (641.4)	11.25 (285.8)	2.00 (50.8)	1.75 (44.5)	4.75 (120.7)	4.38 (111.3)	3/4 NPT	2.75 (69.9)	3.13 (79.5)	A* 6.00 (152.4)	1.50 (38.1)	2.25 (57.2)	1.01 (25.5)	1.00 (25.4)	29.00 (736.6)	1.00 (25.4)	2.00 (50.8)	1.50 (38.1)	12.05 (306.1)	1.12 (28.4)
CA 3x12 A 3x12	12.00 (304.8)	35.03 (889.8)	17.03 (432.6)			4.84 (122.9)										38.78 (985)				17.83 (452.9)	

Size	Stroke	C12	C13	C14	C15	C16	F1	F2	F3	F4	F5	F6	F7	F8	F9	M1	M2	M3	M4	M5	M6
CA 2x2 A 2x2	2.00 (50.8)							9.5 (241.3)	3.44 (87.4)												
CA 2x4 A 2x4	4.00 (101.6)							11.5 (292.1)	5.44 (138.2)												
CA 2x6 A 2x6	6.00 (152.4)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	0.63 (16.0)	13.5 (342.9)	7.44 (189.0)	3.13 (79.5)	0.63 (16.0)	8.00 (203.2)	6.50 (165.1)	1.50 (38.1)	2.75 (69.9)	5.50 (139.7)	5.50 (139.7)	0.75 (19.1)	0.66 (16.8)	4.38 (111.3)	4.38 (111.3)
CA 2x8 A 2x8	8.00 (203.2)							15.5 (393.7)	10.44 (265.2)												
CA 2x10 A 2x10	10.00 (254)							17.5 (444.5)	12.44 (316.0)												
CA 3x5 A 3x5	5.00 (127)							10.25 (260.4)	8.50 (215.9)												
CA 3x8 A 3x8	8.00 (203.2)	3.5 (88.9)	2.00 (50.8)	1.50 (38.1)	1.25 (31.8)	1.75 (44.5)	1.00 (25.4)	13.25 (336.6)	11.50 (292.1)	3.15 (80.0)	1.00 (25.4)	10.00 (254.0)	8.50 (215.9)	1.73 (43.9)	3.15 (80.0)	6.00 (152.4)	6.50 (165.1)	1.00 (25.4)	0.66 (16.8)	4.88 (124.0)	5.38 (136.7)
CA 3x12 A 3x12	12.00 (304.8)							17.25 (438.2)	17.28 (438.9)												

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

* See rear flange illustration on page 50 for AA and SA model dimensions.

Specifications Self-Compensating Models

Model	Effective Weight lbs (kg) We		Energy per Cycle in lbs (Nm) E_3	Energy per Hour in lbs/hour (Nm/hour) Internal Accumulator (Self-Contained) E_4	External Accumulator (A/O Tank) E_4	A/O Tank (Re-circulating) E_4	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
CA 2 x 2-1	1,600-4,800	(726-2,177)							
CA 2 x 2-2	4,000-12,000	(1,814-5,443)							
CA 2 x 2-3	10,000-30,000	(4,536-13,608)	32,000 (3,616)	9,600,000 (1,084,650)	12,000,000 (1,355,820)	15,600,00 (1,762,564)	48-63 (214-280)	0.25	28.2 (12.79)
CA 2 x 2-4	25,000-75,000	(11,340-34,019)							
CA 2 x 4-1	3,200-9,600	(1,452-4,354)							
CA 2 x 4-2	8,000-24,000	(3,629-10,886)							
CA 2 x 4-3	20,000-60,000	(9,072-27,216)	64,000 (7,231)	12,000,000 (1,355,820)	15,000,000 (1,694,770)	19,500,00 (2,203,200)	34-63 (151-280)	0.50	32.6 (14.79)
CA 2 x 4-4	50,000-150,000	(22,680-68,039)							
CA 2 x 6-1	4,800-14,400	(2,117-6,532)							
CA 2 x 6-2	12,000-36,000	(5,443-16,329)							
CA 2 x 6-3	30,000-90,000	(13,608-40,823)	96,000 (10,847)	14,400,000 (1,626,980)	18,000,000 (2,033,730)	23,500,000 (2,655,140)	34-90 (151-400)	0.60	37.2 (16.87)
CA 2 x 6-4	75,000-225,000	(34,019-102,058)							

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

Specifications Continued Self-Compensating Models

Model	Effective Weight lbs (kg)		We Energy per Cycle in lbs (Nm) E_3	Energy per Hour in lbs/hour (Nm/hour) E_4 Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	A/O Tank (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
CA 2 x 8-1	6,400-19,200	(2,903-8,709)							
CA 2 x 8-2	16,000-48,000	(7,257-21,772)							
CA 2 x 8-3	40,000-120,000	(18,144-54,431)	128,000 (14,462)	16,800,000 (1,898,150)	21,000,000 (2,372,680)	27,000,00 (3,050,590)	51-144 (227-641)	0.70	42.6 (19.32)
CA 2 x 8-4	100,000-300,000	(45,359-136,708)							
CA 2 x 10-1	8,000-24,000	(3,629-10,886)							
CA 2 x 10-2	20,000-60,000	(9,072-27,216)							
CA 2 x 10-3	50,000-150,000	(22,680-68,039)	160,000 (18,078)	19,200,000 (2,169,310)	24,000,000 (2,711,640)	31,000,00 (3,502,530)	35-101 (156-449)	0.80	50.2 (22.77)
CA 2 x 10-4	125,000-375,000	(56,700-170,097)							
CA 3 x 5-1	6,400-19,200	(2,903-8,709)							
CA 3 x 5-2	16,000-48,000	(7,257-21,772)							
CA 3 x 5-3	40,000-120,000	(18,144-54,431)	125,000 (14,123)	20,000,000 (2,259,700)	25,000,000 (2,824,620)	32,500,000 (3,672,010)	59-156 (262-694)	0.60	63.8 (28.94)
CA 3 x 5-4	100,000-300,000	(45,359-136,078)							
CA 3 x 8-1	10,240-30,720	(4,645-13,934)							
CA 3 x 8-2	25,600-76,800	(11,612-34,836)							
CA 3 x 8-3	64,000-192,000	(29,030-87,090)	200,000 (22,597)	32,000,000 (3,615,520)	40,000,000 (4,519,390)	52,000,000 (5,875,210)	62-162 (275-721)	0.80	73.6 (33.38)
CA 3 x 8-4	160,000-480,000	(72,575-217,724)							
CA 3 x 12-1	15,360-46,080	(6,967-20,902)							
CA 3 x 12-2	38,400-115,200	(17,418-52,254)							
CA 3 x 12-3	96,000-288,000	(43,545-130,635)	300,000 (33,896)	48,000,000 (5,423,270)	60,000,000 (6,779,090)	78,000,000 (8,812,820)	60-160 (267-712)	1.20	89.4 (40.55)
CA 3 x 12-4	240,000-720,000	(108,862-326,587)							

Specifications Adjustable Models

Model	Effective Weight lbs (kg)	We Energy per Cycle in lbs (Nm) E_3	Energy per Hour in lbs/hour (Nm/hour) E_4 Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	A/O Tank (Re-circulating)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
A 2 x 2	560-170,000 (254-77,111)	32,000 (3,616)	9,600,000 (1,084,650)	12,000,000 (1,355,820)	15,600,00 (1,762,564)	48-63 (214-280)	0.25	31.5 (14.29)
A 2 x 4	510-160,000 (231-72,576)	80,000 (9,039)	12,000,000 (1,355,820)	15,000,000 (1,694,770)	19,500,00 (2,203,200)	34-63 (151-280)	0.50	36.9 (16.74)
A 2 x 6	570-190,000 (259-86,183)	120,000 (13,558)	14,400,000 (1,626,980)	18,000,000 (2,033,730)	23,500,000 (2,655,140)	34-90 (151-400)	0.60	42.6 (19.32)
A 2 x 8	580-200,000 (263-90,719)	170,000 (19,207)	16,800,000 (1,898,150)	21,000,000 (2,372,680)	27,000,000 (3,050,590)	51-144 (227-641)	0.70	49.1 (22.27)
A 2 x 10	720-250,000 (327-113,399)	210,000 (23,727)	19,200,000 (2,169,310)	24,000,000 (2,711,640)	31,000,000 (3,502,530)	35-101 (156-449)	0.80	57.8 (26.22)
A 3 x 5	1,050-340,000 (476-154,223)	140,000 (15,818)	20,000,000 (2,259,700)	25,000,000 (2,824,620)	32,500,000 (3,672,010)	59-156 (262-694)	0.60	72.1 (32.70)
A 3 x 8	1,200-400,000 (544-181,439)	250,000 (28,246)	32,000,000 (3,615,520)	40,000,000 (4,519,390)	52,000,000 (5,875,210)	62-162 (275-721)	0.80	84.9 (38.51)
A 3 x 12	1,350-450,000 (612-204,119)	390,000 (44,064)	48,000,000 (5,423,270)	60,000,000 (6,779,090)	78,000,000 (8,812,820)	60-160 (267-712)	1.20	105.0 (47.63)

Ordering Information Self-Compensating Models

CA 2 x 8 R - 3

Return Method and Accumulator Style	Bore Size	Stroke Length	Mounting Style	Effective Weight
CA = Spring Return, Internal Accumulator	2	2 8	-F Front Flange	-1 Light
CAA = Air Return, External Accumulator	3	4 10	-R Rear Flange	-2 Medium Light
CSA = Spring Return, External Accumulator		5 12	-RF Rectangular Front Flange	-3 Medium Heavy
CNA = Self (Clevis) Return, Internal Accumulator		6	-RR Rectangular Rear Flange	-4 Heavy
			-S Side Foot Mount	
			-C Clevis Mount	

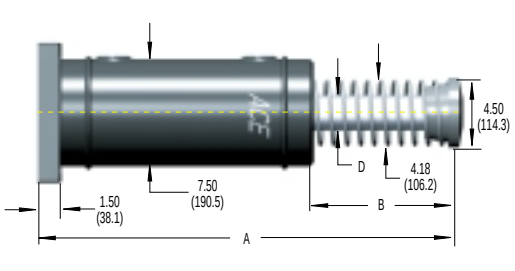
Ordering Information Adjustable Models

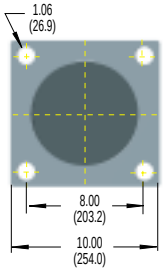
A 2 x 8 - R

Return Method and Accumulator Style	Bore Size	Stroke Length	Mounting Style
A = Spring Return, Internal Accumulator	2	2 8	-F Front Flange
AA = Air Return, External Accumulator	3	4 10	-R Rear Flange
SA = Spring Return, External Accumulator		5 12	-RF Rectangular Front Flange
NA = Self (Clevis) Return, Internal Accumulator		6	-RR Rectangular Rear Flange
			-S Side Foot Mount
			-C Clevis Mount

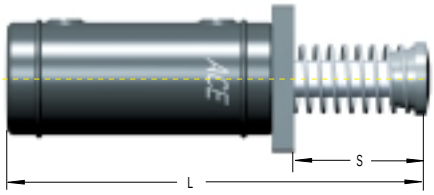
Note: A no button option is available on the 3" Bore only as a special.

Rear Flange

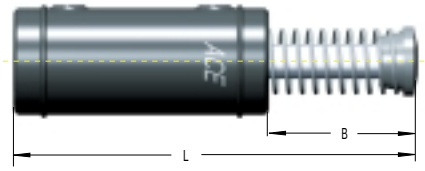


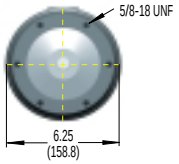


Front Flange

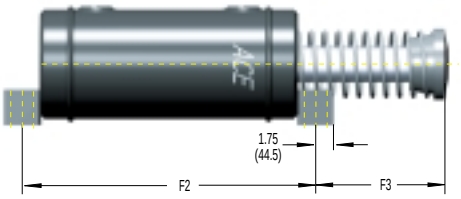


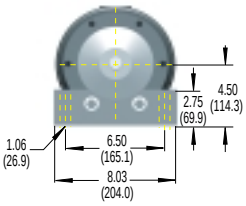
Standard Mount



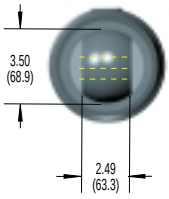


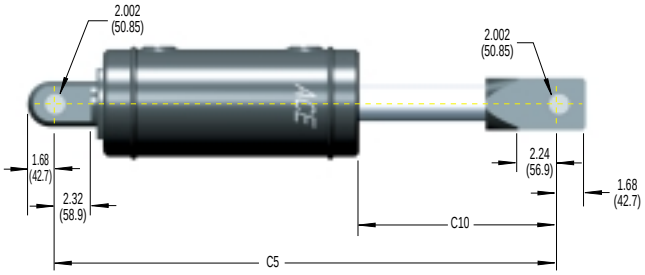
Side-Foot Mount

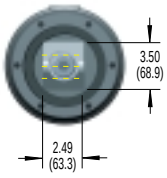




Clevis Mount







Technical Data

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

Operating temperature: 10° to 158° F (-12° to 70° C)

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

Oil type: ATF

Dimensions in inches (millimeters)

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

Specifications

Model	Effective Weight lbs (kg)		We Energy per Cycle in lbs (Nm) E_3	Energy per Hour in lbs/hour (Nm/hour) Internal Accumulator (Self-Contained) E_4	External Accumulator (A/O Tank)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
4 x 6-3	8,000-19,000	(3,600-8,600)	420,000 (47,500)	27,000,000 (3,000,000)	45,000,000 (5,100,000)	108-222 (480-1,000)	Consult Factory	132 (60)
4 x 6-5	19,000-41,000	(8,600-18,600)						
4 x 6-7	41,000-94,000	(18,600-42,700)						
4 x 8-3	11,000-25,000	(5,000-11,400)	560,000 (63,300)	30,000,000 (3,400,000)	50,000,000 (5,600,000)	71-222 (310-1,000)	Consult Factory	150 (68)
4 x 8-5	25,000-55,000	(11,400-25,000)						
4 x 8-7	55,000-125,000	(25,000-57,000)						
4 x 16-3	22,000-50,000	(10,000-23,000)	1,120,000 (126,500)	50,000,000 (5,600,000)	85,000,000 (9,600,000)	Consult Factory	Consult Factory	321 (146)
4 x 16-5	50,000-110,000	(23,000-50,000)						
4 x 16-7	110,000-250,000	(50,000-114,000)						

Ordering Information

CA 4 x 8 R - 5

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

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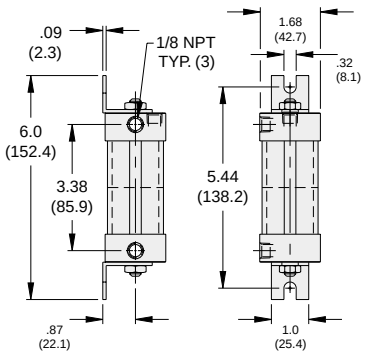
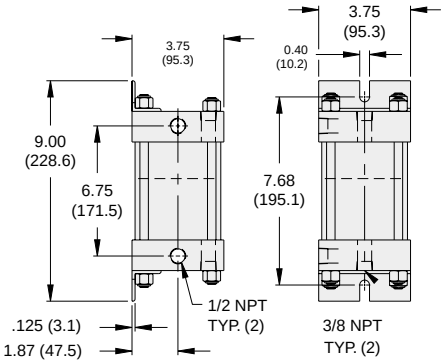
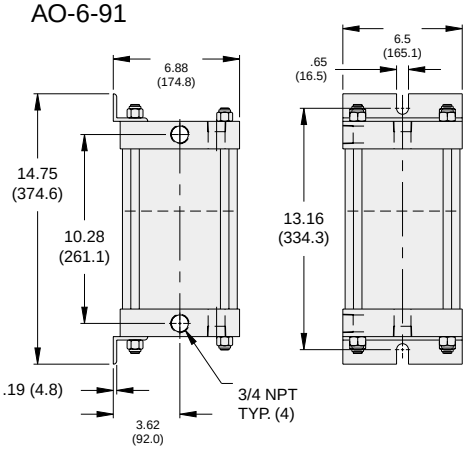
AO-1



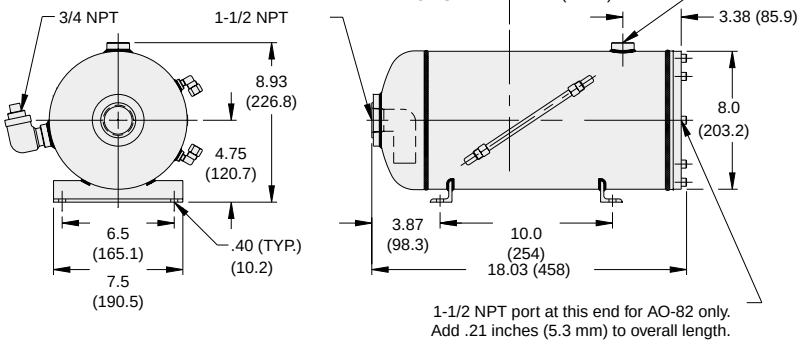
AO-3



AO-6-91



AO-81 and AO-82



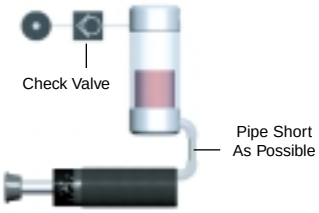
1-1/2 NPT port at this end for AO-82 only.
Add .21 inches (5.3 mm) to overall length.

Capacity (Maximum)

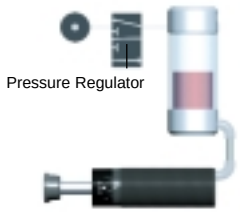
Model	Oil Temp °F (°C)	Max Pressure psi (bar)	Tank Capacity cu/in (cu/cm)	Fill Level oz. (L)	Recommended for Shock Absorber Size
AO-1	175 (79)	100 (7)	2.4 (39.32)	.6 (0.02)	MCA, MCS 33, 36, 45 MAA, MAS 33, 36, 45 MLA, MLS 33, 36, 45
AO-3	175 (79)	100 (7)	35 (573)	12.5 (0.37)	1-1/2 x 2 1-1/2 x 3-1/2 MCA, MCS *33, *36, *45, 64 MAA, MAS *33, *36, *45, 64 MLA, MLS *33, *36, *45, 64
AO-6-91	200 (93)	100 (7)	245 (4,015)	88 (2.60)	1-1/2 x 5 – 3 x 12 MCA, MCS *64 MAA, MAS *64 MLA, MLS *64
AO-81	200 (93)	100 (7)	740 (12,126)	205 (6.06)	4 x 6 – 4 x 16
AO-82	200 (93)	100 (7)	740 (12,126)	205 (6.06)	4 x 6 – 4 x 16

* With re-circulating circuit, example 3 below.

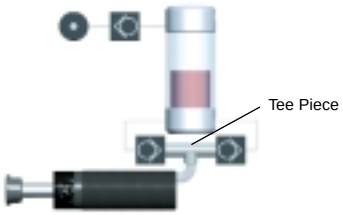
Mounting and Circuits



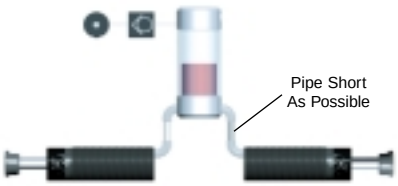
1. The piston rod is immediately returned to its extended position after completing its stroke.



2. Return stroke may be sequenced by pneumatic valve at any desired time. No return force until valve energised.

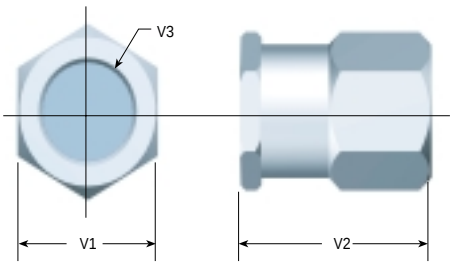


3. A re-circulating cooling circuit allows warm oil to return to the tank while cool oil refills the shock absorber. A re-circulating cooling circuit substantially increases the shock absorber's hourly energy capacity.



4. When connecting more than one shock absorber to an Air-Oil Tank, use caution in selecting the proper reservoir capacity. For two shock absorbers, the next largest Air-Oil Tank size is usually adequate.

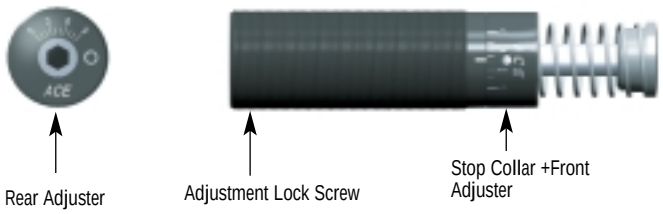
Check Valves



ACE check valves, for use with Air-Oil Tanks, are made of lightweight anodized aluminum. Dimensions below are in inches (millimeters).

Size	V1	V2	V3
CV-1/8	.75 (19.1)	.94 (23.8)	1/8-27 NPT
CV-1/4	1.125 (28.6)	1.31 (33.3)	1/4-18 NPT
CV-3/8	1.125 (28.6)	1.31 (33.3)	3/8-18 NPT
CV-1/2	1.625 (41.3)	1.56 (39.7)	1/2-14 NPT
CV-3/4	1.875 (47.6)	2.31 (58.7)	3/4-14 NPT

Mechanical Stop



The Magnum Series units have a built in Stop Collar (mechanical stop) which also serves as the front adjuster.

If using a shock absorber without a Stop Collar it is important to install a mechanical stop 0.02 to 0.04 inches (0.5 to 1 mm) before the end of the stroke.

General Information

For optimum heat dissipation do not paint the shock absorber. For applications in environments with acids, dusts or powders, abrasives, steam or water, a reasonable effort should be made to protect the shock absorber. Consider adding the air bleed collar to select models (MC 150M, MC 225M and MC 600M). See miniature shock absorber accessories, pages 30 and 31 and Installation Examples, pages 14 and 15. The shock absorber should be securely mounted onto a flat and smooth surface of adequate strength.

Self-Compensating Models

The MC Magnum Group of shock absorbers are self-compensating. Providing the effective weight on the application remains within the range given in the capacity charts, then no adjustment is necessary for changes in weights, speeds or propelling force. These units are available with four standard operating ranges (We min. – We max.) and are identified by the suffix number after the model which goes from -1 (very soft) up to -4 (very hard).

The optimum deceleration is achieved when there is no abrupt change in the load velocity at the beginning or the end of the shock absorber stroke. If there is a hard impact at the start of stroke, use the next softer version (i.e. lower suffix number). If there is a hard setdown at the end of stroke, use the next harder version, or mount two units in parallel. Alternatively change to a larger bore size unit. Contact ACE for further advice.

Adjustable Models

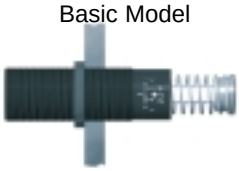
The adjustment has a graduated scale from 0 to 9. The adjuster in the body has a side mounted locking screw which should be loosened (1/2 turn max.) with a hex. key before commencing adjustment. The Magnum Series units can be adjusted by the hex socket at the rear of the body – or by rotating the front stop collar. Both adjusters are internally connected and will show the same adjustment value on the scales as they are turned. After installation cycle the equipment a few times and turn the adjustment until optimum deceleration is achieved (i.e. no abrupt change in the load velocity observed at the beginning or at the end of shock absorber stroke). The shock absorber as delivered is set at 5. If there is a hard impact at start of stroke adjust the unit softer i.e. towards 9 on the scale. If there is a hard setdown at end of stroke adjust the unit harder i.e. towards 0. After adjustment, relock the lock screw.

Adjustment approaching “0” means:

a) Impact velocity is too low: consider changing to Model type ML or:
b) Shock absorber selected is too small: use next larger size or mount 2 units in parallel.

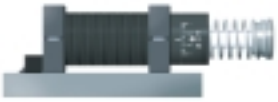
Mounting Options

Basic Model



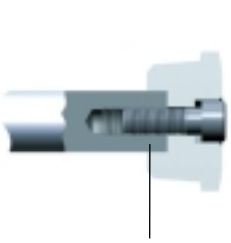
Flange Mounting

Side Foot Mounting

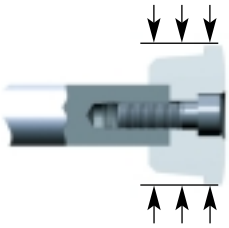


Clevis Mounting

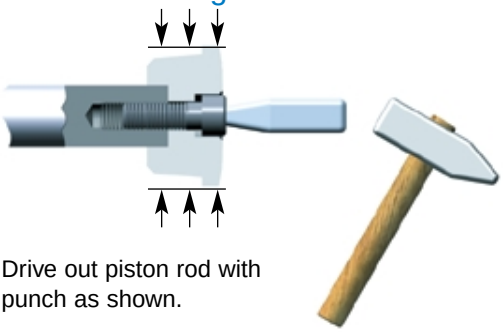
Removing Rod End Button



Press fit (screw secured with loctite).



Clamp button in vice and loosen screw 3 or 4 turns.



Drive out piston rod with punch as shown.

Repairs

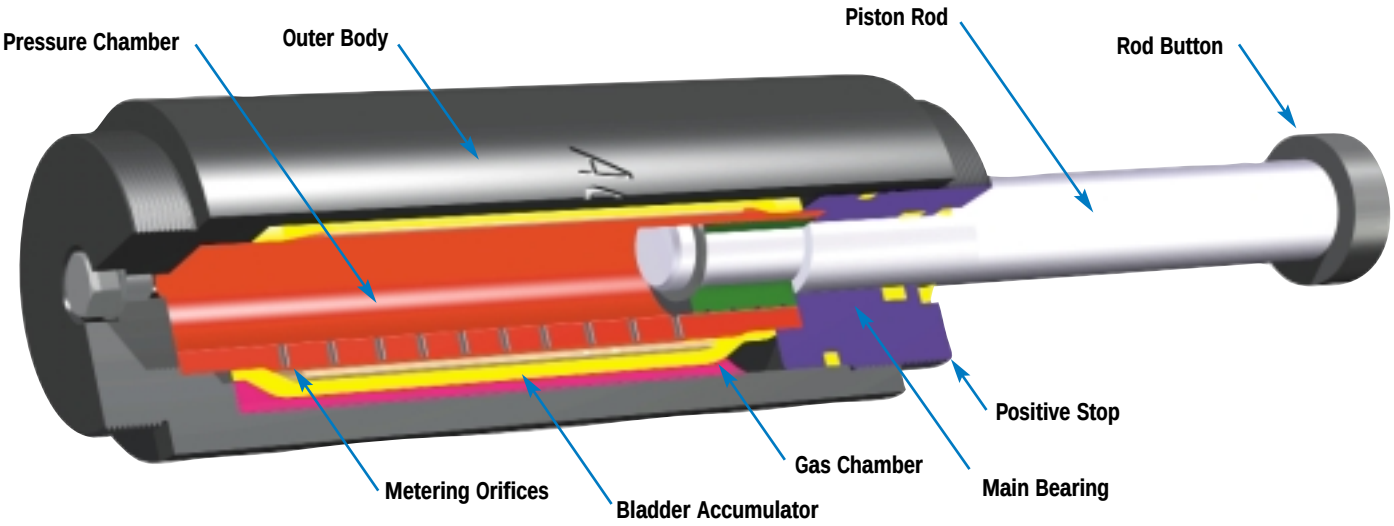
It is possible to overhaul Ace shock absorbers in sizes larger than the MC 600. We would recommend that damaged or worn shock absorbers are returned to ACE for repair. You will find that this is more economical than the comparative cost of repairing yourself. Spare parts and seal kits etc. are available, if required.

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

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

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

Stacker Crane Shock Absorbers SCS-38 to 63

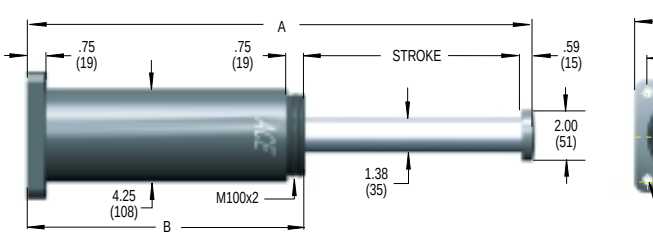


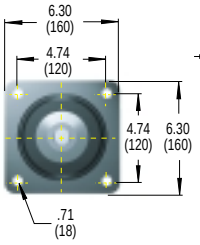
Ordering Information

SCS-38-200-F-X

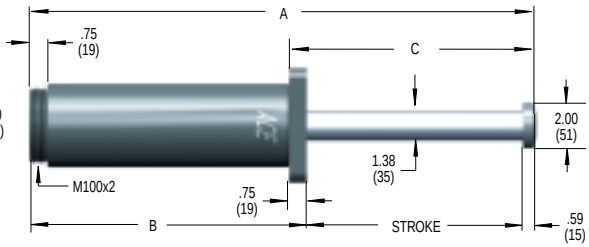
SCS Series	Bore Diameter (mm)	Stroke Length (mm)		Flange Location	Application Number
Stacker Crane Shock Absorbers	38	50	350	F Front Flange	Orificing
	50	100	400	R Rear Flange	Environmental Finish
	63	150	500	S Side Mount	Custom Flanges
		200	600		Fluid
		250	700		
		300	800		
			1000		
			1200		

Rear Flange

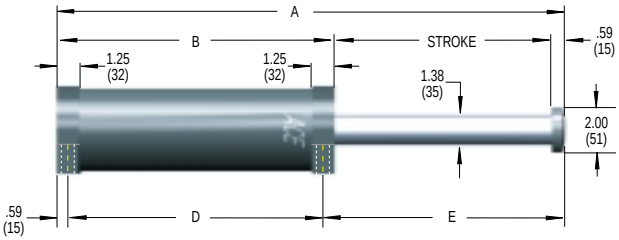


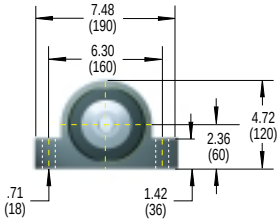


Front Flange



Side Mount





Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	E_3 Energy per Cycle in lbs (kNm)	We Effective Weight Range lbs (kg)	Shipping Weight lbs (kg) F&R	S
SCS-38-50	1.97 (50)	10.63 (270)	8.07 (205)	3.31 (84)	6.89 (175)	3.15 (80)	32,000 (3.6)	750-19,600 (340-8,900)	27.3 (12.4)	29.1 (13.2)
SCS-38-100	3.94 (100)	14.57 (370)	10.04 (255)	5.28 (134)	8.77 (225)	5.21 (132)	64,000 (7.2)	1,500-39,200 (680-17,800)	32.0 (14.5)	33.8 (15.4)
SCS-38-150	5.91 (150)	18.50 (470)	12.01 (305)	7.24 (184)	10.83 (275)	7.08 (180)	96,000 (10.8)	2,250-58,900 (1,020-26,700)	35.9 (16.3)	37.8 (17.1)
SCS-38-200	7.87 (200)	22.44 (570)	13.98 (355)	9.21 (234)	12.80 (325)	9.05 (230)	127,000 (14.4)	3,000-78,500 (1,360-35,600)	39.9 (18.1)	41.7 (18.9)
SCS-38-250	9.84 (250)	26.38 (670)	15.94 (405)	11.18 (284)	14.77 (375)	11.02 (280)	159,000 (18.0)	3,750-97,900 (1,700-44,400)	43.8 (19.9)	45.6 (20.7)
SCS-38-300	11.81 (300)	30.91 (785)	18.50 (470)	13.15 (334)	17.33 (440)	12.99 (330)	191,000 (21.6)	4,500-117,500 (2,040-53,300)	48.9 (22.2)	50.7 (23.0)
SCS-38-350	13.78 (350)	34.84 (885)	20.47 (520)	15.12 (384)	19.29 (490)	14.96 (380)	223,000 (25.2)	5,250-137,100 (2,380-62,200)	52.8 (23.9)	54.6 (24.8)
SCS-38-400	15.75 (400)	39.37 (1,000)	23.03 (585)	17.09 (434)	21.85 (555)	16.93 (430)	255,000 (28.8)	6,000-156,700 (2,720-711,000)	57.9 (26.2)	59.7 (27.1)
SCS-38-500	19.69 (500)	47.83 (1,215)	27.56 (700)	21.02 (534)	26.38 (670)	20.56 (530)	319,000 (36.0)	7,500-196,000 (3,400-88,900)	66.9 (30.3)	68.7 (31.2)
SCS-38-600	23.62 (600)	56.30 (1,430)	32.09 (815)	24.96 (634)	30.91 (785)	24.80 (630)	382,000 (43.2)	8,990-235,200 (4,080-106,700)	75.9 (34.4)	77.7 (35.3)
SCS-38-700	27.56 (700)	64.76 (1,645)	36.61 (930)	28.90 (734)	35.43 (900)	28.74 (730)	446,000 (50.4)	10,490-274,300 (4,760-124,400)	84.9 (38.5)	86.7 (39.3)
SCS-38-800	31.50 (800)	73.23 (1,860)	41.14 (1,045)	32.83 (834)	39.97 (1,015)	32.67 (830)	510,000 (57.6)	11,990-313,500 (5,440-142,200)	93.9 (42.6)	95.7 (43.4)

Technical Data

Maximum force: 18,000 lbs (80 kN)

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

Minimum return force: 45 lbs. (0.2 kN)

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

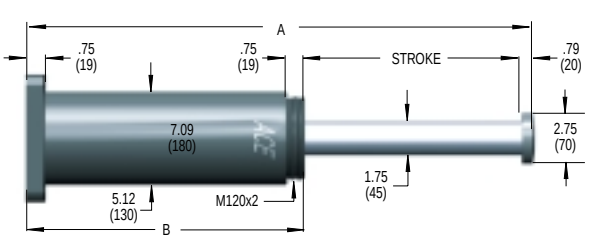
Custom environmental protection options of paint, plating, rod bellows, etc. are available.
Consult factory for your specific needs.

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

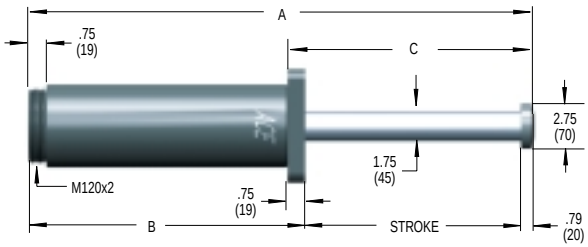
Note: An integral mechanical stop is built into the front of all units.

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

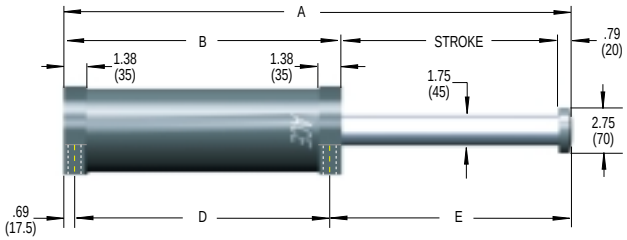
Rear Flange

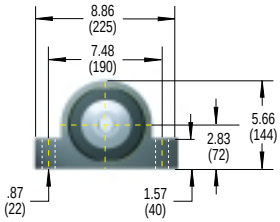


Front Flange



Side Mount





Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	E_3 Energy per Cycle in lbs (kNm)	We Effective Weight Range lbs (kg)	Shipping Weight lbs (kg) F&R	Shipping Weight lbs (kg) S
SCS-50-100	3.94 (100)	15.35 (390)	10.63 (270)	5.47 (139)	9.25 (235)	5.41 (138)	124,000 (14)	2,950-172,000 (1,340-78,000)	48.1 (21.8)	51.3 (23.3)
SCS-50-150	5.91 (150)	19.29 (490)	12.60 (320)	7.44 (189)	11.22 (285)	7.38 (188)	186,000 (21)	4,430-258,000 (2,010-117,000)	53.7 (24.4)	57.0 (25.8)
SCS-50-200	7.87 (200)	23.23 (590)	14.57 (370)	9.41 (239)	13.19 (335)	9.35 (238)	248,000 (28)	5,910-344,000 (2,680-156,000)	59.1 (26.8)	62.3 (28.3)
SCS-50-250	9.84 (250)	27.17 (690)	16.54 (420)	11.38 (289)	15.16 (385)	11.32 (288)	310,000 (35)	7,390-428,000 (3,350-194,000)	64.9 (29.4)	68.1 (30.9)
SCS-50-300	11.81 (300)	31.69 (805)	19.09 (485)	13.35 (339)	17.71 (450)	13.29 (338)	372,000 (42)	8,860-514,000 (4,020-233,000)	71.6 (32.5)	74.9 (34.0)
SCS-50-350	13.78 (350)	35.63 (905)	21.06 (535)	15.31 (389)	19.69 (500)	15.25 (387)	434,000 (49)	10,340-600,000 (4,690-272,000)	77.2 (35.0)	80.4 (36.5)
SCS-50-400	15.75 (400)	40.16 (1,020)	23.62 (600)	17.28 (439)	22.25 (565)	17.22 (438)	496,000 (56)	11,820-686,000 (5,360-311,000)	84.2 (38.2)	87.5 (39.7)
SCS-50-500	19.69 (500)	48.62 (1,235)	28.15 (715)	21.22 (539)	26.77 (680)	21.16 (538)	620,000 (70)	14,750-858,000 (6,690-389,000)	96.8 (43.9)	100.1 (45.4)
SCS-50-600	23.62 (600)	57.09 (1,450)	32.68 (830)	25.16 (639)	31.30 (795)	25.10 (638)	743,000 (84)	17,700-1,030,000 (8,030-467,000)	109.4 (49.6)	112.7 (51.1)
SCS-50-700	27.56 (700)	65.55 (1,665)	37.20 (945)	29.09 (739)	35.83 (910)	29.03 (737)	867,000 (98)	20,660-1,199,000 (9,370-544,000)	122.0 (55.3)	125.2 (56.8)
SCS-50-800	31.50 (800)	74.02 (1,880)	41.73 (1,060)	33.03 (839)	40.36 (1,025)	32.97 (838)	991,000 (112)	23,590-1,371,000 (10,700-622,000)	134.6 (61.0)	137.8 (62.5)
SCS-50-1000	39.37 (1,000)	90.94 (2,310)	50.79 (1,290)	40.91 (1,039)	49.40 (1,255)	40.85 (1,038)	1,239,000 (140)	29,540-1,715,000 (13,400-778,000)	159.7 (72.4)	163.0 (73.9)

Technical Data

Maximum force: 36,000 lbs (160 kN)

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

Minimum return force: 72 lbs. (0.3 kN)

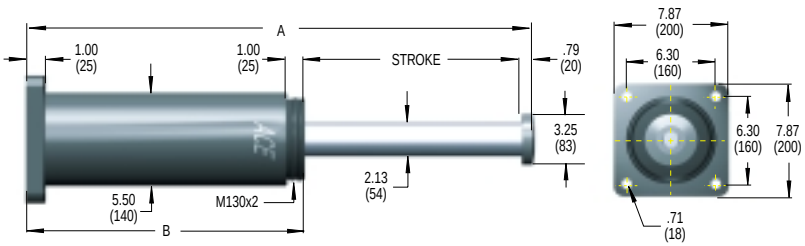
Operating temperature: 10° to 150°F (-12°C to 66°C)
(Consult factory for optional ranges).

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

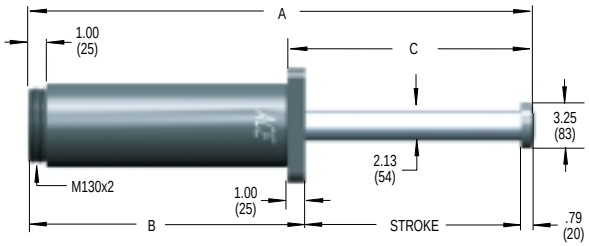
Note: Buttons are standard on all stacker crane shock absorbers.

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

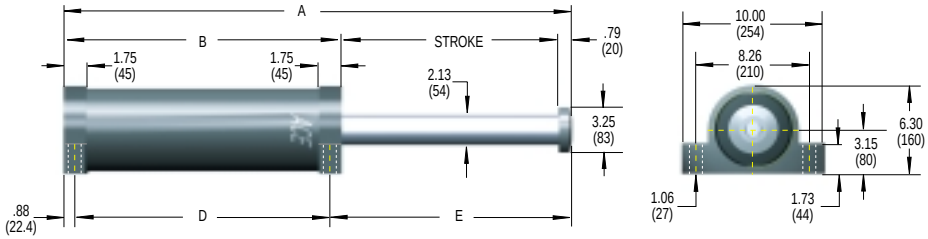
Rear Flange



Front Flange



Side Mount



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	D	E	E_3 Energy per Cycle in lbs (kNm)	We Effective Weight Range lbs (kg)	Shipping Weight lbs (kg) F&R	Shipping Weight lbs (kg) S
SCS-63-100	3.94 (100)	15.94 (405)	11.22 (285)	5.71 (145)	9.47 (241)	5.59 (142)	159,000 (18)	3,750-317,000 (1,700-144,000)	62.8 (28.5)	71.2 (32.3)
SCS-63-150	5.91 (150)	19.88 (505)	13.19 (335)	7.68 (195)	11.44 (291)	7.56 (192)	239,000 (27)	5,620-476,000 (2,550-216,000)	69.6 (31.6)	78.0 (35.4)
SCS-63-200	7.87 (200)	23.82 (605)	15.16 (385)	9.65 (245)	13.41 (341)	9.53 (242)	319,000 (36)	7,500-635,000 (3,400-288,000)	76.4 (34.6)	84.7 (38.4)
SCS-63-250	9.84 (250)	27.76 (705)	17.13 (435)	11.61 (295)	15.39 (391)	11.49 (292)	398,000 (45)	9,370-794,000 (4,250-360,000)	83.2 (37.7)	91.6 (41.5)
SCS-63-300	11.81 (300)	31.69 (805)	19.09 (485)	13.58 (345)	17.35 (441)	13.46 (342)	478,000 (54)	11,240-952,000 (5,100-432,000)	90.0 (40.8)	98.3 (44.6)
SCS-63-350	13.78 (350)	36.42 (925)	21.85 (555)	15.55 (395)	20.11 (511)	15.43 (392)	558,000 (63)	13,120-1,111,000 (5,950-504,000)	99.3 (45.1)	107.7 (48.9)
SCS-63-400	15.75 (400)	40.35 (1,025)	23.82 (605)	17.52 (445)	22.01 (561)	17.40 (442)	637,000 (72)	15,010-1,270,000 (6,810-576,000)	106.1 (48.1)	114.5 (51.9)
SCS-63-500	19.69 (500)	49.02 (1,245)	28.54 (725)	21.46 (545)	26.80 (681)	21.34 (542)	797,000 (90)	18,760-1,587,000 (8,510-720,000)	122.3 (55.5)	130.7 (59.3)
SCS-63-600	23.62 (600)	56.89 (1,445)	32.48 (825)	25.39 (645)	30.74 (781)	25.30 (642)	956,000 (108)	22,510-1,905,000 (10,210-864,000)	135.9 (61.6)	144.2 (65.4)
SCS-63-700	27.56 (700)	65.55 (1,665)	37.20 (945)	29.33 (745)	35.46 (901)	29.21 (746)	1,115,000 (126)	26,260-2,222,000 (11,910-1,008,000)	152.0 (69.0)	160.4 (72.8)
SCS-63-800	31.50 (800)	73.43 (1,865)	41.14 (1,045)	33.27 (845)	39.40 (1,001)	33.15 (842)	1,275,000 (144)	29,980-2,540,000 (13,600-1,152,000)	165.6 (75.1)	174.0 (78.9)
SCS-63-1000	39.37 (1,000)	89.96 (2,285)	49.80 (1,265)	41.14 (1,045)	48.06 (1,221)	41.02 (1,042)	1,593,000 (180)	37,480-3,175,000 (17,000-1,440,000)	195.4 (88.6)	203.7 (92.4)
SCS-63-1200	47.24 (1,200)	106.50 (2,705)	58.46 (1,485)	49.02 (1,245)	56.72 (1,441)	48.90 (1,242)	1,912,000 (216)	44,970-3,810,000 (20,400-1,728,000)	225.1 (102.1)	233.5 (105.9)

Technical Data

Maximum force: 47,200 lbs (210 kN)

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

Minimum return force: 106 lbs. (0.5 kN)

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

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

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

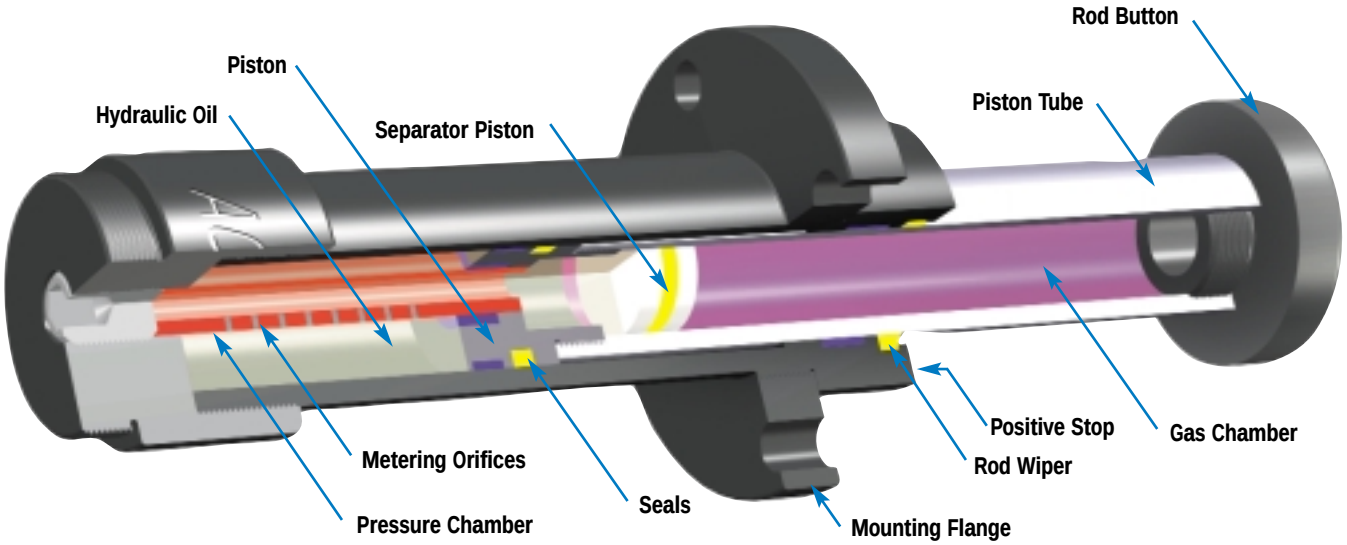
Note: An integral mechanical stop is built into the front of all units.

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

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

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

Industrial Crane Bumper Shocks CB-63 to 160

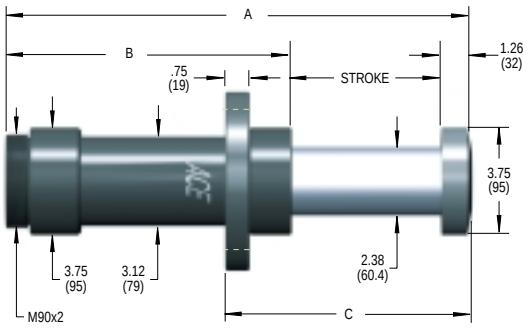


Ordering Information

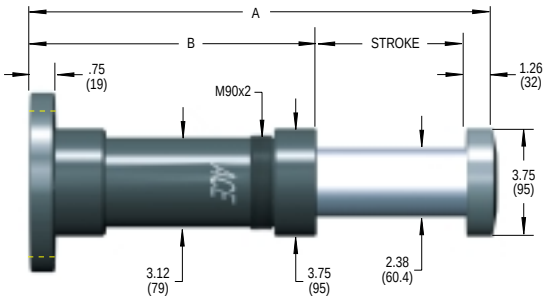
CB-63-100-F-B-X

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

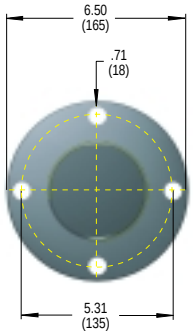
Front Flange



Rear Flange



Flange



Dimensions in inches (millimeters)

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

Technical Data

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

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

Minimum return force: 106 lbs. (0.5kN)

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

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

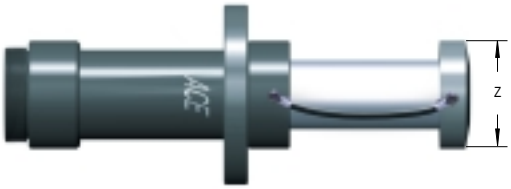
Note: Buttons are standard on all industrial crane bumper shock absorbers. Safety cable is optional.

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

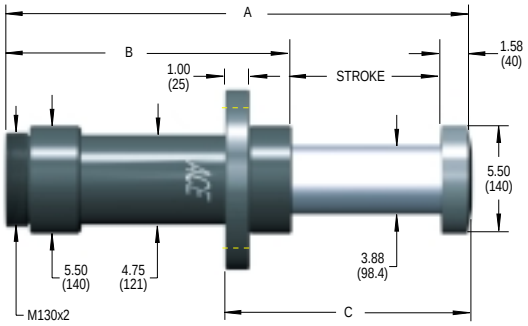
Optional Larger Button

(Optional larger button includes safety cable)

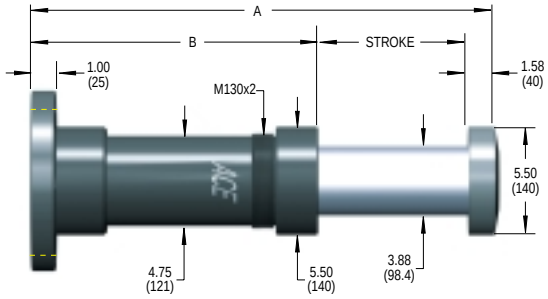
Diameter Z	CB-63	CB-100	CB-160
inch	5.00	7.00	9.00
(mm)	(127)	(178)	(229)



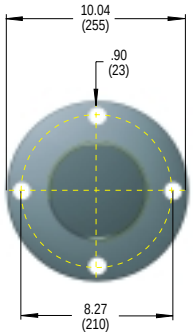
Front Flange



Rear Flange



Flange



Dimensions in inches (millimeters)

Model	Stroke	A	B	C	Rod Return Force lbs (kN) Fully Out	Rod Return Force lbs (kN) Fully In	E_3 Energy per Cycle in lbs (kNm)	We Effective Weight Range lbs (kg)	Shipping Weight lbs (kg)
CB-100-200	7.87 (200)	28.94 (735)	19.49 (495)	12.60 (320)	880 (3.9)	8,850 (39.4)	708,000 (80)	16,670-1,411,000 (7,560-640,000)	93.7 (42.5)
CB-100-300	11.81 (300)	39.57 (1,005)	26.18 (665)	16.54 (420)	880 (3.9)	11,196 (49.8)	1,062,000 (120)	25,000-2,116,000 (11,340-960,000)	112.1 (50.8)
CB-100-400	15.75 (400)	50.20 (1,275)	32.87 (835)	20.47 (520)	880 (3.9)	12,912 (57.4)	1,416,000 (160)	33,330-2,822,000 (15,120-1,280,000)	130.4 (59.1)
CB-100-500	19.69 (500)	60.83 (1,545)	39.57 (1,005)	24.41 (620)	880 (3.9)	14,216 (63.2)	1,770,000 (200)	41,670-3,527,000 (18,900-1,600,000)	148.7 (67.5)
CB-100-600	23.62 (600)	71.46 (1,815)	46.26 (1,175)	28.35 (720)	880 (3.9)	15,237 (67.8)	2,124,000 (240)	50,000-4,233,000 (22,680-1,920,000)	167.0 (75.8)

Technical Data

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

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

Minimum return force: 106 lbs. (0.5kN)

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

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

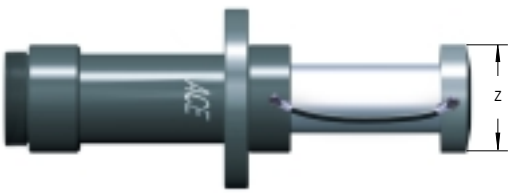
Note: Buttons are standard on all industrial crane bumper shock absorbers. Safety cable is optional.

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

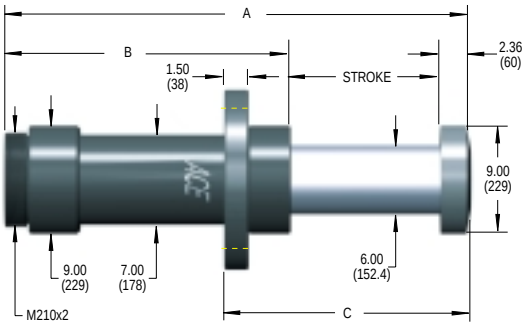
Optional Larger Button

(Optional larger button includes safety cable)

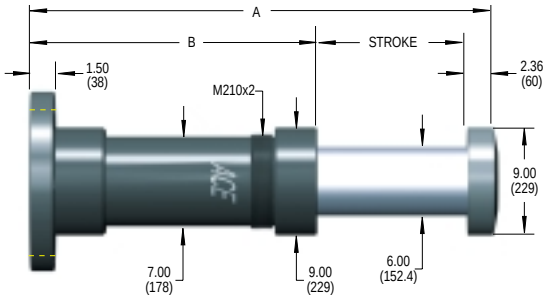
Diameter Z	CB-63	CB-100	CB-160
inch	5.00	7.00	9.00
(mm)	(127)	(178)	(229)



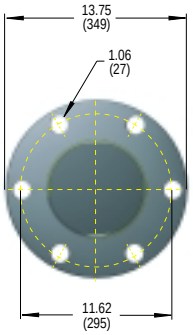
Front Flange



Rear Flange



Flange



Dimensions in inches (millimeters)

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

Technical Data

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

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

Minimum return force: 106 lbs. (0.5kN)

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

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

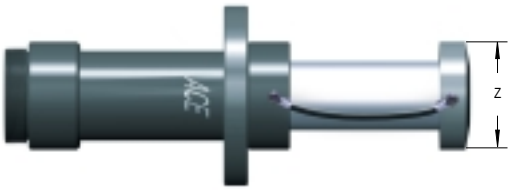
Note: Buttons are standard on all industrial crane bumper shock absorbers. Safety cable is optional.

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

Optional Larger Button

(Optional larger button includes safety cable)

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



ACE VC and VCL Precision Feed Controls are sealed hydraulic units fitted with a high precision metering element. When the piston rod is depressed the hydraulic oil is forced through the adjustable precision metering orifice. This provides a constant and precise feed control throughout the stroke length. The feed rate can be adjusted over a wide range by turning the external adjuster knob at the rear end of the unit. The optional threaded outer body helps to simplify installation and the adjustment of feed control travel limits.
MA and MVC are similar feed control units intended for applications where the higher precision of the VC series is not required.

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

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

Technical Data

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

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

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

Nylon button part no. 250-0268, can be fitted onto piston rod.Unit may be mounted in any position.

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

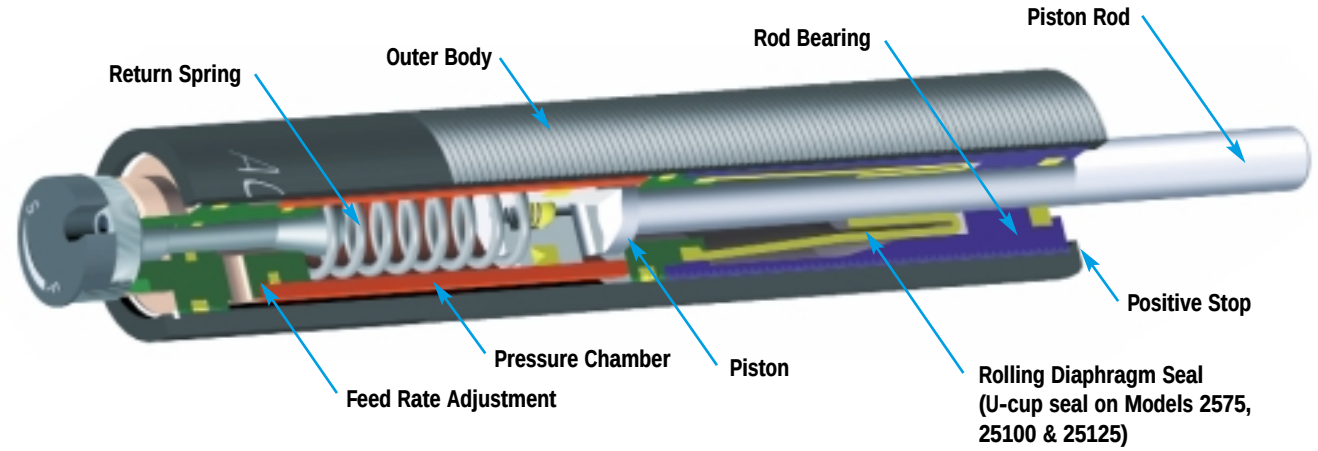
Temperature range: 32° to 140°F (0° to 60°C).

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

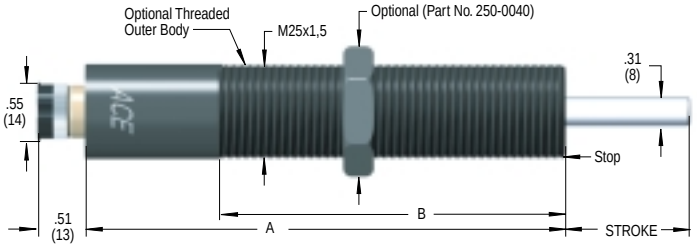
Adjustment: Loosen set screw on adjustment knob prior to adjusting. Tighten set screw after proper adjustment.

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

Precision Hydraulic Feed Controllers VC and VCL, Models 2515-2555

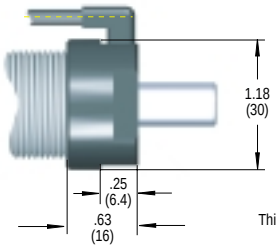


Model VC 25..



Model SP-25

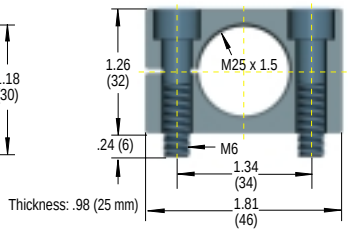
Part No. 10783-000



Air Bleed Collar
for VC/VCL 2515 to 2555

Model MB-25

Part No. 10780-000



Clamp Mount

VC and VCL Dimensions in inches (millimeters)

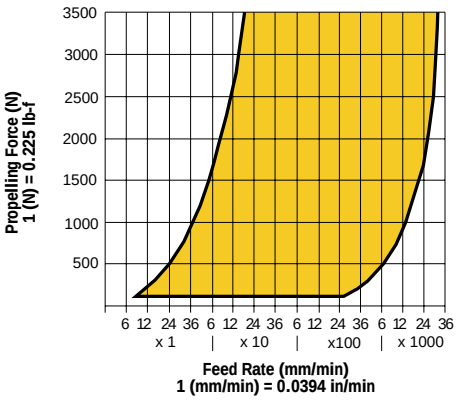
Standard Model	Low Rate Model	Stroke	A	B	Weight lbs.	Weight kg
VC 2515-S	**VC 2515-LS**	0.59 (15)	5.04 (128)	3.15 (80)	0.88	(0.4)
VC 2530-S	**VC 2530-LS**	1.18 (30)	6.34 (161)	4.33 (110)	1.10	(0.5)
VC 2555-S	**VC 2555-LS**	2.16 (55)	8.23 (209)	5.19 (130)	1.32	(0.6)
VC 2575-S	**VC 2575-LS**	2.95 (75)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

VC and VCL Specifications

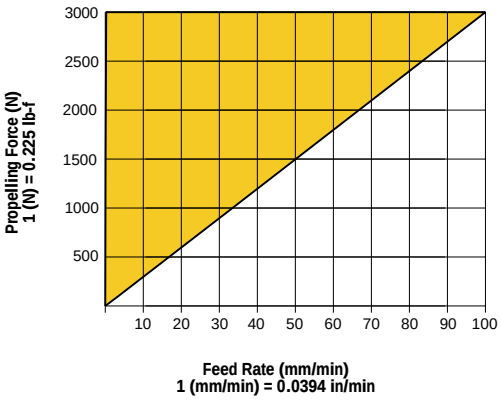
Standard Model	Low Rate Model	Propelling Force N lbs. min max	Propelling Force N (N) min max	Return Force N lbs. min max	Return Force N (N) min max	Reset Time seconds
VC 2515-S	**VC 2515-LS**	6.74 - 787	(30 - 3,500)	1.12 - 2. 25	(5 - 10)	0.2
VC 2530-S	**VC 2530-LS**	6.74 - 787	(30 - 3,500)	1.12 - 3.37	(5 - 15)	0.4
VC 2555-S	**VC 2555-LS**	7.87 - 787	(35 - 3,500)	1.12 - 4.50	(5 - 20)	1.2
VC 2575-S	**VC 2575-LS**	11.24 - 787	(50 - 3,500)	7.39 - 11.56	(33 - 51)	1.7
VC 25100-S	**VC 25100-LS**	13.49 - 787	(60 - 3,500)	6.00 - 11.56	(27 - 51)	2.3
VC 25125-S	**VC 25125-LS**	15.74 - 787	(70 - 3,500)	5.23 - 11.23	(23 - 50)	2.8

VC and VCL Operating Ranges

Operating Range VC



Operating Range VCL



Mounting Examples

Mounting with Clamp Mount MB 25

Installed with Air Bleed Collar SP 25

ACE Controls Inc. · 800-521-3320 · (248) 476-0213 · Fax (248) 476-2470 · www.acecontrols.com · email: shocks@acecontrols.com

The MVC Series feed controls offer a compact design, and are adjustable over a wide range of conditions. This dependable series is a low cost speed/feed control, ideal for applications that do not require the sophistication of more expensive devices.

The MVC Series features fully threaded bodies, integral positive stops and standard rod end buttons. They can be utilized with a wide variety of mounting accessories. See page 30 for accessories.

Technical Data

Impact velocity range: 0.5 to 12 ft/sec (0.15 to 3.66 m/sec).

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

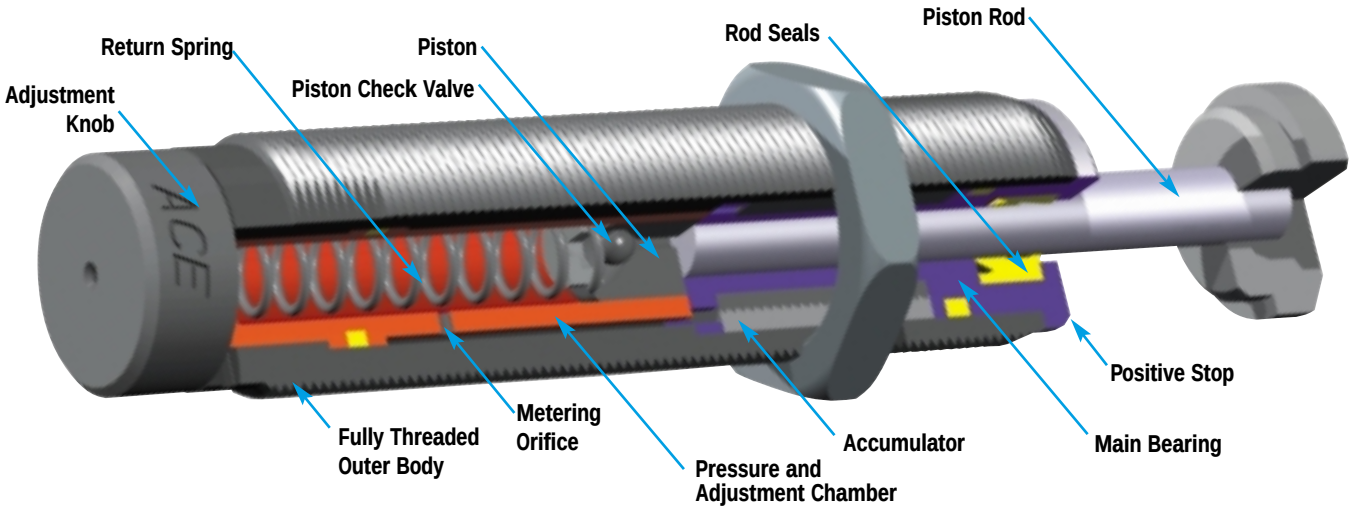
Mechanical stop: Integral mechanical stop built into the front of units.

Oil type: Silicone

Material: Steel body with black oxide finish. Stainless steel piston rod.

Feed Controllers MVC

Adjustable

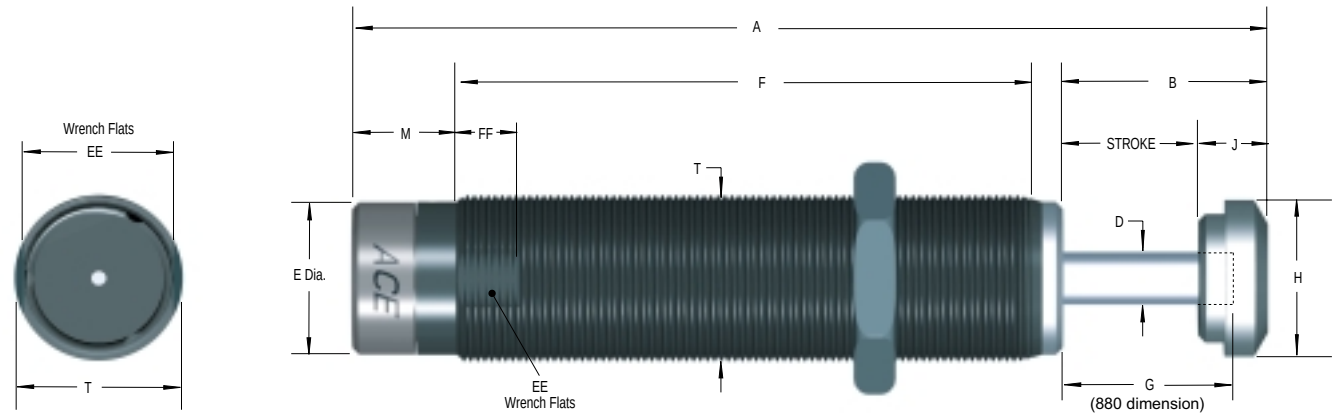


Ordering Information

MVC 225 - ____

Return Method and Accumulator Style	Model Number	Mounting Thread	Button Options
MVC = Velocity/feed control	225	Standard (UNF)	Standard Steel Button
Note: All MVC units are spring return, internal accumulator.	600	M Metric	-NB No Button, Short Rod
	900		-880 No Button, Standard Rod

Note: MA 35 and MA 150 can be utilized as feed controls.



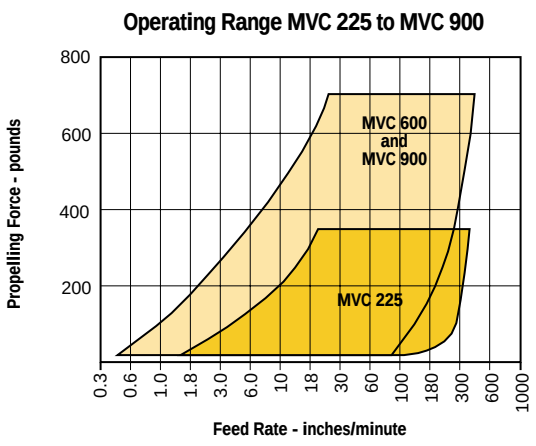
Dimensions in inches (millimeters)

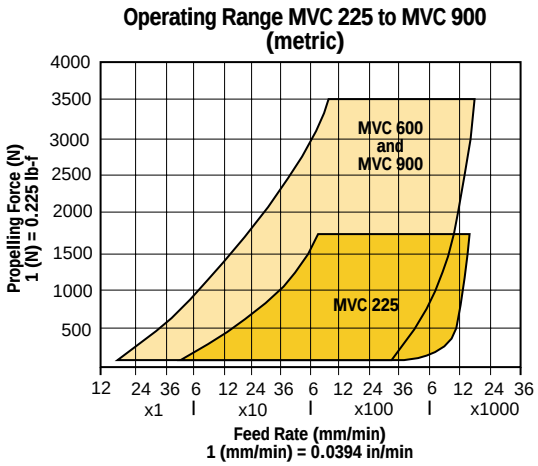
Model	Stroke	A	B	D	E	F	G	H	J	M	T	E E	F F
MVC 225	.75	4.67	1.18	.19	.66	2.75	1.00	.66	.43	.55	3/4-16 UNF	11/16	.50
MVC 225M	(19.1)	(118.6)	(30.0)	(4.8)	(16.8)	(69.9)	(25.3)	(16.8)	(11.0)	(14.0)	M20x1.5	(18.0)	(12.7)
MVC 600	1.00	5.62	1.43	.25	.88	3.33	1.25	.90	.43	.67	1-12 UNF	7/8	.50
MVC 600M	(25.4)	(142.6)	(36.3)	(6.3)	(22.4)	(84.6)	(31.8)	(22.9)	(11.0)	(17.0)	M25x1.5	(23.0)	(12.7)
MVC 900	1.58	7.44	2.01	.25	.88	4.58	1.85	.90	.43	.67	1-12 UNF	7/8	.50
MVC 900M	(40.0)	(189.0)	(51.1)	(6.3)	(22.4)	(116.3)	(46.4)	(22.9)	(11.0)	(17.0)	M25x1.5	(23.0)	(12.7)

Specifications

Model	Propelling Force lbs (N) Min-Max	Time Through Stroke At Slowest Setting With Max. Force	Energy per Hour in lbs/hour (Nm/hour)	Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
MVC 225	5 (22) - 400 (1,779)	1.21 sec	400,000 (45,194)	1.05 (4.69) - 2.15 (9.56)	.65	.28 (0.13)
MVC 600	14 (62) - 800 (3,559)	1.33 sec	600,000 (67,791)	2.40 (10.67) - 6.87 (30.56)	.85	.67 (0.30)
MVC 900	15 (67) - 800 (3,559)	2.11 sec	800,000 (90,388)	2.40 (10.67) - 7.40 (32.92)	.95	.87 (0.39)

Operating Range





See pages 30 and 31 for accessory information.

Lock nut included with each MVC unit.

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

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

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

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

Technical Data

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

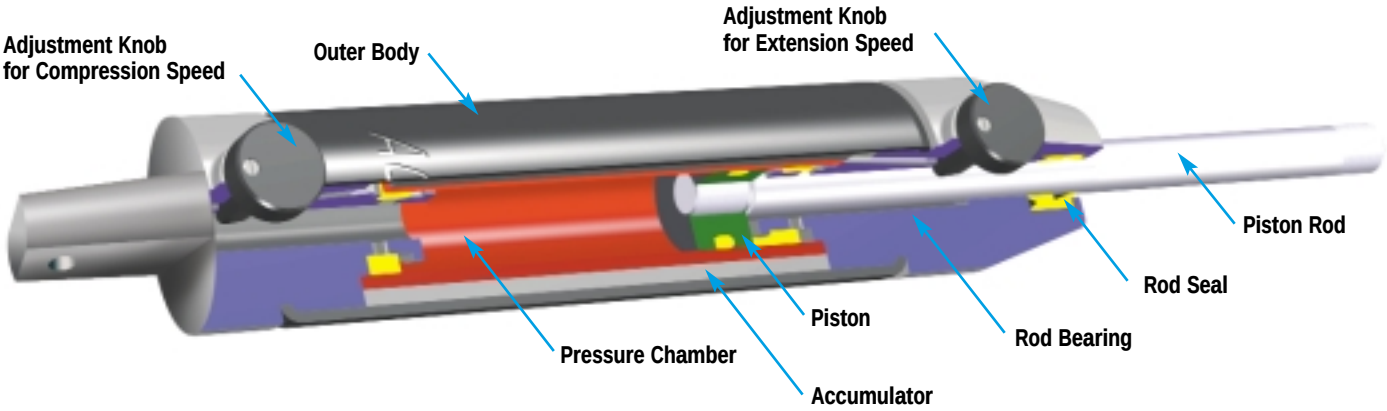
Mechanical stop: Provide mechanical stop .04 to .06 inch (1 to 1.5 mm) before end of each stroke direction.

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

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

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

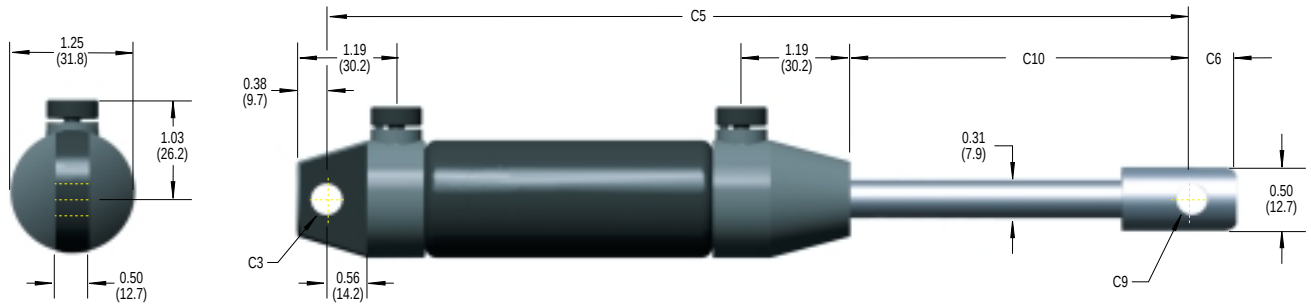
Hydraulic Speed/Feed Controllers DVC



Ordering Information

DVC - 2 - M - CCO

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



Dimensions in inches (millimeters)

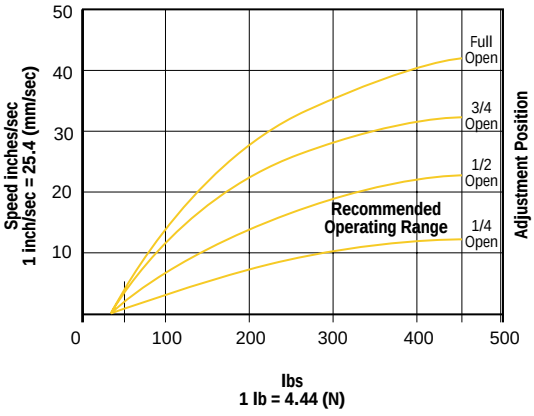
Model	Stroke	C3	C5	C6	C9	C10
DVC-2	2.00	0.25	9.81	0.25	0.25	2.93
DVC-2M	(50.0)	(6.0)	(250.0)	(6.4)	(6.0)	(75.2)
DVC-4	4.00	0.25	13.81	0.25	0.25	4.93
DVC-4M	(100.0)	(6.0)	(350.0)	(6.4)	(6.0)	(124.4)
DVC-6	6.00	0.25	17.81	0.25	0.25	6.93
DVC-6M	(150.0)	(6.0)	(450.0)	(6.4)	(6.0)	(173.6)

Specifications

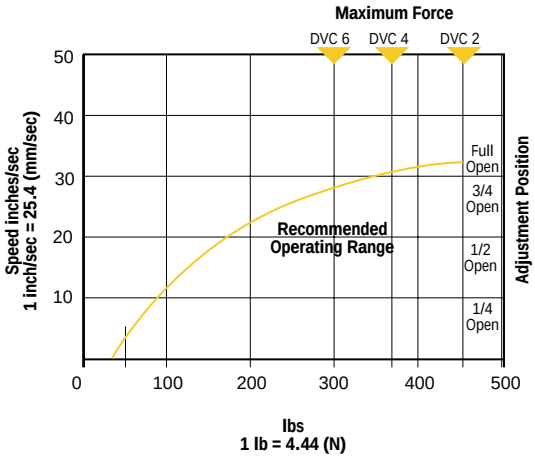
	Tension		Compression		
Model	Maximum Propelling Force	Minimum Force to Operate Through Full Stroke	Maximum Propelling Force	Minimum Force to Operate Through Full Stroke	Shipping Weight lbs (kg)
DVC-2	450 lbs	9.5 lbs	450 lbs	9.5 lbs	0.75 lbs
DVC-2M	2,000 N	(42 N)	2,000 N	(42 N)	0.34 kgs
DVC-4	450 lbs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

Speed Controls

Tension Speed Control Chart (All Models)

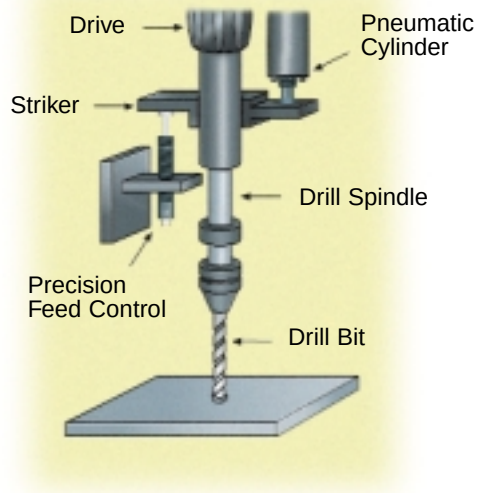


Compression Speed Control Chart



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

Drilling Sheet Metal

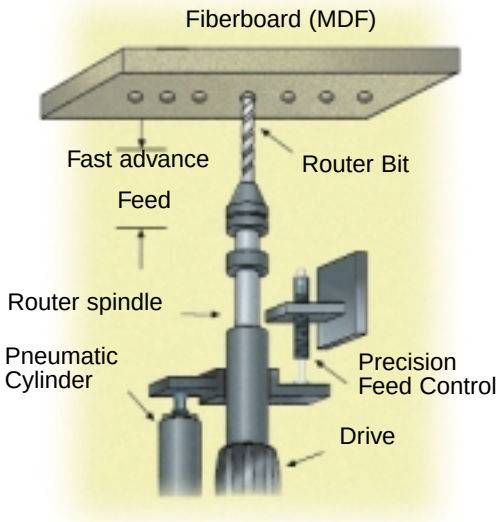


A high force is necessary at the start of drilling when the drill first contacts the sheet.

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

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

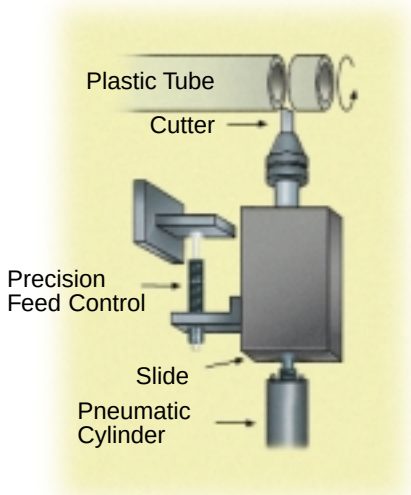
Cutting Holes in MDF Furniture Panels



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

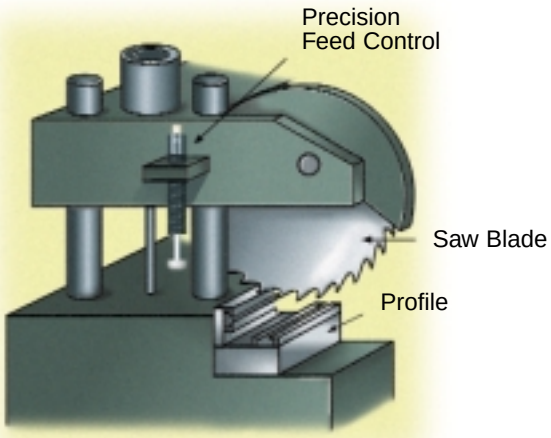
After installing the ACE VC Feed Control the feed rate could be adjusted precisely. The expensive and special tandem cylinder could be replaced by a standard one and the complicated regulating device was no longer required.

Cutting and Chamfering of Plastic Tubes



Precisely adjustable cutting and feed speeds are required depending on the particular material being processed. A standard ACE VC Feed Control with its fine adjustment enables the cutter to be controlled exactly for different materials. Using a standard pneumatic cylinder for the drive force provides an economic and easily set up system for various materials.

Sawing Aluminum and Plastic Profiles



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

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

ACE Controls **drawing selection software, interfACE** offers you the capability to select 2D and 3D industrial and safety absorber drawing files. Selecting specific drawing files saves you from having to download the entire CAD File library. **InterfACE can be downloaded directly from the ACE Controls web site at www.acecontrols.com.** Once you have interfACE in your system, you can access the ACE web site at any time, select the specific drawing file that you require, and download it.

ACE's full line of industrial shock absorbers, stacker crane safety shock absorbers, crane bumper safety shock absorbers as well as velocity and feed controllers are available on interfACE.

In addition, ACE's **Windows-based ACESIZE sizing software** is available for downloading and offers you the capability to select the correct shock absorber to meet your application requirements.

If you prefer an **interfACE/ACESIZE CD-ROM**, simply contact your ACE Controls distributor or ACE directly. Distributors can be easily located on the ACE web site at www.acecontrols.com.

interfACE Features

interfACE on ACE website – 2D and 3D drawings, DWG format only
- Designed to work with Windows 95, 98, NT and 2000
- Interfaces with AutoCAD 13 and 14

interfACE on ACE CD-ROM – 2D and 3D drawings, DWG and DXF formats
- Designed to work with Windows 95, 98, NT and 2000
- Interfaces with AutoCAD 13 and 14

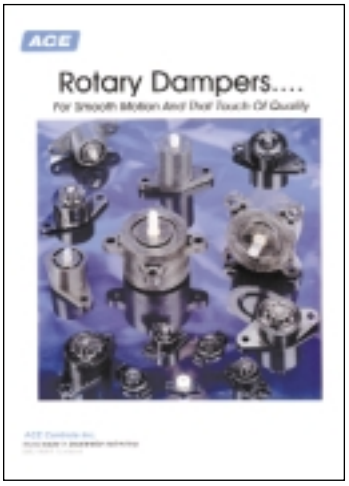
ACE Controls, Inc. is focused on continuous improvement. We therefore reserve the right to change models, dimensions, or specifications without notice or obligation.

Gas Springs and Hydraulic Dampers

ACE offers a rugged and dependable line of gas springs that are ideal for lifting and counterbalancing loads. They are also utilized for tensioning and as a direct support for sliding weights. Select applications for gas springs include: safety covers, machine guards, access panels, hood supports and ventilation hatches.

ACE Controls' hydraulic dampers are the economical choice for solving your automation damping problems. These maintenance free controls are ideal for drilling and tapping equipment, pick and place automation, swinging loads, tooling fixtures, lids, slides and more.

Rotary Dampers

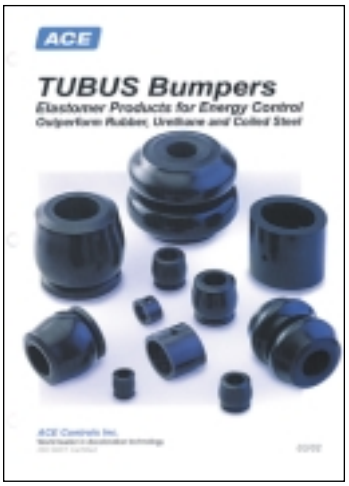


ACE's expanded line of compact rotary dampers promotes smooth mechanical motion that enhances functionality and provides "that touch of quality". Additional benefits include increased operational safety and component life, as well as noise reduction.

Rotary dampers minimize kinetic energy by controlling velocity. Designs are available utilizing viscous shear, vane with orifice or piston types, in addition to a locking damper. Models are available as single or bidirectional, continuously rotating or single rotating. Other options include: with or without gears, latching or unlatching, and fixed or adjustable.

Selected applications for rotary dampers include: computer hardware, flip top cell phones, compact disc units, video cameras, tape players, automotive compartment panels and seats, aerospace and medical equipment, furniture, safety covers and machine guards.

TUBUS Elastomer Bumpers



TUBUS elastomer bumpers in various applications boast five times longer life expectancy than coiled steel, ten times more durability than rubber and twenty times more than urethane.

Lightweight, ultra-strong, exceedingly durable TUBUS elastomer bumpers are ideal for use in highly corrosive environments. The material is resistant to chemicals, oil, grease, saltwater, ultraviolet light, hydraulic fluids, fuel and microorganisms. These versatile units will not absorb water and will not swell.

Easily adaptable to existing systems, TUBUS bumpers are suited for applications in the electric drive, robotic, fitness equipment and crane bumper markets. Additional selected applications include: jounce stops, rebound bumpers and stops, oil well heads, as well as mining, steel, paper and sawmill equipment.

Sizing software is available on the ACE web site or on CD-ROM and includes a cross-reference for ACE industrial shock absorbers.

Cylinders

Flairline, an affiliate of ACE Controls, offers an extensive line of cylinders that are light in weight, but heavy duty in features, reliability and economy. Included are double-acting, spring return, NFPA interchangeable, miniature and magnetic switch series.

Models feature high-strength piston rods, corrosion-resistant heads and caps, circumflex key construction, and versatile mounting options. Pneumatic and hydraulic cylinders are available in bore sizes from 1/2" to 4" in any stroke length.

With *FLAIRLINE/FAST* delivery, all standard products are shipped in three to five working days. Contact Flairline for a free 32-page catalog featuring dimensional data, application and mounting tips, flow charts and maintenance information.

Flairline
phone: (248) 478-3330
fax: (248) 478-3321

Flow Controls and Check Valves

Flairline also offers a line of flow controls and check valves, featuring the O-Check® dilating O-ring. The patented O-Check® design provides positive leakproof sealing and maximum free flow with minimum breakaway.

Quick to open, and quick to close, O-Check® outflows the competition and will last millions of cycles. Standard Series Cv check valve NPT sizes are 1/8, 1/4, 3/8, 1/2 and 3/4".

Flairline right-angle flow controls incorporate O-Check® as the bypass valve. Series RFC models permit full free flow in one direction and accurately metered flow in the opposite direction. Standard metering needle design includes compound needle taper of 5° and 15° and fine adjustment stem threads. Standard NPT sizes are 1/8, 1/4, 3/8, 1/2 and 3/4".

Flairline
phone: (248) 478-3330
fax: (248) 478-3321

ACE Controls, Inc. – World Headquarters, Farmington, Michigan, USA

ACE Controls, Inc. – Worldwide Affiliates

ACE Controls International
Newton-Le-Willows, United Kingdom

ACE Stossdampfer GMBH
Langenfeld, Germany

ACE Controls Japan Ltd.
Chiba Prefecture, Japan

ACE Controls Inc., the world leader in deceleration technology, is an ISO 9001 certified manufacturer. Its global customer service network includes offices in England, Germany and Japan with distributors in over 110 cities in 35 countries.

ACE Controls is focused on, and committed to continuous improvement. The goal is to provide customers with cost-effective, world-class products to meet current and future requirements in a competitive marketplace. In order to accomplish this, ACE's engineering team utilizes the latest CAD System design, structural analysis and simulation software.

Rigorous lab testing assures that all new ACE products are capable of meeting the most demanding deceleration challenges. Products are evaluated for endurance, cycle life and material strength.

Manufacturing and quality control processes incorporate the latest in equipment and techniques. A high technology coordinate measuring machine (CMM) inspects ACE's middle and large bore product lines.

Smaller parts are subject to a comprehensive inspection by a sophisticated computerized video measurement system.

ACE Controls is continuously seeking the best solutions for its customers. As a result, ACE is committed to investing in leading edge software and high-technology equipment.

For additional information, please contact a distributor or ACE Controls directly.

ACE Capabilities video tape or CD-ROM available upon request.

USA, Canada and Latin America

United States

Location	City	Distributor	Telephone
Alabama	Birmingham	Fluid Power Systems, Inc.	205-798-9440
Arizona	Phoenix	Hel-Tek Porter's	602-269-7931
	Phoenix	R. D. Playman Co.	602-265-4821
Arkansas	Fort Smith	Franklin Electrofluid Co.	800-264-7604
	Little Rock	Franklin Electrofluid Co.	800-272-5665
California	Costa Mesa	Clayton Controls Co.	714-556-9446
	Santa Clara	Nor-Cal Controls, Inc.	408-727-5756
Colorado	Denver	Advanced Air Products Co.	303-778-0800
Connecticut	Bloomfield	Pearse-Pearson Co., Inc.	860-242-7777
Florida	Tampa	Gulf Controls Corp.	800-282-9125
Georgia	Alpharetta	Power Systems, Inc.	770-475-1680
Hawaii	Honolulu	Hawaiian Fluid Power	808-833-4516
Illinois	Elk Grove Village	Fluid Power Engrg. Co.	847-364-7455
	St. Louis, MO	Air Specialists	314-298-7400
Indiana	Columbus	Neff Engrg. Co., Inc.	812-372-8288
	Evansville	Neff Engrg. Co., Inc.	812-476-7500
	Ft. Wayne	Neff Engrg. Co., Inc.	260-489-6007
	Indianapolis	Neff Engrg. Co., Inc.	317-841-9244
	South Bend	Neff Engrg. Co., Inc.	574-272-8282
	Valparaiso	Neff Engrg. Co., Inc.	219-464-3269
Kansas	Kansas City	Powerflow Systems, Inc.	913-342-7024
	Overland Park	Fluid Systems & comp., Inc.	800-747-2552
Kentucky	Elizabethtown	Air Hydro Power, Inc.	270-763-0259
	Glaskow	Air Hydro Power, Inc.	270-651-1353
	Henderson	Air Hydro Power, Inc.	270-827-8008
	Lexington	Air Hydro Power, Inc.	859-255-6155
	Louisville	Air Hydro Power, Inc.	502-451-1000
Louisiana	Shreveport	The Weston Co., Inc.	318-227-1871
	New Orleans	The Weston Co., Inc.	504-486-6653
Michigan	**Detroit**	**ACE Controls, Inc.**	**800-521-3320**
	Flint	Neff Engrg/Kober Sales	810-232-9350
	Grand Rapids	Neff Engrg. Co., Inc.	616-554-1974
	Grandville	Michigan Fluid Power, Inc.	616-538-5700
Minnesota	Eden Prairie	Braas Co.	612-937-8902
Mississippi	Jackson	AHC Fluid Power	601-969-7022
Missouri	St. Louis	Air Specialists	314-298-7400
Nebraska	Omaha	Powerflow Systems, Inc.	402-331-3104
New Jersey	Maplewood	Airoyal Company	973-761-4150
New York	Buffalo	Callahan Motion Control	716-741-8321
	Hauppauge, LI	Airoyal Company	631-434-1892
North Carolina	Concord	C.F.T.	704-784-8101
Ohio	**Cleveland**	**ACE Controls, Inc.**	**800-521-3320**
	Dayton	Voelker Controls Co.	937-433-8128
	Toledo	**ACE Controls, Inc.**	**800-521-3320**
Oklahoma	Oklahoma City	Shepherd Controls	800-533-1866
	Tulsa	Southwestern Controls	918-663-6777
Pennsylvania	Exton	Dev-Air Corp.	610-524-9927
	Mainland	Air-Oil Systems	800-333-5520
	Pittsburgh	Pennsylvania Controls Co.	800-247-9425
Tennessee	Memphis	Action Fluid Power, Inc.	901-794-0857
	Nashville	Meredith Air Controls, Inc.	615-256-1888
Texas	Austin	Shepherd Controls & Assoc.	800-533-1866
	Dallas	Shepherd Controls & Assoc.	800-533-1866
	(East Texas)	Shepherd Controls & Assoc.	800-533-1866
	Dallas	Southwestern Controls	800-444-9367
	Houston	Shepherd Controls & Assoc.	800-533-1866
	Houston	Southwestern Controls	713-777-2626
	San Antonio	Southwestern Controls	800-444-9368

United States

Location	City	Distributor	Telephone
Utah	Salt Lake City	Advanced Air Products Co.	801-466-1111
Virginia	Fredericksburg	Advanced Pneumatics	540-898-4511
	Roanoke	Advanced Pneumatics	540-563-1234
Washington	Seattle	Warden Fluid Dynamics	206-633-0382
	Spokane	Warden Fluid Dynamics	800-234-8265
	Vancouver	Warden Fluid Dynamics	360-696-4946
Wisconsin	Appleton	Neff Engr. of Wisc.	920-738-5900
	Mequon	Neff Engr. of Wisc.	262-834-6300

If you are located in one of the following states, please refer to the column on the right for the nearest state with an ACE Controls stocking distributor, and select from the list above.

State	ACE Stocking Distributor State
Alaska	Washington
Delaware	Pennsylvania
Idaho	Washington
Iowa	Illinois, Kansas, Minnesota
Maine	Connecticut
Massachusetts	Connecticut
Maryland	Pennsylvania & Virginia
Montana	Washington
Nevada	California
New Hampshire	Connecticut
New Mexico	Texas
North Dakota	Minnesota
Rhode Island	Connecticut
Oregon	Washington
South Carolina	North Carolina
South Dakota	Minnesota
Vermont	Connecticut
Washington D.C.	Pennsylvania
West Virginia	Pennsylvania & Virginia
Wyoming	Colorado

Canada

Alberta	Edmunton	Peerless Engrg.Sales Ltd.	780-439-3322
British Columbia	Burnaby	Peerless Engrg.Sales Ltd.	604-659-4100
	Prince George	Peerless Engrg.Sales Ltd.	250-563-2130
New Brunswick	St. John	Cowper	506-634-7763
Nova Scotia	Dartmouth	Cowper	902-468-8036
Ontario	Kingston	Cowper	613-547-9991
Ontario	Waterloo	Vickers-Warnick	519-884-8946
Ontario	London	Cowper	519-681-0430
Ontario	Markham	Cowper	905-294-0204
Ontario	Mississauga	Cowper	905-607-2508
Ontario	Stoney Creek	Vickers-Warnick	905-662-7737
Ontario	Mississauga	Vickers-Warnick	905-564-0188
Quebec	Lachine	Cowper	514-637-6746

Latin America

Mexico	Mexico City	Atlas Industrial Supply, Inc.	52-55-5148-8104
	Mexico City	Kopar	52-55-5207-8688
	Monterrey	Atlas Industrial Supply, Inc.	52-81-8342-5260
	Monterrey	Kopar	52-81-8348-7383
	Saltillo	Atlas Industrial Supply, Inc.	52-844-439-3263
Puerto Rico	Canovanas	P & C Company.	787-768-5033

Visit the ACE Controls web site for direct hot links to numerous ACE distributor web sites.
ACE Controls web site – www.acecontrols.com

Worldwide

Europe

Austria	**Langenfeld (Germany)**	**ACE Stossdampfer GMBH**	**0-2173-922610**
Belgium	**Langenfeld (Germany)**	**ACE Stossdampfer GMBH**	**0-2173-922610**
Croatia	Zagreb	Bibus Zagreb	385-1-3818-006
Czech Republic	Brno	Bibus S.R.O.	420-5-4712-53-00
Denmark	Silkeborg	AVN Pneumatik	45-70-20-04-11
Finland	Helsinki	Nestepaine Oy.	03-58-961-3633
France	Paris	Doedijns France S.A.R.L.	33-1-4399-1000
Germany	**Langenfeld**	**ACE Stossdampfer GMBH**	**0-2173-922610**
Greece	Athens	Pneumatic, Industrial Automation Systems	341-21-01
Holland	**Langenfeld (Germany)**	**ACE Stossdampfer GMBH**	**0-2173-922610**
Hungary	Budapest	Yeruham Muvek Kft	361-412-4161
	Budapest	Bibus Kft.	361-265-2733
Italy	Turin	R.T.I.	39-011-700053
Norway	Ski	Oiltech AS	47-64-911180
Poland	Gdynia	Bibus Menos Sp. Z.O.O.	48-58-621-2335
Portugal	Valongo	Air Control S.A.	351-966-237-438
Slovakia	Nitra	Bibus SK	421-37-741-2525
Spain	San Sebastian	Air Control S.A.	34-943-445080
Sweden	Sollentuna	HYDNET AB	46-85-94-70470
Switzerland	Wallisellen	Bibus A.G.	41-1877-50-11
United Kingdom	**Newton-Le-Willows**	**ACE Controls International**	**01-925-227171**

Worldwide

Australia	Rowville	IMI Norgren Pty. Ltd.	03-92130800
Hong Kong	Kowloon	IMI Norgren Pty. Ltd.	852-2492-7608
	Kwai Chung	Universe Technology	852-2619-0013
India	Calcutta	Maco Corp. India	0091334758500
	Hyderabad	3D Equipment	91-40-666-8109
Israel	Petha-Tiqva	Ilan and Gavish Automation	972-3-9221824
Japan	**Chiba Prefecture**	**ACE Controls Japan Ltd.**	**81-436-246711**
Jordan	Amman	Atafawok Trading Est.	00-962-6402-3873
Korea	Seoul	Seyang Corp.	82-31-498-0121
Malaysia	Selangor	Hoerbiger-Origa Pte. Ltd.	(65) 64832959
New Zealand	Penrose, Auckland	Plummer Pneumatics Ltd.	0-9-593605
	Penrose, Auckland	IMI Norgren Pty. Ltd.	0-9-5790189
Pakistan	Karachi	J.J. Hyd. & Pneu. Systems	21-566-1063
PRC	Beijing	IMI Norgren Pty. Ltd.	86-10-6581-3978
	Shanghai	IMI Norgren Pneumatics	86-21-6485-7935
Singapore	Singapore	Hoerbiger-Origa Pte. Ltd.	(65) 64832959
	Singapore	IMI Norgren Pty. Ltd.	(65) 862-1811
South Africa	Isando	Isando Pneumatics Ltd.	27-11-9745176
South America	Sao Paulo, Brazil	OBR Equipamentos	55-11-6914-3698
	Santiago, Chile	Taylor Automatizacion S.A.	56-2555-1516
Taiwan	Taipei	Danyao Trading Co. Ltd.	886-2-2276-8200
Thailand	Bangkok	B-TAC Automation Ltd.	0-2-33190624
	Bangkok	Hoerbiger-Origa Pte. Ltd.	(65) 64832959
Turkey	Karakoy	T.M.G. Pneu. & Hyd. Control	56-2555-1516

ACE

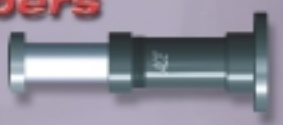
World leader in deceleration technology

ACE Controls Inc.

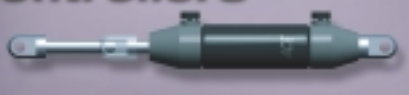
Main Catalog

Industrial Shock Absorbers

Safety Shock Absorbers



Velocity and Feed Controllers



system ISO 9001 certified

06/02

ACE Controls, Inc.
23435 Industrial Park Drive • P.O. Box 71 • Farmington, Michigan 48332-0071
800-521-3320 • (248) 476-0213 • Fax (248) 476-2470

Industrial Shock Absorbers

- Decelerate Loads
- Prevent Impact Damage
- Dampen Noise
- Increase Cycle Speeds
- Improve Product Performance

An ACE shock absorber decelerates a free-falling 100 lb (45 kg) weight so effectively that the contents of the glass don't even spill. Watch for ACE's "Wine Drop" demonstration at industrial exhibitions around the world.

ACE Controls, Inc. on the Web
www.acecontrols.com
email: shocks@acecontrols.com

Catalog No. 200-0069