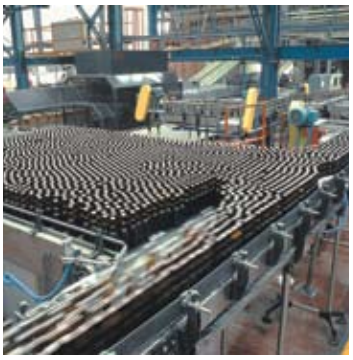


aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding

Pneumatic Actuator Products

Cylinders, Guided Cylinders and Rotary Actuators

Catalog 0900P-5

Parker

ENGINEERING YOUR SUCCESS.

Warning, Offer of Sale

⚠ WARNING

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS AND/OR SYSTEMS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users h aving technical expertise. It is important that you analyze all aspects of your application including consequences of any failure, and review the information concerning the product or system in the current product catalog. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

The items described in this document are hereby offered for sale by Parker Hannifin Corporation, its subsidiaries or its authorized distributors. This offer and its acceptance are governed by the provisions stated on the separate page of this document entitled “Offer of Sale”.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Industrial Shock Absorbers

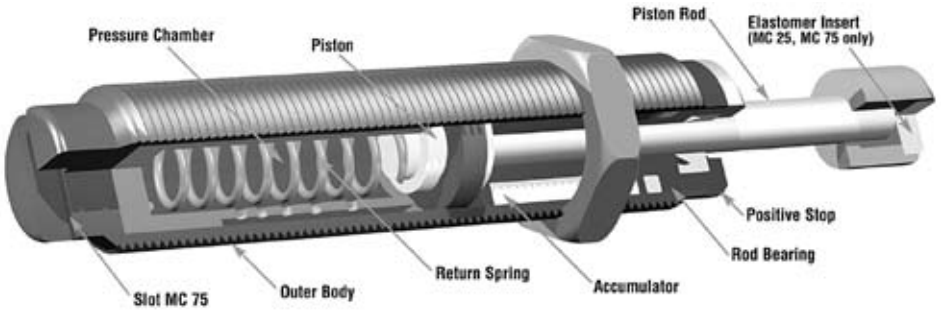
Section N

Contents

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

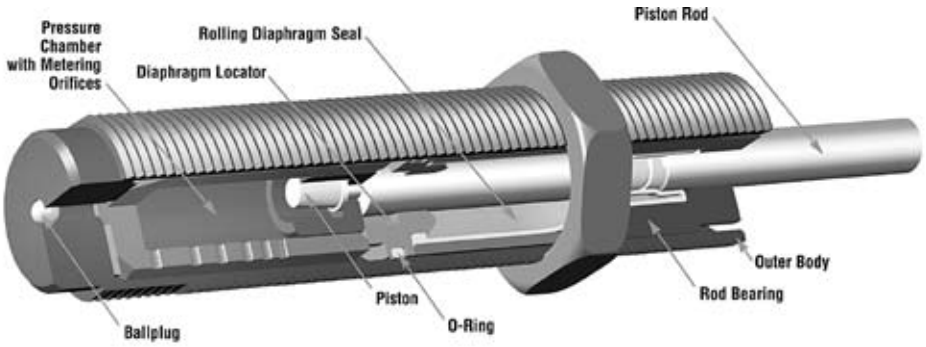
Miniature Shock Absorbers MC 9 to MC 75

Self-Compensating



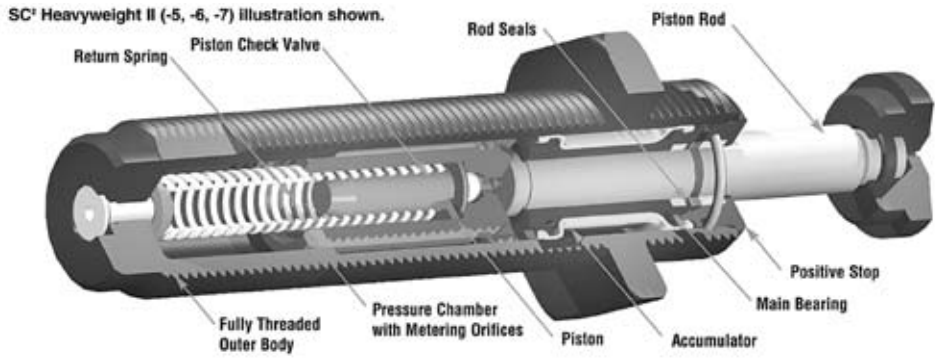
Miniature Shock Absorbers MC 150, MC 225 and MC 600

Self-Compensating



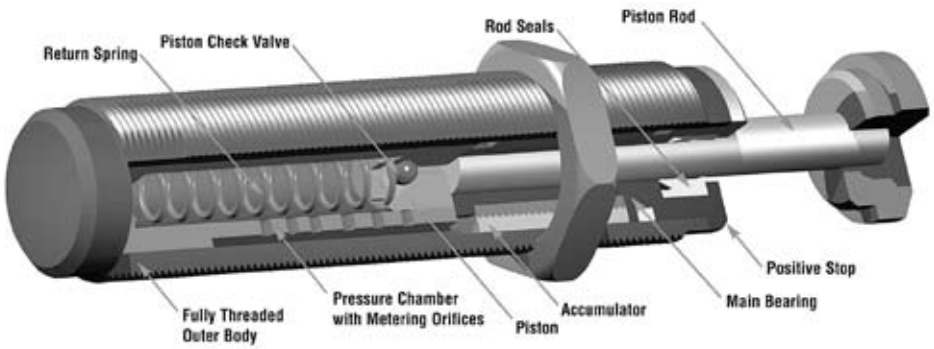
Heavyweight Shock Absorbers SC 300 and SC 650

Soft Contact and Self-Compensating



Miniature Shock Absorbers SC 190 to SC 925

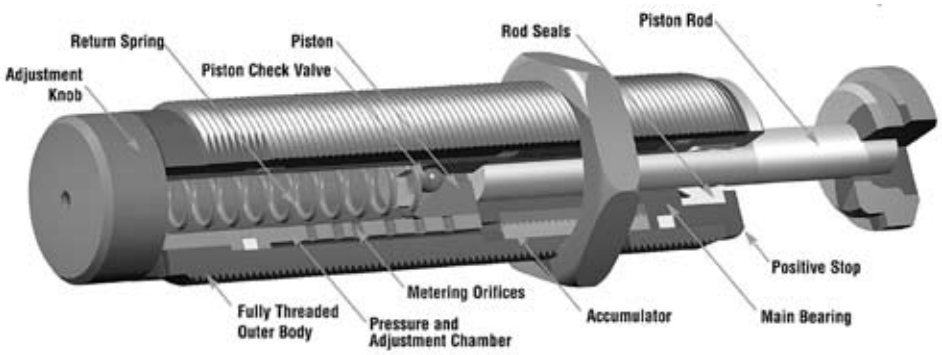
Soft Contact and Self-Compensating



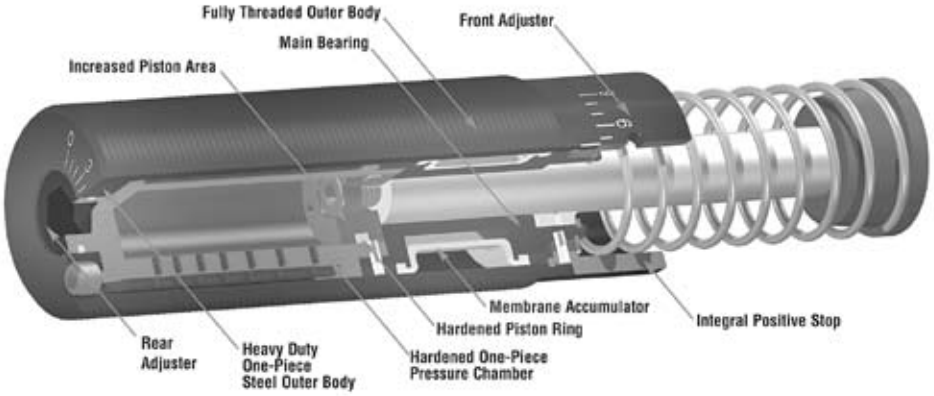
N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

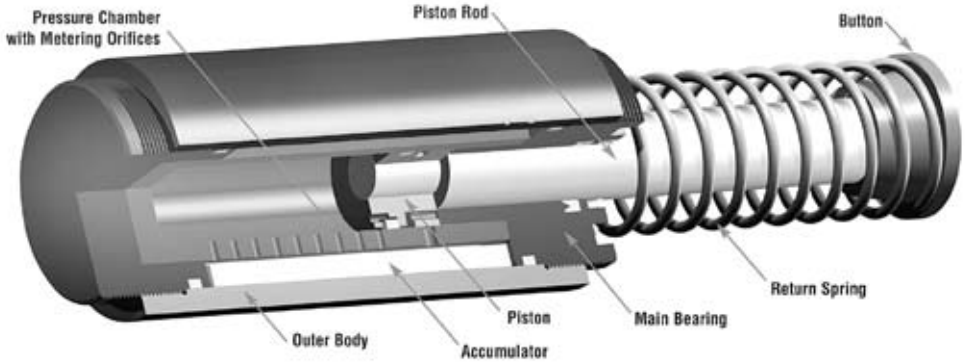
MA Series 225-900 Shock Absorbers (Miniature Adjustable) *Adjustable*



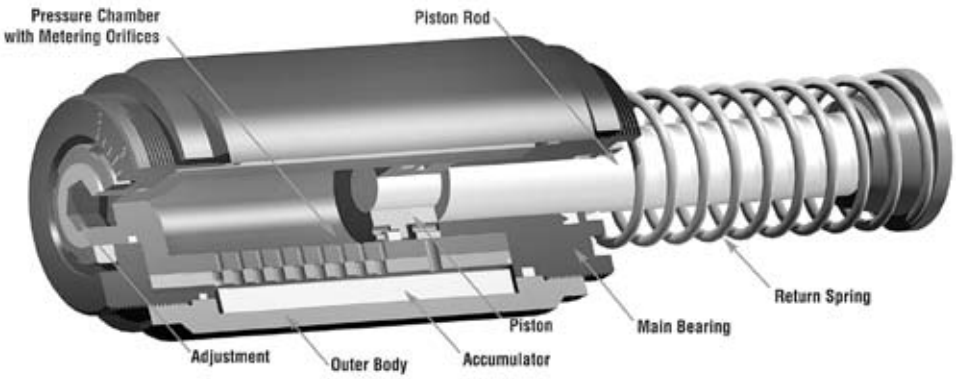
Magnum Series MA and ML 33 to 64 *Adjustable*



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

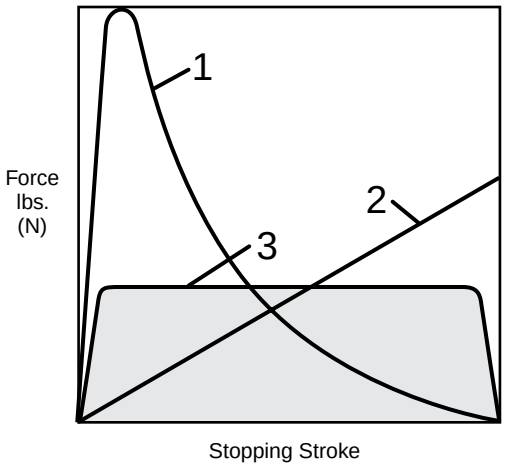


Heavy Industrial Shock Absorbers A2 to A3 *Adjustable*



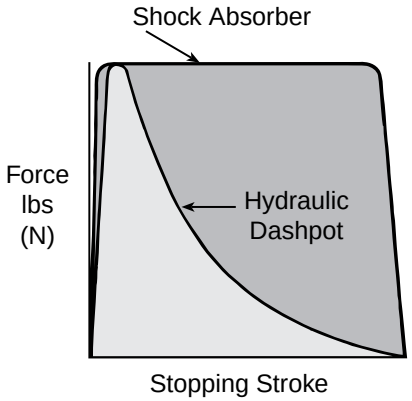
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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 to bounce back.
3. **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 industrial shock absorbers.

Energy Capacity

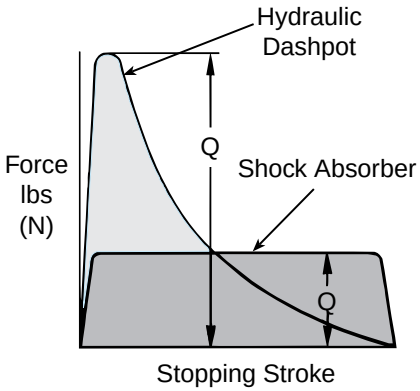


Premise:
Same maximum reaction force.

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

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

Reaction Force
(stopping force)

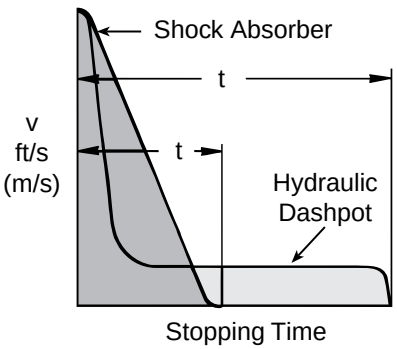


Premise:
Same energy absorption (area under the curve).

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

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

Stopping Time



Premise:
Same energy absorption.

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

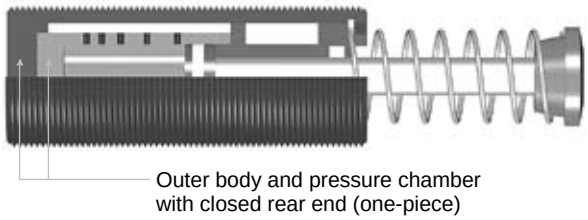
Benefit:
By installing a shock absorber cycle times are reduced giving much higher production rates.

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

The use of one piece / closed end bodies and inner pressure chambers 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 Parker with that of some of its competitors:

Parker Shock Absorber

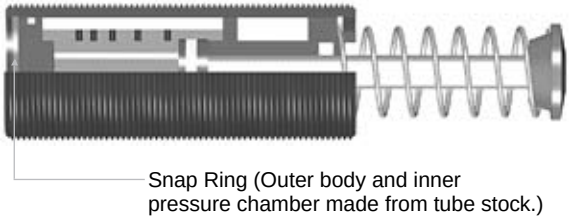


Parker builds its shock absorbers with closed end/one piece bodies and inner pressure chambers, which greatly reduces the chance of sudden failure, or machine damage in the event of an overload.

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.

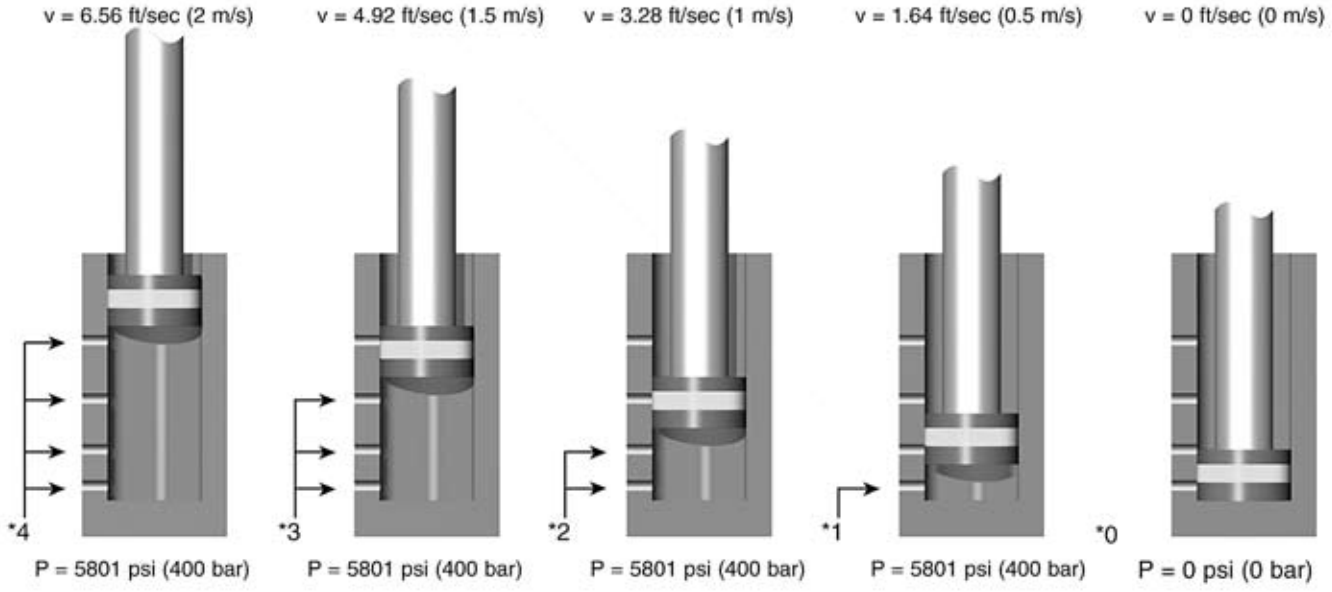
Other Shock Absorber



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.

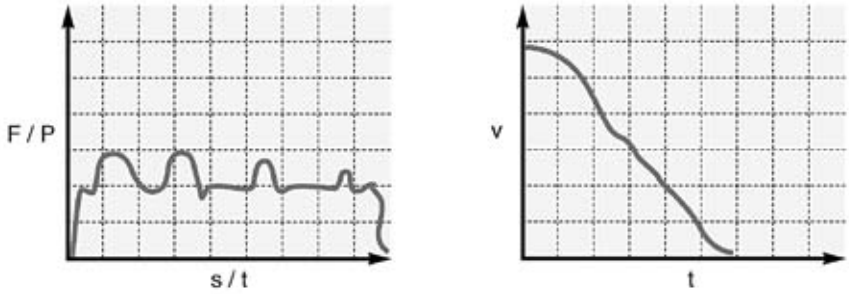
What happens with an overload or gradual oil loss?
The snap ring breaks or is extruded due to excessive force.
Machine damage!! Equipment Stops!!
Production Halted!! Emergency Repair!!

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)



Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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, an 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, an 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, Parker 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.

Figure A

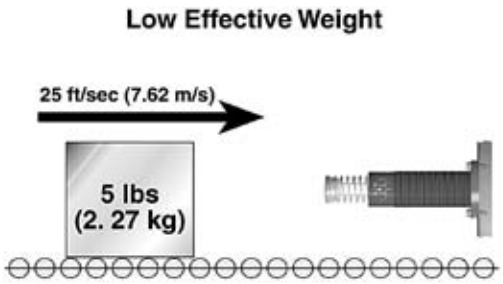


Figure B

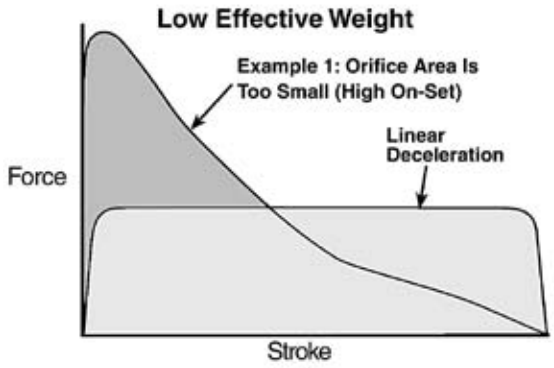


Figure C

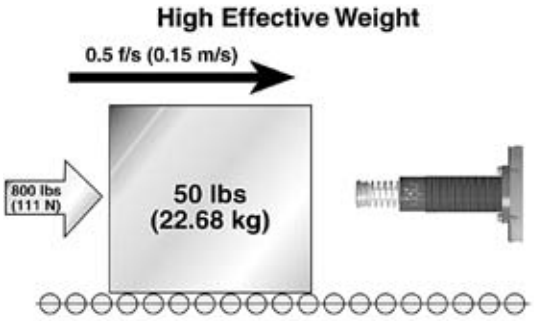
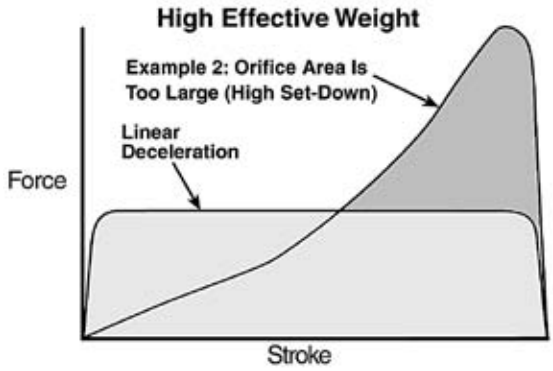


Figure D



N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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

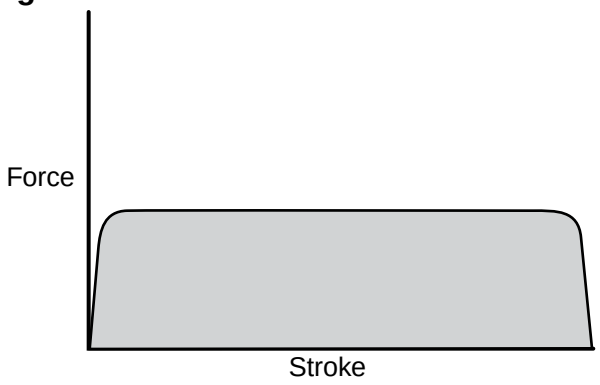


Figure B

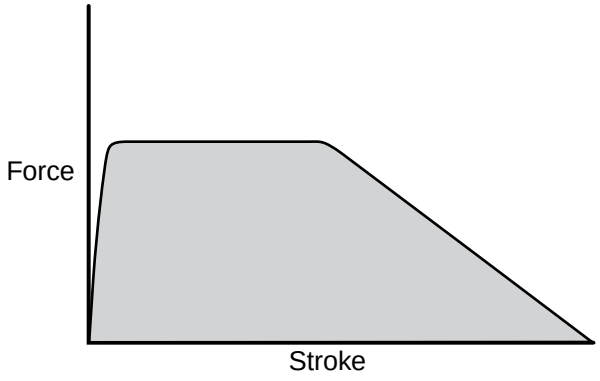


Figure C

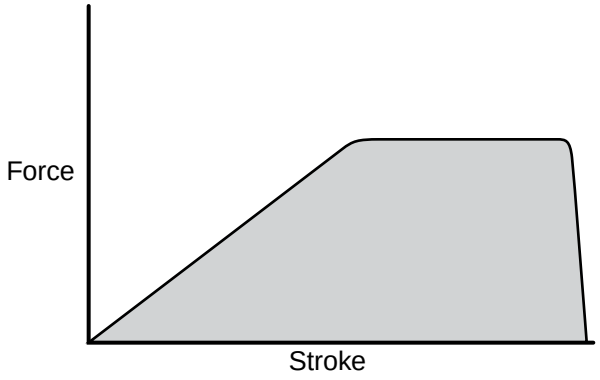
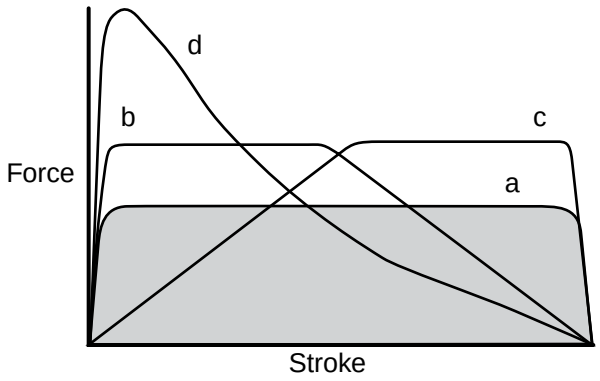


Figure D

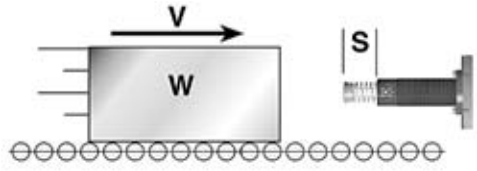


Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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

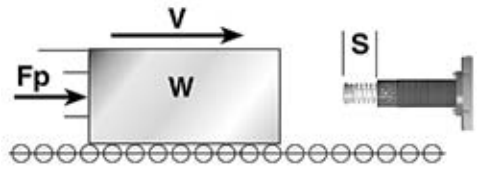
W = 500 lbs
V = 3 ft/sec
Fp = 0
C = 500/hour

$E_1 = (0.186) \bullet (500) \bullet (3^2) = 837$ 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



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

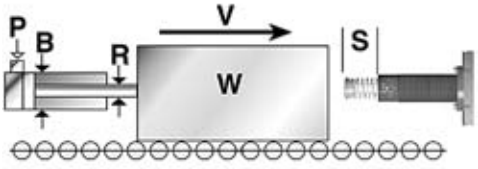
W = 14 lbs
V = 2.2 ft/sec
Fp = 30 lbs
C = 100/hour
s = 0.4 inches

$F = 30$ = 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.

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

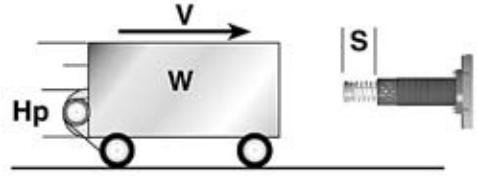
W = 120 lbs
V = 2 ft/sec
B = 1.5 inches
R = 0 inches
P = 60 psi
C = 60/hour
s = 0.75 inches

$F = 0.785 \bullet (1.5^2 - 0^2) \bullet 60$ = 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



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

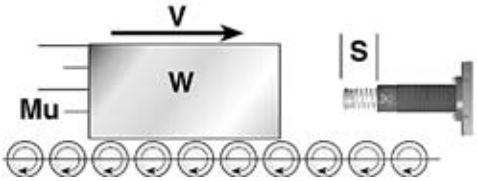
W = 2,100 lbs
V = 1 ft/sec
Hp = 2 hp
ST = 2.5
C = 20/hour
s = 2 inches

$F = (550) \bullet (2.5) \bullet (2) / 1$ = 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 inch

$F = (250) \bullet (0.2)$ = 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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Inclined and Vertical Sizing Examples
Linear Decelerators

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

V1 Weight, Vertical Free Fall

Examples: Elevator Emergency Stops, Flying Shears, Test Equipment

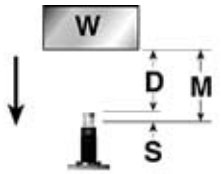
FORMULA

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

EXAMPLE

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

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



V1 - Select from Model Rating Chart: MA 4575

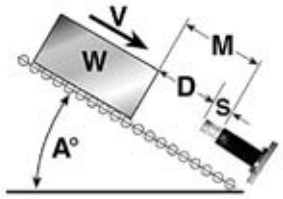
V2 Weight Sliding Down Incline

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

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

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

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



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

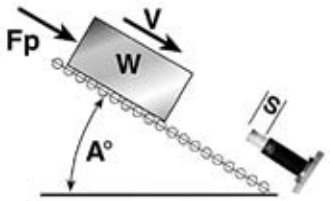
V3 Down Incline with Propelling Force

Inclined Conveyor Belt, High Speed Safety Doors

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

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

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



V3 - Select from Model Rating Chart: MC 150H

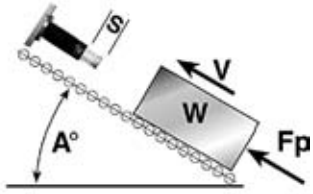
V4 Up Incline with Propelling Force

Elevator, Inclined Power Conveyor

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

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

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



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

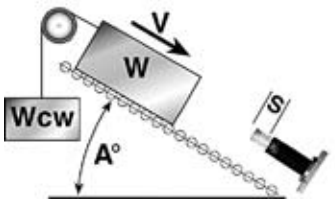
V5 Down Incline with Counter Weight

Lifting Door with Counter Balance

$F = (W)•SIN(A)-W_{CW}$
$E_1 = (0.186)•(W)•(V^2)$
$E_2 = (F)•(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)•(C)$
$We = E_3 / (0.186)•(V^2)$

W = 1,500 lbs
V = 0.5 ft/sec
A = 45°
W_{CW} = 500 lbs
C = 1/hour
s = 1 inch

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



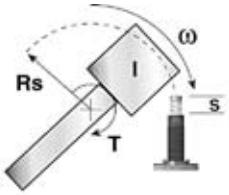
V5 - Select from Model Rating Chart: ML 3325

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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

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

EXAMPLE

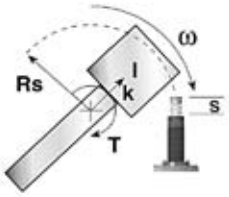
I = 3,930 lb-ft-sec2
ω = 172°/sec
T = 480,000 lbs-in
Rs = 40 inches
C = 30/hour
s = 6 inches

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



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

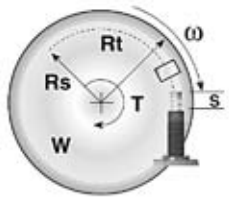
W = 300 lbs
k = 2.5 inches
ω = 180°/sec
T = 9,000 lbs-in
Rs = 25 inches
C = 1,200/hour
s = 1 inch

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

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

R3 Index Table

Examples: Index Table, Rotating Work Station



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

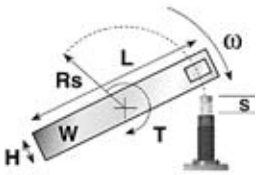
W = 195 lbs
Rt = 20 inches
ω = 85°/sec
T = 1,700 lbs-in
Rs = 15 inches
C = 60/hour
s = .75 inches

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

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

R4 Turnover

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



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

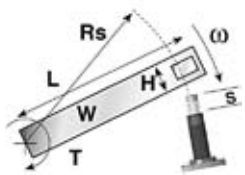
W = 150 lbs
L = 38 inches
H = 1 inch
ω = 70°/sec
T = 15,000 lbs-in
Rs = 12 inches
C = 500/hour
s = 1 inch

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

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

R5 Uniform Bar, Horizontal Plane

Examples: Swinging Beam, Robotic Arm



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

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

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

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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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

R6 Uniform Bar, Vertical Plane

Examples: Cross-Conveyor Transfer, Gantry Walkway

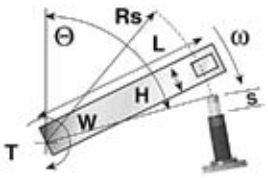
FORMULA

$Wa = (W)\bullet(H^2+4\bullet L^2)/12\bullet(Rs^2)$
$V = (Rs)\bullet(\omega)/688$
$F = [T+.5\bullet L\bullet W\bullet SIN(\theta)]/Rs$
$E_1 = (0.186)\bullet(Wa)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

EXAMPLE

W = 5 lbs
H = .25 inches
L = 6 inches
θ = 87.6°
ω = 360°/sec
T = 20 lbs-in
Rs = 6 inches
C = 1,800/hour
s = .25 inches

$Wa = (5)\bullet(.25^2+4\bullet 6^2)/12\bullet(6^2)$ = 1.7 lbs
$V = (6)\bullet(360)/688$ = 3.1 ft/sec
$F = [20+.5\bullet 6\bullet 5\bullet SIN(87.6)]/6$ = 5.8 lbs
$E_1 = (0.186)\bullet(1.7)\bullet(3.1^2)$ = 3.0 in lbs
$E_2 = (5.8)\bullet(.25)$ = 1.5 in lbs
$E_3 = 3.3 + 1.5$ = 4.8 in lbs
$E_4 = (4.5)\bullet(1,800)$ = 8,100 in lbs/h
$We = 4.5 / (0.186)\bullet(3.1^2)$ = 2.5 lbs



R6 - Select from Model Rating Chart: MC 25L

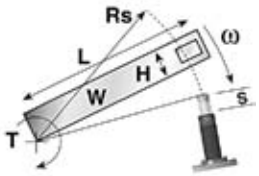
R7 Door, Horizontal Plane

Examples: Cabinet Doors, Machine Enclosures

$Wa = (W)\bullet(H^2+L^2)/(3\bullet Rs^2)$
$V = (Rs)\bullet(\omega)/688$
$F = t/Rs$
$E_1 = (0.186)\bullet(Wa)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

W = 120 lbs
H = 1 inch
L = 42 inches
ω = 60°/sec
T = 1,800 lbs-in
Rs = 10 inches
C = 4/hour
s = .5 inches

$Wa = (120)\bullet(1^2+42^2)/(3\bullet 10^2)$ = 706 lbs
$V = (10)\bullet(60)/688$ = .9 ft/sec
$F = 1,800/10$ = 180 lbs
$E_1 = (0.186)\bullet(706)\bullet(.9^2)$ = 106.4 in lbs
$E_2 = (180)\bullet(.5)$ = 90 in lbs
$E_3 = 106.4 + 90$ = 196.4 in lbs
$E_4 = (196.4)\bullet(4)$ = 785 in lbs/h
$We = 196.4 / (0.186)\bullet(.9^2)$ = 1,303.6 lbs



R7 - Select from Model Rating Chart: MC 225H2

R8 Door, Vertical Plane

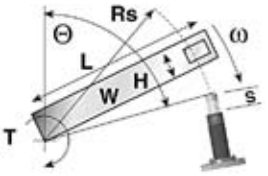
Examples: Hatches, Lids, Hoods

$Wa = (W)\bullet(H^2+L^2)/(3\bullet Rs^2)$
$V = (Rs)\bullet(\omega)/688$
$F^* = [T+.5\bullet L\bullet W\bullet SIN(\theta)]/Rs$
$E_1 = (0.186)\bullet(Wa)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

*Force is approximate

W = 60 lbs
H = 1 inch
L = 10 inches
θ = 150°
ω = 200°/sec
T = 45 lbs-in
Rs = 10 inches
C = 1,900/hour
s = .63 inches

$Wa = (60)\bullet(1^2+10^2)/(3\bullet 10^2)$ = 20.2 lbs
$V = (10)\bullet(200)/688$ = 2.9 ft/sec
$F = [45+.5\bullet 10\bullet 60\bullet SIN(150)]/10$ = 19.5 lbs
$E_1 = (0.186)\bullet(20.2)\bullet(2.9^2)$ = 31.6 in lbs
$E_2 = (19.5)\bullet(0.63)$ = 12.3 in lbs
$E_3 = 34 + 12.3$ = 43.9 in lbs
$E_4 = (43.9)\bullet(1,900)$ = 83,382 in lbs/h
$We = 43.9 / (0.186)\bullet(2.9^2)$ = 28.1 lbs



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

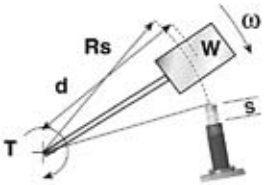
R9 Weight at Radius, Horizontal Plane

Examples: Circuit Breakers, Swinging Gates

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

W = 40 lbs
d = 8 inches
ω = 110°/sec
T = 150 lbs-in
Rs = 7 inches
C = 1,500/hour
s = .5 inches

$Wa = (40)\bullet(8^2)/(7^2)$ = 52 lbs
$V = (7)\bullet(110)/688$ = 1.1 ft/sec
$F = 150/7$ = 21 lbs
$E_1 = (0.186)\bullet(52)\bullet(1.1^2)$ = 11.7 in lbs
$E_2 = (21)\bullet(.5)$ = 10.5 in lbs
$E_3 = 11.7 + 10.5$ = 22.2 in lbs
$E_4 = (22.2)\bullet(1,500)$ = 33,300 in lbs/h
$We = 22.2 / (0.186)\bullet(1.1^2)$ = 98.6 lbs



R9 - Select from Model Rating Chart: MC 150H

R10 Weight at Radius, Vertical Plane

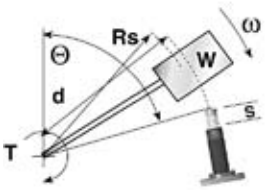
Examples, Impact Testers, Pendulums

$Wa = (W)\bullet(d^2)/(Rs^2)$
$V = (Rs)\bullet(\omega)/688$
$F^* = [T+W\bullet d\bullet SIN(\theta)]/Rs$
$E_1 = (0.186)\bullet(Wa)\bullet(V^2)$
$E_2 = (F)\bullet(s)$
$E_3 = E_1 + E_2$
$E_4 = (E_3)\bullet(C)$
$We = E_3 / (0.186)\bullet(V^2)$

*Force is approximate

W = 40 lbs
d = 8 inches
θ = 90°
ω = 110°/sec
T = 150 lbs-in
Rs = 7 inches
C = 1,500/hour
s = .5 inches

$Wa = (40)\bullet(8^2)/(7^2)$ = 52 lbs
$V = (7)\bullet(110)/688$ = 1.1 ft/sec
$F = [150+40\bullet 8\bullet SIN(90)]/7$ = 67 lbs
$E_1 = (0.186)\bullet(52)\bullet(1.1^2)$ = 11.7 in lbs
$E_2 = (67)\bullet(.5)$ = 33.5 in lbs
$E_3 = 11.7 + 33.5$ = 45.2 in lbs
$E_4 = (45.2)\bullet(1,500)$ = 67,800 in lbs/h
$We = 45.2 / (1.1^2)$ = 200.8 lbs



R10- Select from Model Rating Chart: MC 150H

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

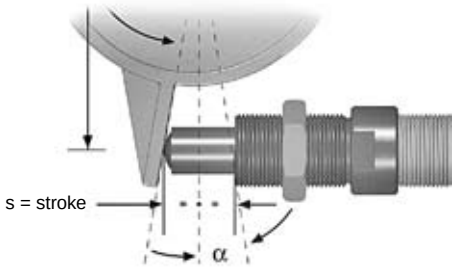
1 Shock Absorbers for Pneumatic Cylinders

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

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

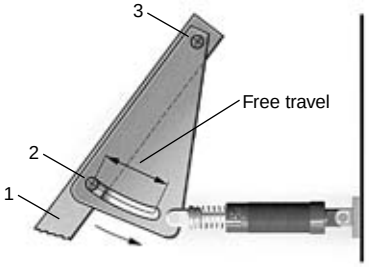
With heavy loads or high velocities normal cylinder cushions are often overloaded. This causes shock loading leading to premature cylinder failure or excessive maintenance.
Using oversized cylinders to withstand this shock loading is not the best solution since this considerably increases air consumption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

2 Side Load Adapter for High Side Load Angles



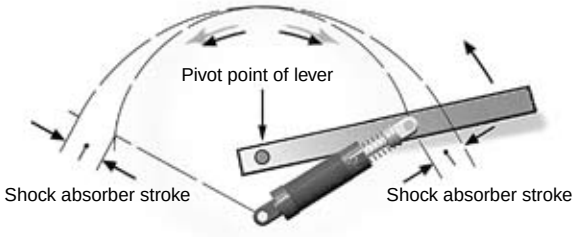
The side loading is removed from the shock absorber piston rod leading to considerably longer life. Wherever possible mount shock absorber so that impacting face is perpendicular to shock absorber axis half way through stroke.
See pages N48 and N49 for more details.

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.

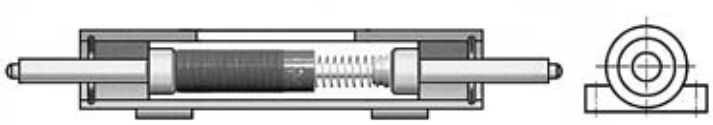
4 One Shock Absorber for Both Ends of Travel



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

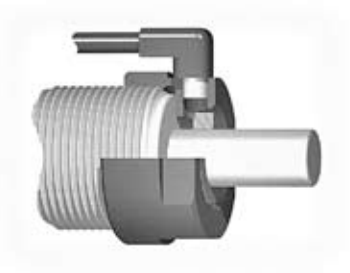
Tip: Leave approx.0.06 in (1.5 mm) of shock absorber stroke free at each end of travel.

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



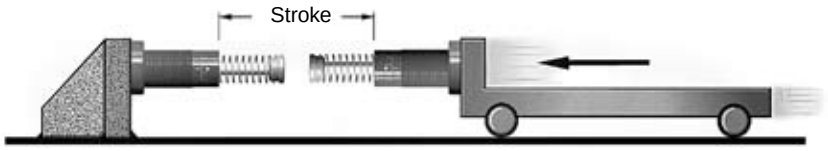
By using this air bleed collar the operating lifetime of shock absorbers in aggressive environments can be considerably increased. The adapter protects the shock absorber seals from cutting fluids, cleaning agents, cooking oils etc. by using a low pressure air bleed.

Available for select shock absorbers.

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

7 Double Stroke Length



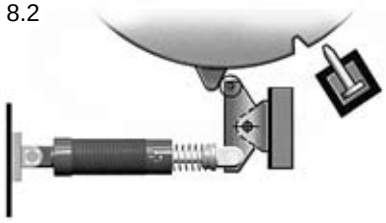
50% lower reaction force (Q) 50% lower deceleration (a)

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

8 Ride Over Latch

8.1

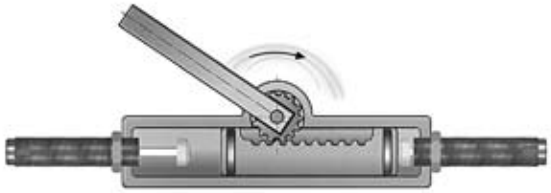
8.2



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

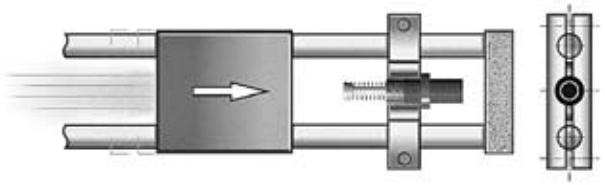
8.2 The latch absorbs the rotational energy of the turntable etc. The turntable can then be held in the datum position with a lock bolt or similar device.

9 Rotary Actuator or Rack and Pinion Drive



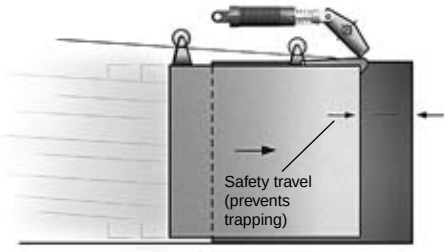
The use of shock absorbers allows higher operating speeds and weights as well as protecting the drive mechanism and housing from shock loads.

10 Adjustable Stop Clamp e.g. for Handling Equipment



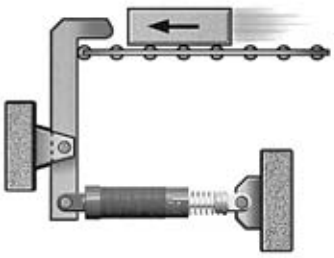
The gentle deceleration of shock absorbers makes the use of adjustable stop clamps possible and removes any chance of the clamp slipping. The kinetic energy is completely removed before the mechanical stop is reached thus making high index speeds possible.

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.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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			Product Catalog Page
				Self-Contained	A/O Tank	A/O Re-circulating	
MC 9-1	0.20	9	1.35-7.0	18,000	N/A	N/A	N16
MC 9-2	0.20	9	1.75-9.0	18,000			N16
MC 10L	0.20	4	0.75-6.0	35,000	N/A	N/A	N16
MC 10H	0.20	7	1.5-11	35,000			N16
MC 25L	0.25	20	1.5-5	120,000			N16
MC 25	0.25	20	4-12	120,000	N/A	N/A	N16
MC 25H	0.25	20	10-30	120,000			N16
MC 75-1	0.40	75	0.5-2.5	250,000			N16
MC 75-2	0.40	75	2-14	250,000	N/A	N/A	N16
MC 75-3	0.40	75	6-80	250,000			N16
MC 150	0.50	150	2-22	300,000			N18
MC 150H	0.50	150	20-200	300,000	N/A	N/A	N18
MC 150H2	0.50	150	150-450	300,000			N18
MC 225	0.50	225	5-55	400,000			N18
MC 225H	0.50	225	50-500	400,000	N/A	N/A	N18
MC 225H2	0.50	225	400-2,000	400,000			N18
MC 600	1.00	600	20-300	600,000			N18
MC 600H	1.00	600	250-2,500	600,000	N/A	N/A	N18
MC 600H2	1.00	600	880-5,000	600,000			N18
SC 190-1	0.63	225	3-15	300,000			N20
SC 190-2	0.63	225	8-40	300,000	N/A	N/A	N20
SC 190-3	0.63	225	20-100	300,000			N20
SC 190-4	0.63	225	50-225	300,000			N20
SC 300-1	0.75	300	3-18	400,000			N20
SC 300-2	0.75	300	10-60	400,000			N20
SC 300-3	0.75	300	30-180	400,000			N20
SC 300-4	0.75	300	70-450	400,000			N20
SC 300-5	0.59	650	25-100	400,000	N/A	N/A	N22
SC 300-6	0.59	650	75-300	400,000			N22
SC 300-7	0.59	650	200-400	400,000			N22
SC 300-8	0.59	620	300-1,500	400,000			N22
SC 300-9	0.59	620	700-4,300	400,000			N22
SC 650-1	1.00	650	17-100	600,000			N20
SC 650-2	1.00	650	50-300	600,000			N20
SC 650-3	1.00	650	150-900	600,000			N20
SC 650-4	1.00	650	450-2,600	600,000			N20
SC 650-5	0.91	1,860	50-250	600,000	N/A	N/A	N22
SC 650-6	0.91	1,860	200-800	600,000			N22
SC 650-7	0.91	1,860	700-2,400	600,000			N22
SC 650-8	0.91	1,860	1,700-5,800	600,000			N22
SC 650-9	0.91	1,860	4,000-14,000	600,000			N22
SC 925-1	1.58	975	30-200	800,000			N20
SC 925-2	1.58	975	90-600	800,000	N/A	N/A	N20
SC 925-3	1.58	975	250-1,600	800,000			N20
SC 925-4	1.58	975	750-4,600	800,000			N20
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	N26, N28
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	N26,N 28
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	N26, N28
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	N26, N28
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	N26, N30
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	N26, N30
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	N22, N30
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	N26, N32
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	N26, N32
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	N26, N32

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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			Product Catalog Page
				Self-Contained	A/O Tank	A/O Re-circulating	
CA 2x2-1 CA 2x2-2 CA 2x2-3 CA 2x2-4	2.00	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	N38, N40
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	N38, N40
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	N38, N40
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	N38, N40
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	N38, N40
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	N38, N40
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	N38, N40
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	N38, N40
CA 4x6-3 CA 4x6-5 CA 4x6-7	6.00 6.00 6.00	420,000 420,000 420,000	8,000-19,000 19,000-41,000 41,000-94,000	27,000,000 27,000,000 27,000,000	45,000,000 45,000,000 45,000,000	58,000,000 58,000,000 58,000,000	N38, N44 N38, N44 N38, N44
CA 4x8-3 CA 4x8-5 CA 4x8-7	8.00 8.00 8.00	560,000 560,000 560,000	11,000-25,000 25,000-55,000 55,000-125,000	30,000,000 30,000,000 30,000,000	50,000,000 50,000,000 50,000,000	65,000,000 65,000,000 65,000,000	N38, N44 N38, N44 N38, N44
CA 4x16-3 CA 4x16-5 CA 4x16-7	16.00 16.00 16.00	1,120,000 1,120,000 1,120,000	22,000-50,000 50,000-110,000 110,000-250,000	50,000,000 50,000,000 50,000,000	85,000,000 85,000,000 85,000,000	110,000,000 110,000,000 110,000,000	N38, N44 N38, N44 N38, N44

Adjustable Models

MA 35 MA 150 MA 225 MA 600	0.40 0.50 0.75 1.00	35 150 225 600	13-125 2-200 5-500 20-3,000	53,000 300,000 400,000 600,000	N/A	N/A	N24 N24 N24 N24
MA 900 MA 3325 MA 3350	1.58 0.91 1.91	900 1,500 3,000	30-4,500 20-3,800 28-5,400	800,000 670,000 760,000	1,100,000 1,200,000	1,500,000 1,600,000	N24 N27 N27
MA 3625 MA 3650	0.91 1.91	1,500 3,000	20-3,800 28-5,400	670,000 760,000	1,100,000 1,200,000	1,500,000 1,600,000	N27 N27
MA 4525 MA 4550 MA 4575	0.91 1.91 2.91	3,450 6,900 10,350	95-22,000 150-32,000 155-33,000	950,000 1,000,000 1,300,000	1,400,000 1,700,000 2,000,000	1,700,000 2,200,000 2,500,000	N27, N30 N27, N30 N27, N30
MA 6450 MA 64100 MA 64150	1.91 3.91 5.91	18,000 36,000 54,000	480-110,000 600-115,000 730-175,000	1,300,000 1,700,000 2,200,000	2,600,000 3,400,000 4,400,000	3,400,000 4,400,000 5,700,000	N27, N32 N27, N32 N27, N32
1-1/2x2 1-1/2x3-1/2 1-1/2x5 1-1/2x6-1/2	2.00 3.50 5.00 6.50	16,000 28,000 40,000 52,000	430-70,000 480-80,000 500-90,000 680-100,000	3,200,000 5,600,000 8,000,000 10,400,000	4,000,000 7,000,000 10,000,000 13,000,000	5,200,000 9,100,000 13,000,000 17,000,000	N36 N36 N36 N36
A 2x2 A 2x4 A 2x6 A 2x8 A 2x10	2.00 4.00 6.00 8.00 10.00	32,000 80,000 120,000 170,000 210,000	560-170,000 510-160,000 570-190,000 580-200,000 720-250,000	9,600,000 12,000,000 14,400,000 16,800,000 19,200,000	12,000,000 15,000,000 18,000,000 21,000,000 24,000,000	15,600,000 19,500,000 23,500,000 27,000,000 31,000,000	N39, N40 N39, N40 N39, N40 N39, N40 N39, N40
A 3x5 A 3x8 A 3x12	5.00 8.00 12.00	140,000 250,000 390,000	1,050-340,000 1,200-400,000 1,350-450,000	20,000,000 32,000,000 48,000,000	25,000,000 40,000,000 60,000,000	32,500,000 52,000,000 78,000,000	N39, N40 N39, N40 N39, N40

Low Velocity Adjustable Models

ML 3325 ML 3350	0.91 1.91	1,500 3,000	.05-1.5 .05-1.5	670,000 760,000	1,100,000 1,200,000	1,500,000 1,600,000	N27 N27
ML 3625 ML 3650	0.91 1.91	1,500 3,000	.05-1.5 .05-1.5	670,000 760,000	1,100,000 1,200,000	1,500,000 1,600,000	N27 N27
ML 4525 ML 4550	0.91 1.91	3,450 6,900	.05-1.5 .05-1.5	950,000 1,000,000	1,400,000 1,700,000	1,700,000 2,200,000	N27, N30 N27, N30
ML 6425 ML 6450	0.91 1.91	9,000 18,000	.05-1.5 .05-1.5	1,100,000 1,300,000	2,200,000 2,600,000	2,900,000 3,400,000	N27, N32 N27, N32

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorbers MC 9 to MC 75
Self-Compensating

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.

Ordering Information

MC 75 -1

MC Series

Model Number

9
10
25
75

Mounting Thread

MC9
M M6 x 1.0 metric

MC 10
M M8 x 1.0 metric
E M8 x 0.75 metric

MC 25
Standard (UNEF)
M Metric

MC 75
Standard (UNF)
M Metric

Effective Weight

MC9
-1 Light
-2 Medium

MC 10
L Light Range
H Heavy Range

MC 25
L Light Range
Standard Range
H Heavy Range

MC75
-1 Light
-2 Medium
-3 Heavy

Button Options

MC 9 and 10
Standard No Button
-B Delrin Button

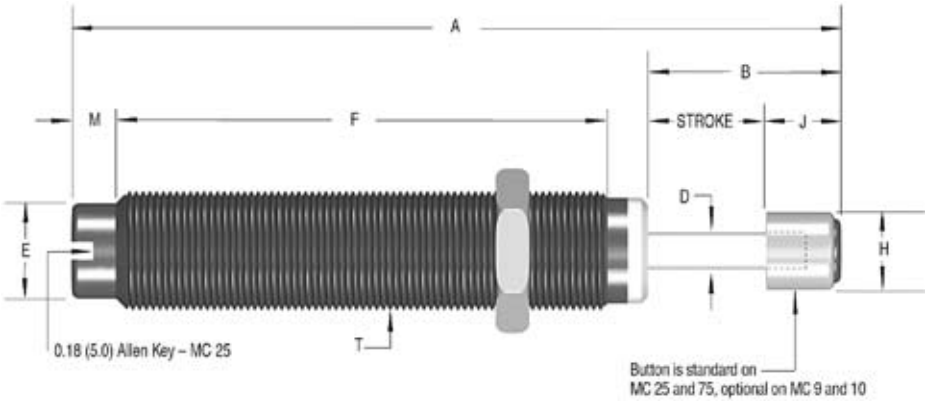
MC 25 and 75
Standard with Button
-NB *No button, short rod
-880 No button, standard rod

*Consult factory for dimensional details.

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorbers MC 9 to MC 75
Self-Compensating



Dimensions IN INCHES (MILLIMETERS)

Model	Stroke	A	B	C	D	E	F	H	J	M	T	EE	FF
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	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 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	.02 (0.01)
MC 25L **MC 25** **MC 25H**	1.5 - 5.0 4 - 12 10 - 30	(0.70 - 2) (2 - 5) (5 - 14)	20 (2)	120,000 (13,550)	0.8 - 1.7 (3.56 - 7.56)	0.20	.06 (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	.09 (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 158°F (-10° to 70°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 The Actuator Division.

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.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorbers MC 150 to MC 600
Self-Compensating

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.

Ordering Information

MC 225 _ _ _

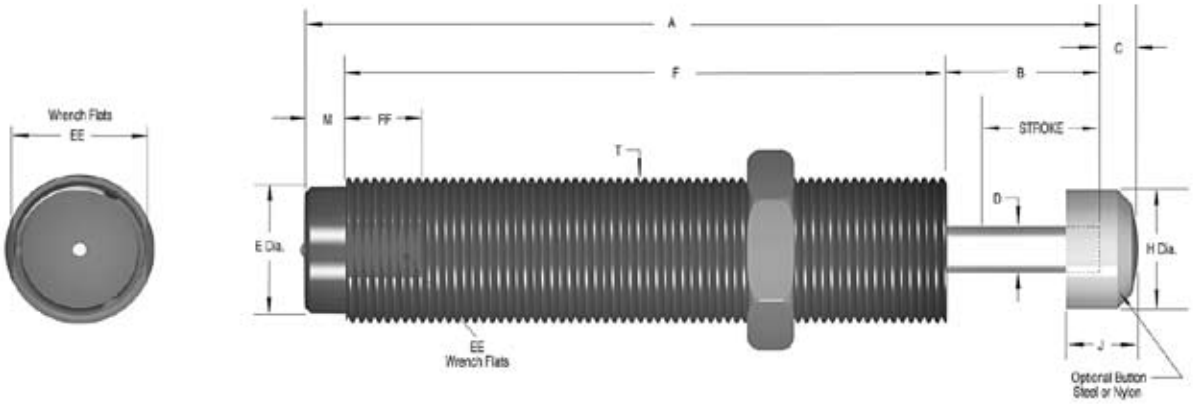
MC Series	Model Number	Mounting Thread	Effective Weight	Button Options
	150	Standard (UNF)	**MC 150, 225, 600**	Standard No Button
	255	M Metric	Standard Range	-B Nylon Button
	600	ME* Fine Metric	H Heavy Range	-BS Steel Button
		ML** Coarse Metric	H2 Extra Heavy Range	

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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorbers MC 150 to MC 600
Self-Compensating



Dimensions IN INCHES (MILLIMETERS)

Model	Stroke	A	B	C	D	E	F	H	J	M	T	EE	FF
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	We Effective Weight (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 20 - 200 150 - 450	(0.91 - 10) (9 - 91) (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 50 - 500 400 - 2,000	(2 - 25) (23 - 227) (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 - 300 250 - 2,500 880 - 5,000	(9 - 136) (113 - 1,134) (399 - 2,268)	600 (88) (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 to be used in contact with such fluids specify neoprene rolling seal. 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 The Actuator Division.

Lock nut included with each shock absorber.

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

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

SC² Series SC 190 to SC 925
Soft Contact and Self-Compensating

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.

Ordering Information

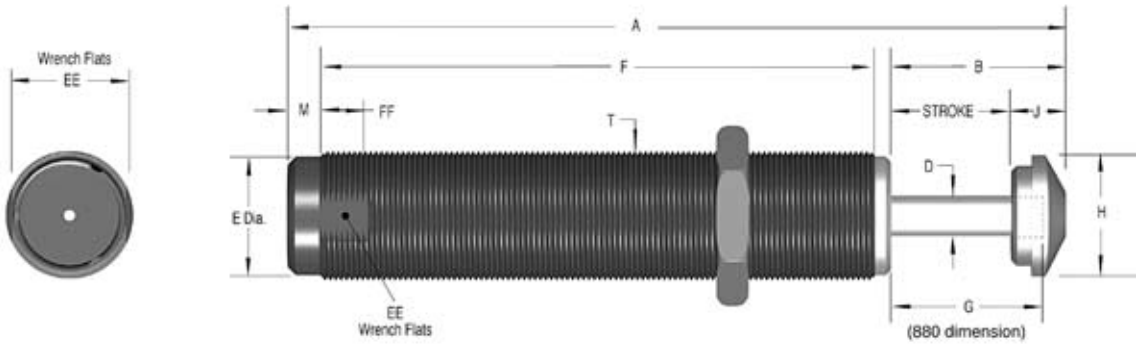
SC 300 -1 ____

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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

SC² Series SC 190 to SC 925
Soft Contact and Self-Compensating



Dimensions IN INCHES (MILLIMETERS)

Model	Stroke	A	B	D	E	F	G	H	J	M	T	EE	FF
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)	E3 Energy per Cycle in lbs (Nm)	E4 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 - 38 (5 - 18) 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)

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: #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 The Actuator Division.

Lock nut included with each shock absorber.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

SC² Heavyweight Series SC 300 to SC 650
Soft Contact and Self-Compensating

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.

SC² 300 and SC² 650 Heavyweight II Series Shock Absorbers offer 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.

Ordering Information

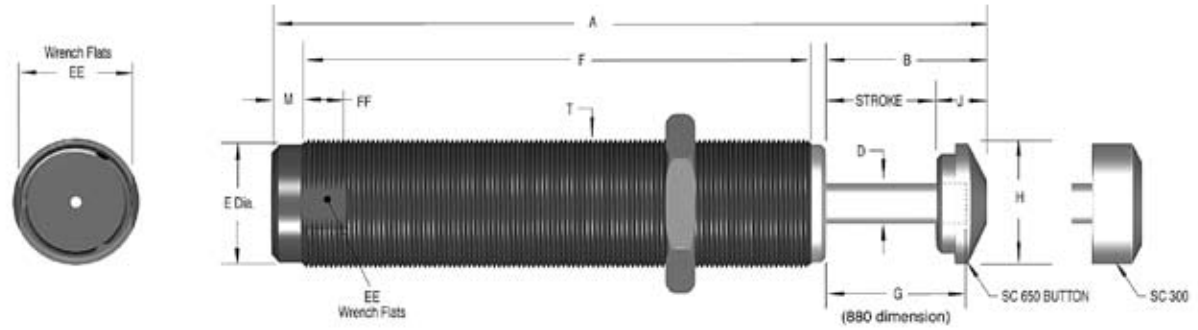
SC 300 - 5

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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

SC² Heavyweight Series SC 300 to SC 650
Soft Contact and Self-Compensating



Heavyweight Series Dimensions IN INCHES (MILLIMETERS)

Model	Stroke	A	B	D	E	F	G	H	J	M	T	EE	FF
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)	E3 Energy per Cycle in lbs (Nm)	E4 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 - 2,400 (317 - 1,089)	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: #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 The Actuator Division.

Lock nut included with each shock absorber.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorbers MA 35 to MA 900
Adjustable

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.

Ordering Information

MA 225 -

MA Series

MA = Miniature Adjustable

Model Number

35
150
225
600
900

Mounting Thread

Standard (UNF)
M Metric
ME Fine Metric (MA 150 only)

Button Options

MA 35
Standard with Button
-NB No Button, Short Rod

MA 150
Standard No Button
-B Nylon Button
-BS Steel Button

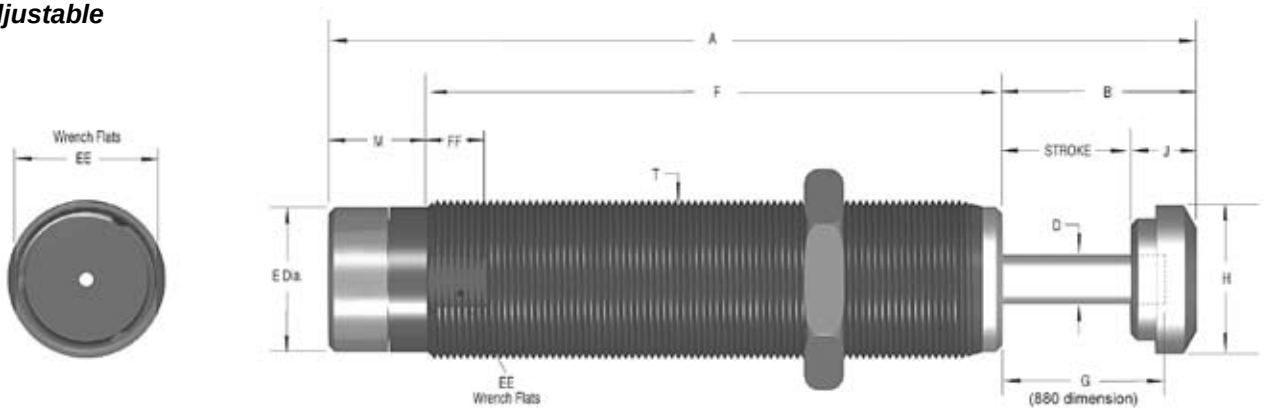
MA225-900
Standard Steel Button
-NB No Button, Short Rod
-880 No Button, Standard Rod

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorbers MA 35 to MA 900

Adjustable



Dimensions **IN INCHES (MILLIMETERS)**

Model	Stroke	A	B	D	E	F	G	H	J	M	T	EE	FF
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 (142.6)	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

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)
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: #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 The Actuator Division.

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.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series MC 33 to MC 64
Self-Compensating

Parker presents the ultimate in industrial shock absorber design...the Magnum Series. 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 Series 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.

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series MA and ML 33 to 64
Adjustable

Magnum Series 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 Series adjustable shock absorbers are **directly interchangeable** with obsolete primary series 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 Series 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 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.

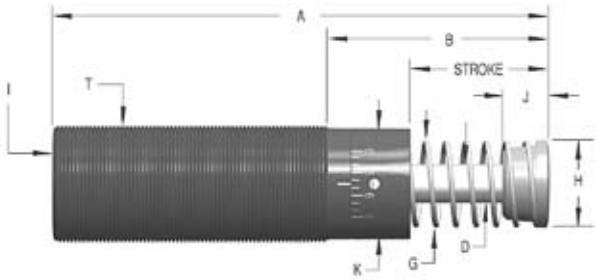
The Actuator Division recommends that side load not exceed 5°. Maximum side load depends on application.
For additional information consult The Actuator Division.

Lock nut included with each shock absorber.

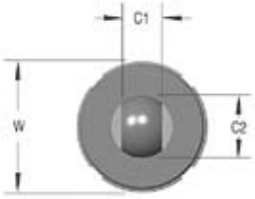
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

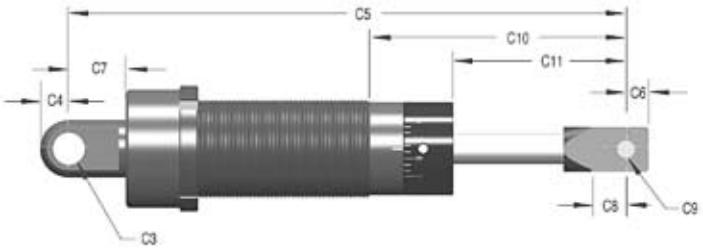
Magnum Series MC/MA/ML 33 and 36
Self-Compensating and Adjustable

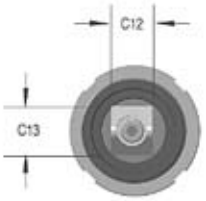
Primary Mount



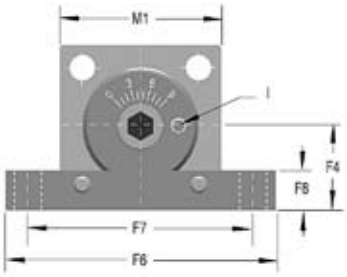
Clevis Mount

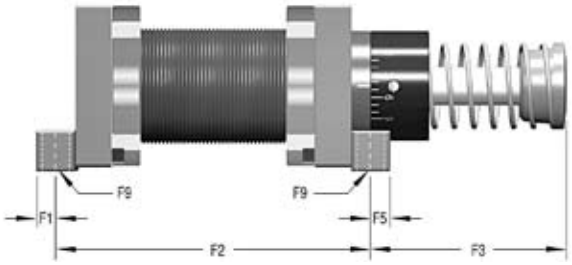






Side-Foot Mount





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 MC, MA, ML 3350	2.75 (69.9)	2.37 (60)	0.50 (12.7)	0.23 (5.9)

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

Note: For models MAA, MLA and MCA indicate P for the side port option when ordering clevis mount.

Note: M 36 and 1-3/8 thread is optional.

Note: A side port can be adapted to Magnum Series 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 N34.

Note: Poly pad available on 33 models only – part no. 250-0011.

Lock nut included with each shock absorber. See page N51 for dimensions.

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

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series MC/MA/ML 33 and 36
Self-Compensating and Adjustable

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 MC, MA, ML 3650	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

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

Specifications...MC Series, Self-Compensating

Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4			Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
				Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)	External Accumulator (Re-circulating)			
MC 3325-1	20-80	(9-36)	1,350 (153)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.00 (0.45)
MC 3325-2	68-272	(31-123)							
MC 3325-3	230-920	(104-417)							
MC 3325-4	780-3,120	(354-1,415)							
MC 3350-1	40-160	(18-73)	2,700 (305)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.2 (0.54)
MC 3350-2	136-544	(62-247)							
MC 3350-3	460-1,840	(209-835)							
MC 3350-4	1,560-6,240	(708-2,830)							
MC 3625-1	20-80	(9-36)	1,350 (153)	670,000 (75,000)	1,100,000 (124,000)	1,500,000 (169,000)	10.3-19.8 (46-88)	0.03	1.23 (0.56)
MC 3625-2	68-272	(31-123)							
MC 3625-3	230-920	(104-417)							
MC 3625-4	780-3,120	(354-1,415)							
MC 3650-1	40-160	(18-73)	2,700 (305)	760,000 (85,000)	1,200,000 (135,000)	1,600,000 (180,000)	9.9-30.3 (44-135)	0.06	1.51 (0.68)
MC 3650-2	136-544	(62-247)							
MC 3650-3	460-1,840	(209-835)							
MC 3650-4	1,560-6,240	(708-2,830)							

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	1.0 (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)

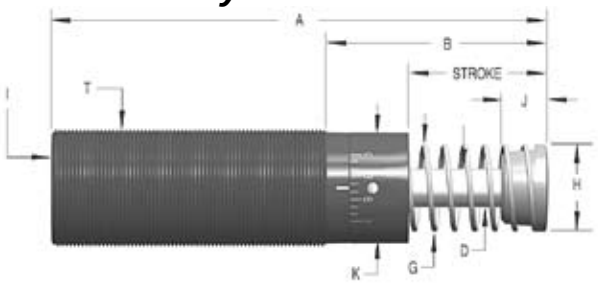
Impact velocity range: 0.06 to 1.5 ft/sec (0.02 to 0.46 m/sec)

Note: Side load not to exceed 5°. Maximum side load depends on application.

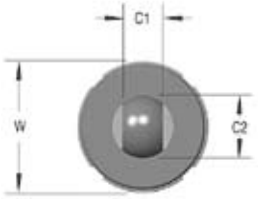
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

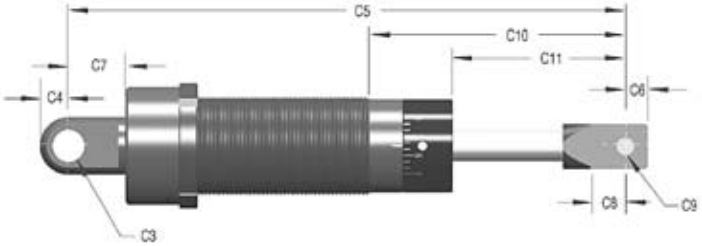
Magnum Series MC/MA/ML 45
Self-Compensating and Adjustable

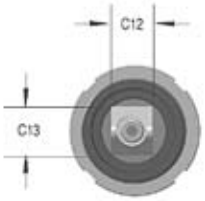
Primary Mount



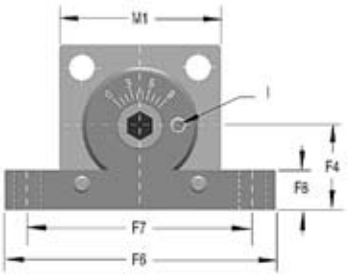
Clevis Mount

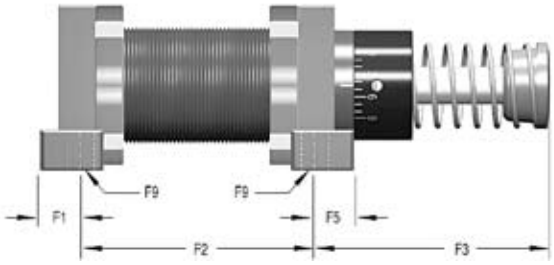






Side-Foot Mount





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, ML 4575	11.85 (301)					4.57 (116.1)	3.51 (89.2)					5.38 (237.8)	4.06 (103.1)		

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

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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series MC/MA/ML 45
Self-Compensating and Adjustable

Specifications...MC Series, Self-Compensating									
Model	**We Effective Weight lbs (kg)**		**E3 Energy per Cycle in lbs (Nm)**	**Energy per Hour in lbs/hour (Nm/hour) E4**			**Return Force lbs (N)**	**Return Time sec**	**Shipping Weight lbs (kg)**
				Internal Accumulator (Self-Contained)	**External Accumulator (A/O Tank)**	**External Accumulator (Re-circulating)**			
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	N/A	N/A	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	N/A	N/A	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 Series 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 N34.

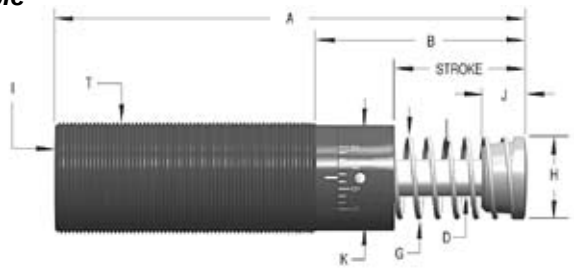
Note: Side load not to exceed 5°. Maximum side load depends on application.

Lock nut included with each shock absorber. See page N 51 for dimensions.

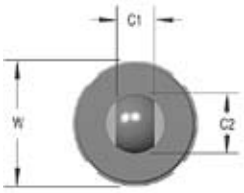
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

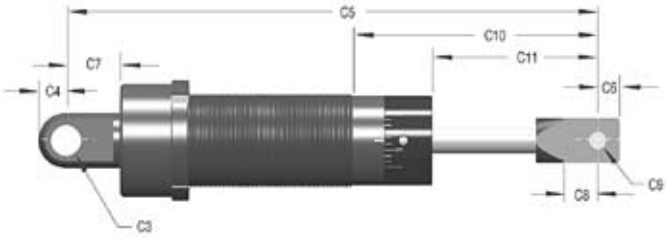
Magnum Series MC/MA/ML 64
Self-Compensating and Adjustable

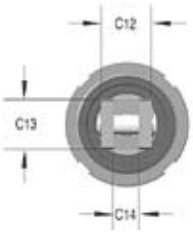
Primary Mount



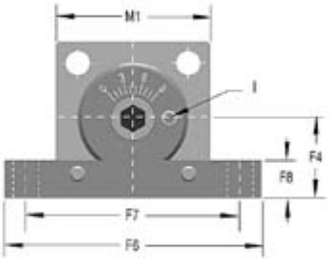
Clevis Mount

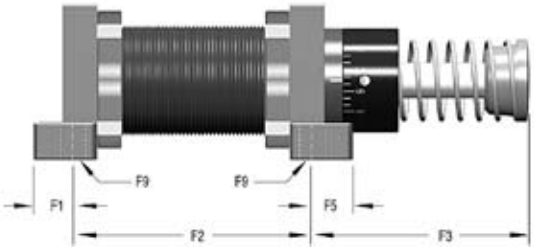






Side-Foot Mount





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 (127.00)	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				8.31 (211.1)		

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

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series MC/MA/ML 64
Self-Compensating and Adjustable

Specifications...MC Series, Self-Compensating

Model	We Effective Weight Cycle lbs (kg)		E3 Energy per Accumulator in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4 Internal Accumulator (Self-Contained)	E4 External Accumulator (A/O Tank)	E4 External Force (Re-circulating)	Return Time lbs (N)	Return Weight sec	Shipping 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 (69-155)	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	N/A	N/A	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	N/A	N/A	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 male fitting is shipped with the shock. MAA and MAS 45 and 64 have pipe plugs.**

Note: A side port can be adapted to Magnum Series 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 N34.

Note: MA and MC 64150 models include an integral, 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: For models MAA, MLA and MCA indicate P for the side port option when ordering clevis mount.

Note: 64150 models do not include a stop collar. Adjustable models can still be adjusted from front or rear.

Note: Side load not to exceed 5°. Maximum side load depends on application.

Lock nut included with each shock absorber. See page N51 for dimensions.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Ordering Information

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.

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

1-1/2" Bore Series
Adjustable

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 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

Model	We Effective Weight lbs (kg)	E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4		Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
			Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)			
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
- A = Spring Return, Internal Accumulator
- AA = Air Return, External Accumulator
- SA = Spring Return, External Accumulator
- NA = Self (Clevis) Return, Internal Accumulator

Bore Size
- 1-1/2

Stroke Length
- 2
- 3-1/2
- 5
- 6-1/2

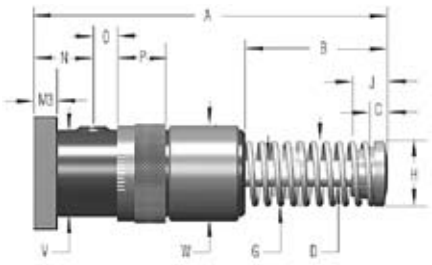
Mounting Style
- -F Front Flange
- -R Rear Flange
- -RF Front Rectangular Flange
- -RR Rear Rectangular Flange
- -S Side Foot Mount
- -C Clevis Mount

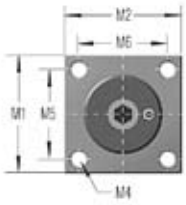
N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

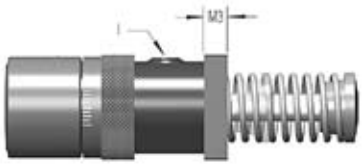
1-1/2" Bore Series
Adjustable

Rear Flange

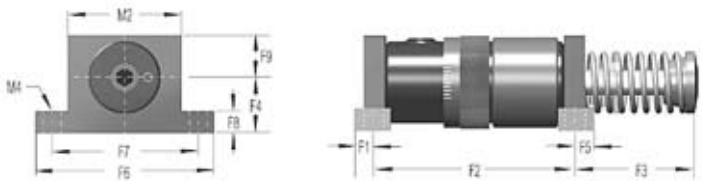




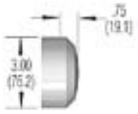
Front Flange



Side-Foot Mount

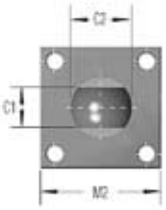


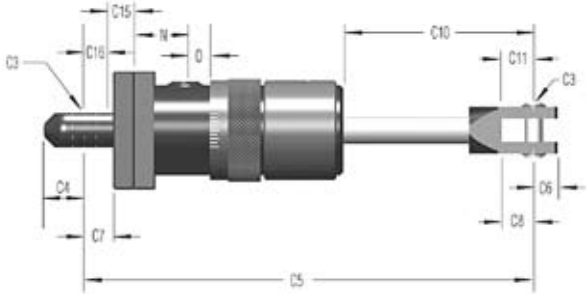
Poly Pad

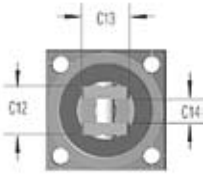


Part No. 250-0003

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)	0.81 (20.6)	1.00 (25.4)	2.69 (68.3)	2.75 (69.9)	1/2 NPT	1.38 (35.1)	1.38 (35.0)	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)	12.94 (328.6)	0.63 (16.0)	1.25 (31.8)
1-1/2 x 3-1/2	3.50 (88.9)	12.69 (322.3)	5.63 (142.9)							2.00 (50.8)	0.28 (7.1)								15.97 (405.6)		
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	1.41 (35.7)	5.41 (137.3)	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)	**5.18 (131.6)	**4.31 (109.5)	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 3-1/2		6.91 (175.4)								6.69 (169.9)	5.81 (147.6)												
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.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

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

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 PARKERSIZE INDUSTRIAL SHOCK ABSORBER 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 .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 N44 and N45 for CA 4" Bore dimensions and specifications.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Heavy Industrial Shock Absorbers A 2 and A 3
Adjustable

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 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).

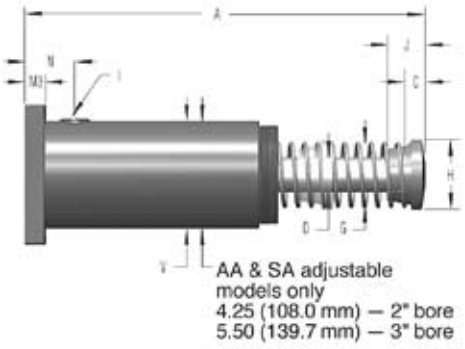
Hard impact at the start of stroke-turn adjuster toward 9.

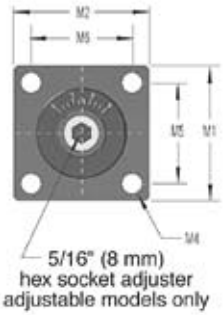
Hard set-down at the end of stroke-turn adjuster toward 0.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

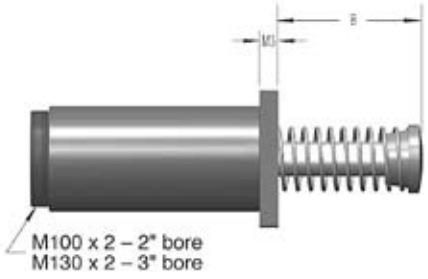
CA and A 2", 3" Bore Series – Heavy Duty Models
(CA) Self-Compensating and (A) Adjustable

Rear Flange

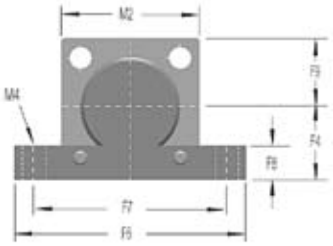


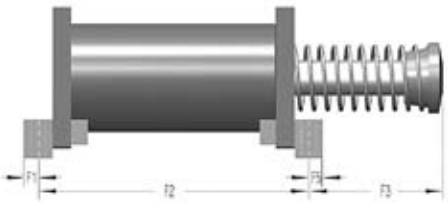


Front Flange

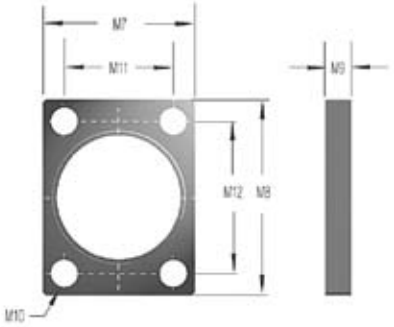


2" Bore Foot Mount

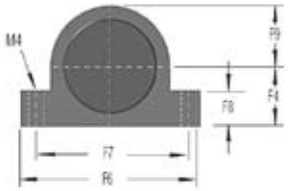


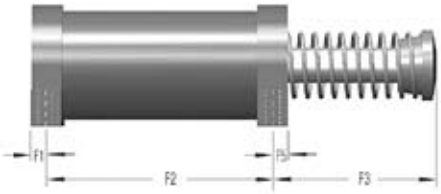


Rectangular Flange

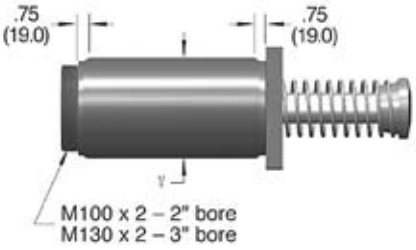


3" Bore Foot Mount

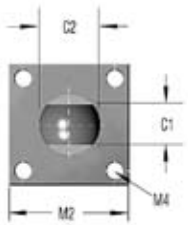


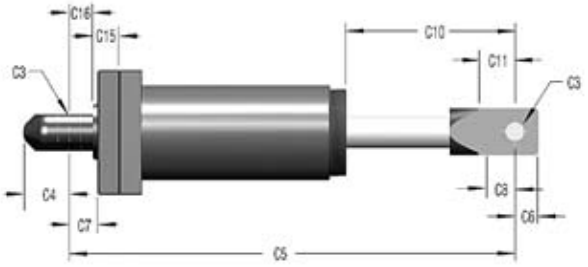


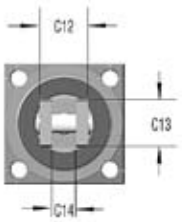
(A) Adjustable
2" & 3" Bore Models



Clevis Mount







N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

CA and A 2", 3" Bore Series – Heavy Duty Models
(CA) Self-Compensating and (A) Adjustable

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*	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)					6.00 (152.4)					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 N44 for AA and SA model dimensions.

Specifications...Self-Compensating Models

Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4 Internal Accumulator (Self-Contained)	E4 External Accumulator (A/O Tank)	E4 A/O Tank (Re-circulating)	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)	32,000	9,600,000	12,000,000	15,600,000	48-63	0.25	28.2
CA 2 x 2-3	10,000-30,000	(4,536-13,608)	(3,616)	(1,084,650)	(1,355,820)	(1,762,564)	(214-280)		(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)	64,000	12,000,000	15,000,000	19,500,000	34-63	0.50	32.6
CA 2 x 4-3	20,000-60,000	(9,072-27,216)	(7,231)	(1,355,820)	(1,694,770)	(2,203,200)	(151-280)		(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)	96,000	14,400,000	18,000,000	23,500,000	34-90	0.60	37.2
CA 2 x 6-3	30,000-90,000	(13,608-40,823)	(10,847)	(1,626,980)	(2,033,730)	(2,655,140)	(151-400)		(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.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

CA and A 2", 3" Bore Series – Heavy Duty Models
(CA) Self-Compensating and (A) Adjustable

Specifications (continued)...Self-Compensating Models

Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4 Internal Accumulator (Self-Contained)	E4 External Accumulator (A/O Tank)	E4 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)	128,000	16,800,000	21,000,000	27,000,000	51-144	0.70	42.6
CA 2 x 8-3	40,000-120,000	(18,144-54,431)	(14,462)	(1,898,150)	(2,372,680)	(3,050,590)	(227-641)		(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)	160,000	19,200,000	24,000,000	31,000,000	35-101	0.80	50.2
CA 2 x 10-3	50,000-150,000	(22,680-68,039)	(18,078)	(2,169,310)	(2,711,640)	(3,502,530)	(156-449)		(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)	125,000	20,000,000	25,000,000	32,500,000	59-156	0.60	63.8
CA 3 x 5-3	40,000-120,000	(18,144-54,431)	(14,123)	(2,259,700)	(2,824,620)	(3,672,010)	(262-694)		(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)	200,000	32,000,000	40,000,000	52,000,000	62-162	0.80	73.6
CA 3 x 8-3	64,000-192,000	(29,030-87,090)	(22,597)	(3,615,520)	(4,519,390)	(5,875,210)	(275-721)		(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)	300,000	48,000,000	60,000,000	78,000,000	60-160	1.20	89.4
CA 3 x 12-3	96,000-288,000	(43,545-130,635)	(33,896)	(5,423,270)	(6,779,090)	(8,812,820)	(267-712)		(40.55)
CA 3 x 12-4	240,000-720,000	(108,862-326,587)							

Specifications...Adjustable Models

Model	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4 Internal Accumulator (Self-Contained)	E4 External Accumulator (A/O Tank)	E4 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)	15,600,000 (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)	19,500,000 (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	(3279-113,399)	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)

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

CA and A 2", 3" Bore Series – Heavy Duty Models
(CA) Self-Compensating and (A) Adjustable

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

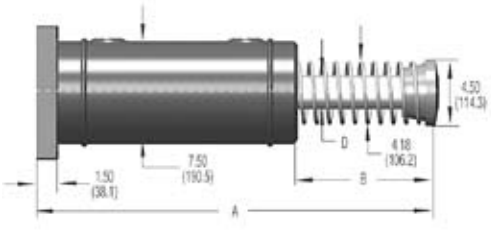
Return Method and Accumulator Style	Bore Size	Stroke Length	Mounting Style
A = Spring Return, Internal Accumulator	2	2 8	-F Front Flange
AA = Air Return, External Accumulator	3	4 10	-R Rear Flange
SA = Spring Return, External Accumulator		5 12	-RF Rectangular Front Flange
NA = Self (Clevis) Return, Internal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

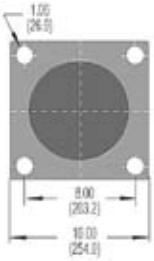
Note: A no button option is available on the 3" Bore only as a special.

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

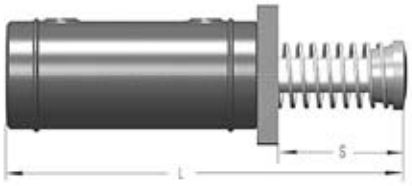
CA 4” Bore Series – Heavy Duty Models
Self-Compensating

Rear Flange

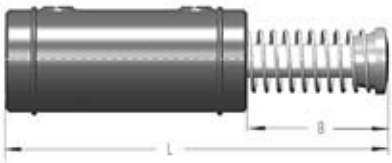


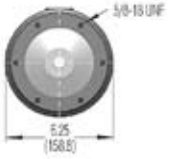


Front Flange

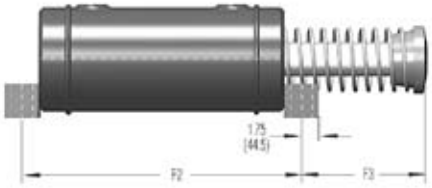


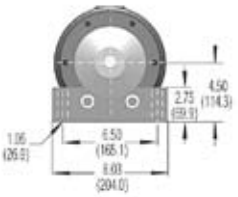
Standard Mount



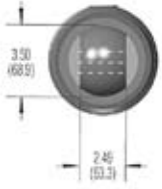


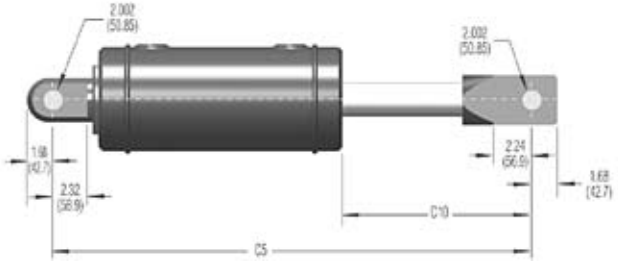
Side-Foot Mount

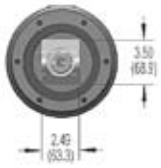




Clevis Mount







Technical Data

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

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

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

Oil type: ATF

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

CA 4" Bore Series – Heavy Duty Models
Self-Compensating

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	We Effective Weight lbs (kg)		E3 Energy per Cycle in lbs (Nm)	Energy per Hour in lbs/hour (Nm/hour) E4		Return Force lbs (N)	Return Time sec	Shipping Weight lbs (kg)
				Internal Accumulator (Self-Contained)	External Accumulator (A/O Tank)			
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

CA = Spring Return, Internal Accumulator
CAA = Air Return, External Accumulator
CSA = Spring Return, External Accumulator
CNA = Self (Clevis) Return, Internal Accumulator

Bore Size

4

Stroke Length

6
8
16

Mounting Style

-F Front Flange
-R Rear Flange
-RP Rear Standard
-FP Front Standard
-FRP Front and Rear Standard
-S Side Foot Mount
-C Clevis Mount

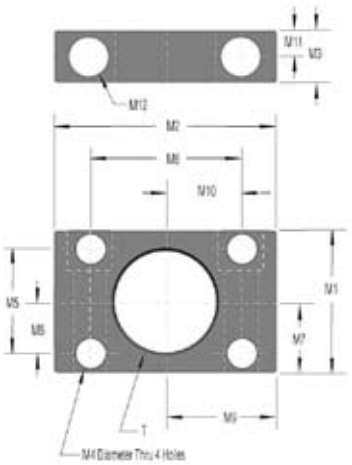
Effective Weight

-3 Light
-5 Medium
-7 Heavy

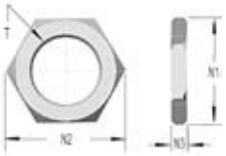
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorber Accessories
Mounting Blocks

Mounting Block

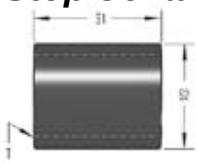


Lock Nut



One lock nut included with each shock absorber where appropriate.

Stop Collar

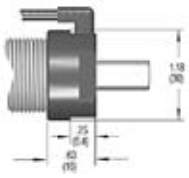


Side load adapters are available for select models, see pages N48 and N49.

Mounting Block IN INCHES (MILLIMETERS)															**Lock Nut**				**Stop Collar**		
Used With	**Part #**	**T**	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**	**M8**	**M9**	**M10**	**M11**	**M12**	**Part #**	**N1**	**N2**	**N3**	**Part #**	**S1**	**S2**
MC 10E **MC 10M**	**N/A**	M8x0.75 M8x1													**250-0362** **250-0482**	.43 (11)	.49 (12.5)	.12 (3.0)	**N/A**		
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	**250-0404**	.50 (12.7)	.56 (14.2)	.09 (2.3)	**250-0406**	.81 (20.6)	.56 (14.2)
MC 25M	**250-0307**	M10x1												(4.5) Dia. Thru (8) C'Bore x (5) Deep M4x7 Soc. Hd Screw	**250-0315**	.55 (14.0)	.59 (15.0)	.12 (3.0)	**250-0408**	.79 (20.0)	.56 (14.3)
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	**250-0405**	.62 (16.5)	.70 (17.8)	.13 (3.3)	**250-0407**	.81 (20.6)	.62 (15.7)
MA 35M **MC 75M**	**250-0309**	M12x1												(4.5) Dia. Thru (8) C'Bore x (5) Deep M4x7 Soc. Hd Screw	**250-0317**	.55 (14.0)	.63 (16.0)	.16 (4.0)	**250-0409**	.79 (20.0)	.63 (16.0)
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	**250-0231**	.88 (22.4)	1.00 (25.4)	.31 (7.9)	**250-0271**	.75 (19.1)	.69 (17.5)
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	**250-0233**	.67 (17.0)	.77 (19.6)	.20 (5.0)	**250-0272**	.79 (20.0)	.69 (17.5)
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	**250-0399**	1.00 (25.4)	1.15 (29.2)	.25 (6.4)	**250-0403**	1.25 (38.1)	1.00 (25.4)
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	**250-0207**	.94 (24.0)	1.10 (28.0)	.24 (6.0)	**250-0410**	.98 (25.0)	.98 (25.0)
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	**250-0400**	1.25 (31.8)	1.44 (36.6)	.25 (6.4)	**250-0275**	1.75 (44.5)	1.25 (31.8)
MC600ML	**N/A**														**250-0239**	1.25 (31.8)	1.44 (36.6)	.31 (7.9)	**250-0263**	1.77 (45.0)	1.26 (32.0)
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	**250-0040**	1.18 (30.0)	1.36 (34.6)	.31 (7.9)	**250-0276**	1.77 (45.0)	1.26 (32.0)

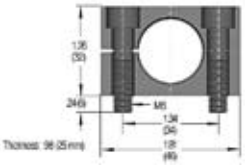
Air Bleed Collar

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

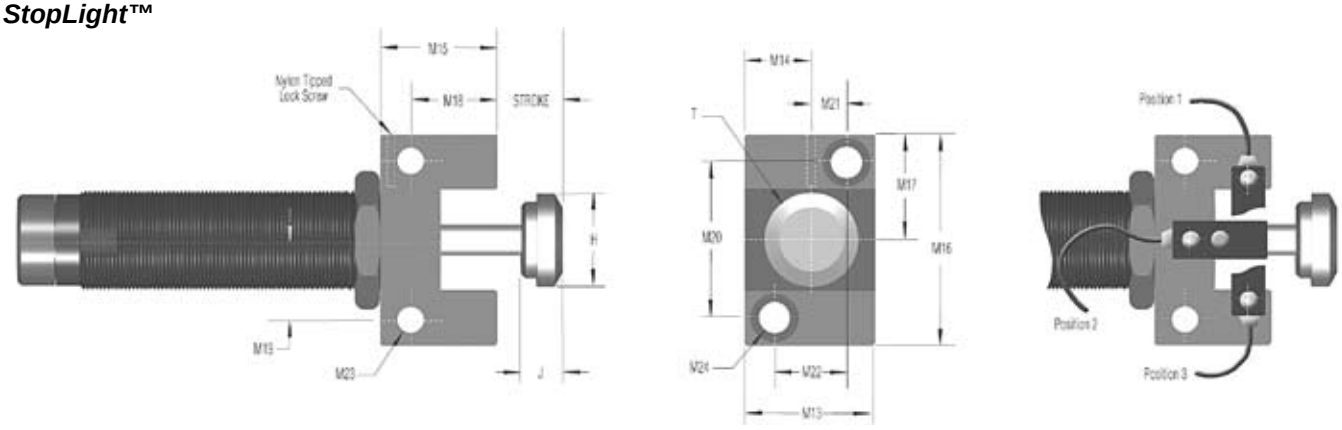
Used With	Model	Part#
MC 600 M	MB-25	10780-000



N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorber Accessories
StopLight™



Mounting Block IN INCHES (MILLIMETERS)

Used With	Part #	T	H	J	M 13	M 14	M 15	M 16	M 17	M 18	M 19	M 20	M 21	M 22	M 23	M 24
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														

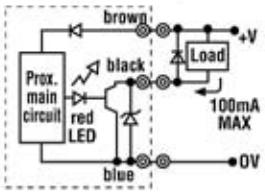
StopLight™ Switches are available in both NPN and PNP styles. Part numbers are 250-3 NPN and 250-3 PNP, respectively. The switches can be used with any StopLight mounting blocks.

** A complete StopLight assembly includes mounting block, proximity switch and steel button. Use the table below to order MC Series buttons. Steel buttons are an integral part of series MA and SC² and MVC units. Shock absorbers are ordered separately.*

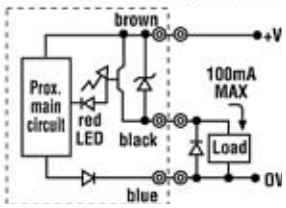
Model	Steel Button Part #
MA 150	250-0383
MC 150, MC 150M	250-0111
MC 225, MC 225M	250-0112
MC 600, MC 600M	250-0113

Specifications

250-3 NPN
NPN-type Proximity Switch



250-3 PNP
PNP-type Proximity Switch



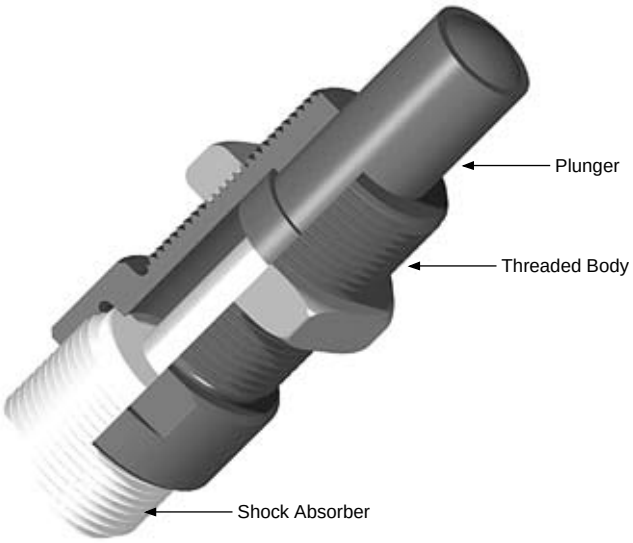
Supply Voltage:	10 to 27 VDC Ripple p to p 10% max
Current Consumption:	15mA max (at 24 VDC)
Control Output:	• 3-Wire Output: 100mA max • Voltage Impression: 30 VDC max • Residual Voltage: 1 VDC max
Operator Indicator:	Red LED. Power off = dark. Stand By = Dim Light. Detection = Bright Light.
Operating 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	±20% max of detecting distance at 68° F (20° C)
Temperature Fluctuation:	with a temperature range of 14° to 140° F (-10° to 60° C)
Variation Due To	±5% max of detecting distance at 12/24/VDC
Voltage Fluctuation:	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)

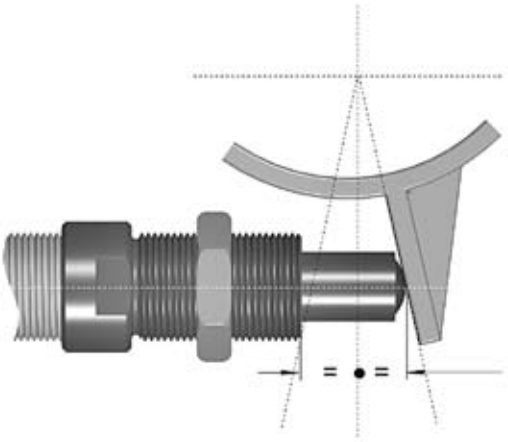
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorber Side Load Adapters
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.

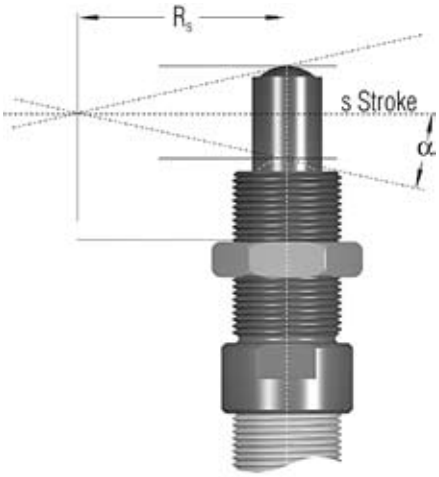
Formula: $\alpha = \tan^{-1}\left(\frac{s}{2 \bullet Rs}\right)$ $R_{smin} = \frac{s}{2 \bullet \tan\alpha max}$

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

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

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

$\alpha = (7.09)°$

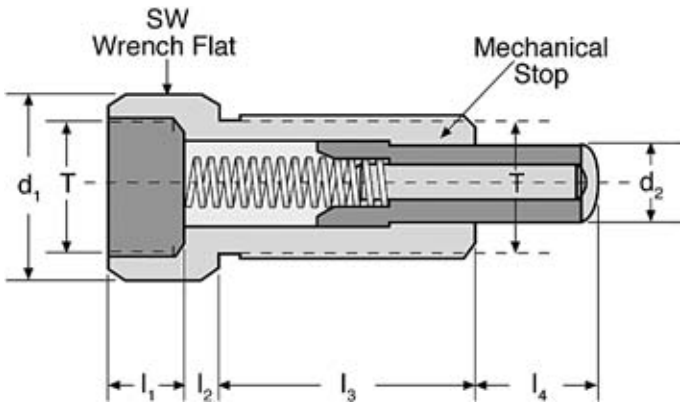


α	=	angle of impact
α max	=	maximum angle of impact
s	=	stroke
R_s	=	radius
R_{smin}	=	minimum r

N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Miniature Shock Absorber Side Load Adapters



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	**SC190M-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: Side load not to exceed 5". Maximum side load depends on application, shock absorber model, and stroke length.

Note: The side load adapter can only be installed on select metric shock absorbers without rod end button.

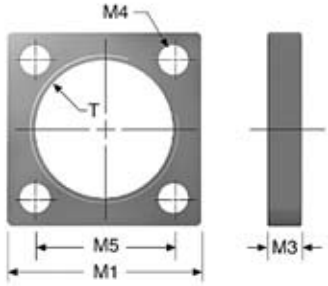
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series Group Accessories

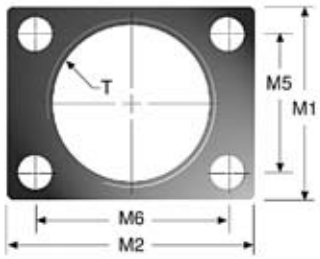
Square and Rectangular Flanges IN INCHES (MILLIMETERS)

Used With	Square Flange	Rect Flange	T	M1	M2	M3	M4	M5	M6
MA 33 ML 33 MC 33		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	N/A	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		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	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

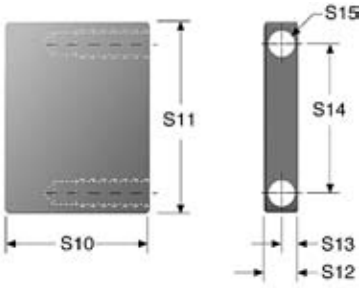


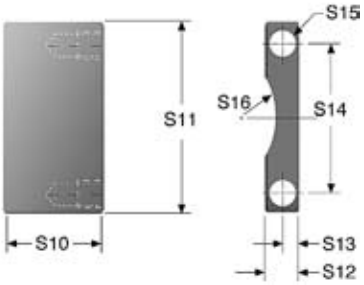
Rectangular Flange



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.

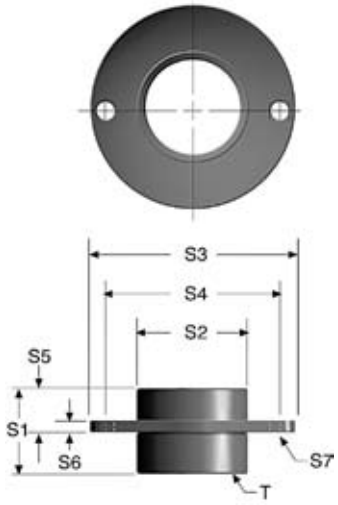
N

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Magnum Series Group Accessories

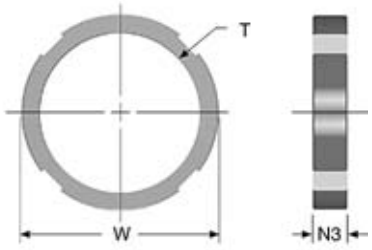
Flanged Stop Collars IN INCHES (MILLIMETERS)

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	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MA 36M ML 36M MC 36M									
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 (69.6)	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)

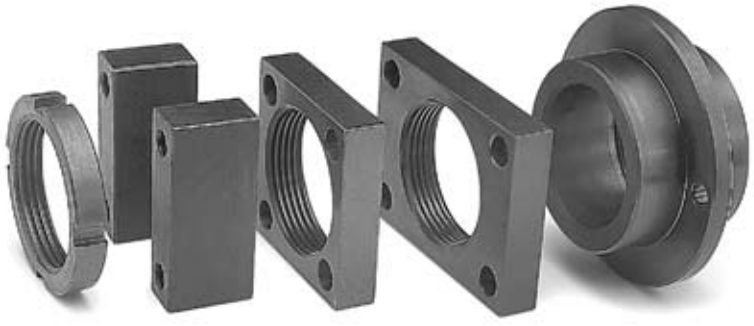


Lock Nuts IN INCHES (MILLIMETERS)

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.



Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Side-Foot Mount Assembly

Side-Foot Mount Assembly			
Used With	**Part #**	**Used With**	**Part #**
MA 33 **ML 33** **MC 33**	250-0015	**MA 6450** **MA 64100** **ML 6425** **ML 6450** **MC 6450** **MC 64100**	250-0300
MA 33M **ML 33M** **MC 33M**	250-0294		
MA 36 **ML 36** **MC 36**	N/A	**MA 6450M** **MA 64100M** **ML 6425M** **ML 6450M** **MC 6450M** **MC 64100M**	250-0304
MA 36M **ML 36M** **MC 36M**	N/A		
MA 45 **ML 45** **MC 45**	250-0025	**MA 64150** **MC 64150**	250-0030
MA 45M **ML 45M** **MC 45M**	250-0300	**MA 64150M** **MC 64150M**	250-0304

Note: See pages 28, 30 and 32 for Mega Series side-foot mount drawings and dimensions.

Clevis Mount Assembly

Clevis Mount Assembly			
Used With	**Part #**	**Used With**	**Part #**
MA 33 **ML 33** **MC 33** **MAS** **MLS** **MCS**	250-0225	**ML 6425** **ML 6425M**	250-0625 250-0626
MA 33M **ML 33M** **MC 33M** **MAS 33M** **MLS 33M** **MCS 33M**	250-0323	**MA 6450** **ML 6450** **MC 6450**	250-0625
		MA 6450M **ML 6450M** **MC 6450M**	250-0626
		MA 64100 **MC 64100**	250-0625
MAN 33 **MLN 33** **MCN 33** **MAA 33** **MLA 33** **MCA 33**	250-0018	**MA 64100M** **MC 64100M**	250-0626
		MAN 64150 **MCN 64150** **MAA 64150** **MCA 64150**	250-0625
MAN 33M **MLN 33M** **MCN 33M** **MAA 33M** **MLA 33M** **MCA 33M**	250-0322	**MAN 64150M** **MCN 64150M** **MAA 64150M** **MCA 64150M**	250-0626
		MA 64150 **MCA 64150** **MAS 64150** **MCS 64150**	250-0627
MA 45 **ML 45** **MC 45**	250-0324		
MA 45M **ML 45M** **MC 45M**	250-0325	**MA 64150M** **MCA 64150M** **MAS 64150M** **MCS 64150M**	250-0628

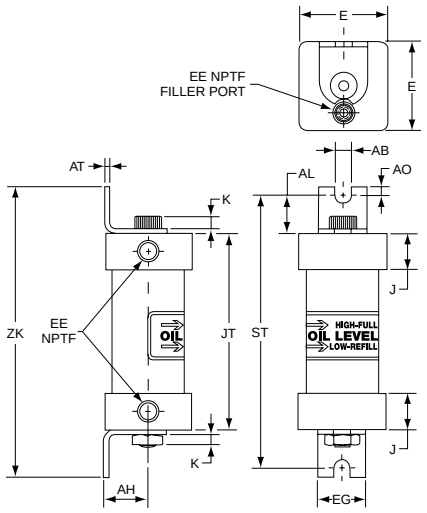
Note: See pages 28, 30 and 32 for Mega Series clevis mount drawings and dimensions.

N

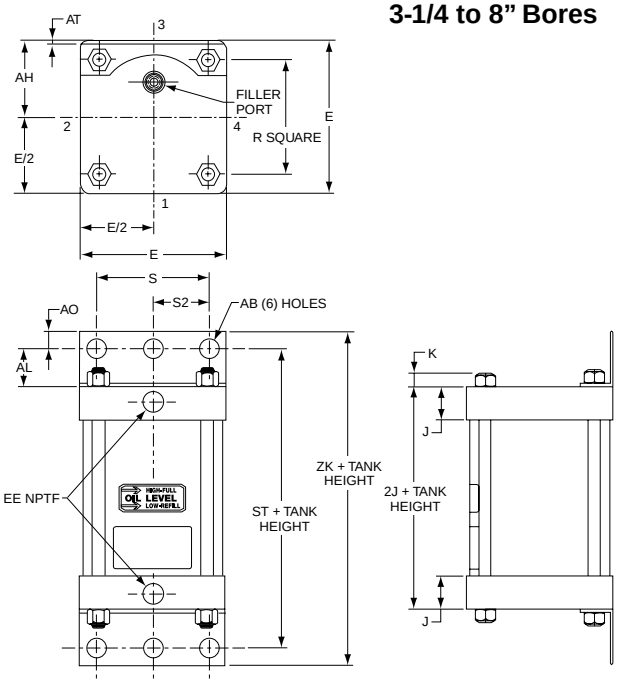
Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Air-Oil Tanks

1-1/4" Bore

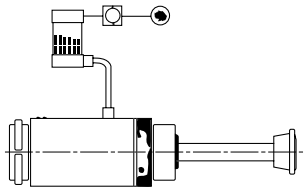


3-1/4 to 8" Bores

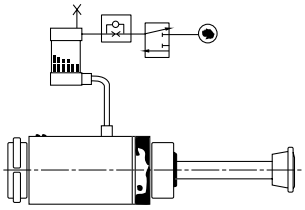


Dimensions															
Bore Size	**E**	**J**	**K**	**R**	**S**	**AB**	**AH**	**AL**	**AO**	**AT**	**EE**	**ST**	**ZK**	**EG**	**JT**
1 1/4	1 27/32	3/4	1/4	–	–	11/32	29/32	25.32	3/16	31/32	1/8	5 5/8	6	1	4 1/16
3 1/4	3 3/4	1 3/16	3/16	2.76	2 3/4	9/16	1 15/16	1 1/4	1/2	1/8	1/2	5	6	–	–
6	6 1/2	1.41	7/16	4.88	5 1/4	13/16	3 1/4	1 3/8	5/8	3/16	3/4	5 3/4	7	–	–
8	8 1/2	1.44	9/16	6.44	7 1/8	13/16	4 1/4	1 13/16	11/16	1/4	3/4	6 5/8	8	–	–

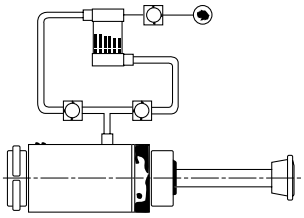
Mounting and Circuits



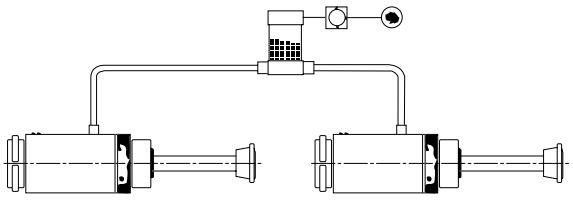
1. The piston rod is immediately returned to its extended position after completing the stroke.



2. The piston rod remains it its retracted position until it is signaled to return. Special bleed-down type check valve is required for this circuit.



3. A recirculating cooling circuit allows warm oil to return to the tank while cool oil refills the shock absorber. A recirculating 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.

Capacity (Maximum)				
Model	**Oil Temp (°F)**	**Max. Pressure (psi)**	**Capacity (cubic inches)**	**Recommended shock absorber size**
1.25CB3TKU x 2.00	200	100	2.4	MC 3325 MC 3350
3.25CB3TKU x 5.00	200	100	41.4	MC 4525 MC 64150
6.00CB3TKU x 9.00	200	100	254.5	1-1/2 x 5 - 3 x 12
8.00CB3TKU x 15.00	200	100	754	4 x 6 - 4 x 16
8.00 CB3TKUS x 15.00 *S = 1 1/2 NPTF ports in cap face*	200	100	754	4 x 6 - 4 x 16

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Safety Guide for Selecting and Using Hydraulic, Pneumatic Cylinders and Their Accessories

WARNING: ⚠ FAILURE OF THE CYLINDER, ITS PARTS, ITS MOUNTING, ITS CONNECTIONS TO OTHER OBJECTS, OR ITS CONTROLS CAN RESULT IN:

- **Unanticipated or uncontrolled movement of the cylinder or objects connected to it.**
- **Falling of the cylinder or objects held up by it.**
- **Fluid escaping from the cylinder, potentially at high velocity.**

THESE EVENTS COULD CAUSE DEATH OR PERSONAL INJURY BY, FOR EXAMPLE, PERSONS FALLING FROM HIGH LOCATIONS, BEING CRUSHED OR STRUCK BY HEAVY OR FAST MOVING OBJECTS, BEING PUSHED INTO DANGEROUS EQUIPMENT OR SITUATIONS, OR SLIPPING ON ESCAPED FLUID.

Before selecting or using Parker (The Company) cylinders or related accessories, it is important that you read, understand and follow the following safety information. Training is advised before selecting and using The Company's products.

1.0 General Instructions

1.1 Scope – This safety guide provides instructions for selecting and using (including assembling, installing, and maintaining) cylinder products. This safety guide is a supplement to and is to be used with the specific Company publications for the specific cylinder products that are being considered for use.

1.2 Fail Safe – Cylinder products can and do fail without warning for many reasons. All systems and equipment should be designed in a fail-safe mode so that if the failure of a cylinder product occurs people and property won't be endangered.

1.3 Distribution – Provide a free copy of this safety guide to each person responsible for selecting or using cylinder products. Do not select or use The Company's cylinders without thoroughly reading and understanding this safety guide as well as the specific Company publications for the products considered or selected.

1.4 User Responsibility – Due to very wide variety of cylinder applications and cylinder operating conditions, The Company does not warrant that any particular cylinder is suitable for any specific application. This safety guide does not analyze all technical parameters that must be considered in selecting a product. The hydraulic and pneumatic cylinders outlined in this catalog are designed to The Company's design guidelines and do not necessarily meet the design guideline of other agencies such as American Bureau of Shipping, ASME Pressure Vessel Code etc. The user, through its own
analysis and testing, is solely responsible for:

- Making the final selection of the cylinders and related accessories.
- Determining if the cylinders are required to meet specific design requirements as required by the Agency(s) or industry standards covering the design of the user's equipment.
- Assuring that the user's requirements are met, OSHA requirements are met, and safety guidelines from the applicable agencies such as but not limited to ANSI are followed and that the use presents no health or safety hazards.
- Providing all appropriate health and safety warnings on the equipment on which the cylinders are used.

1.5 Additional Questions – Call the appropriate Company technical service department if you have any questions or require any additional information. See the Company publication for the product being considered or used, or call 1-800-CPARKER, or go to www.parker.com, for telephone numbers of the appropriate technical service department.

2.0 Cylinder and Accessories Selection

2.1 Seals – Part of the process of selecting a cylinder is the selection of seal compounds. Before making this selection, consult the "seal information page(s)" of the publication for the series of cylinders of interest.

The application of cylinders may allow fluids such as cutting fluids, wash down fluids etc. to come in contact with the external area of the cylinder. These fluids may attack the piston rod wiper and or the primary seal and must be taken into account when selecting and specifying seal compounds.

Dynamic seals will wear. The rate of wear will depend on many operating factors. Wear can be rapid if a cylinder is mis-aligned or if the cylinder has been improperly serviced. The user must take seal wear into consideration in the application of cylinders.

2.2 Piston Rods – Possible consequences of piston rod failure or separation of the piston rod from the piston include, but are not limited to are:

- Piston rod and or attached load thrown off at high speed.
- High velocity fluid discharge.
- Piston rod extending when pressure is applied in the piston retract mode.

Piston rods or machine members attached to the piston rod may move suddenly and without warning as a consequence of other conditions occurring to the machine such as, but not limited to:

- Unexpected detachment of the machine member from the piston rod.
- Failure of the pressurized fluid delivery system (hoses, fittings, valves, pumps, compressors) which maintain cylinder position.
- Catastrophic cylinder seal failure leading to sudden loss of pressurized fluid.
- Failure of the machine control system.

Follow the recommendations of the "Piston Rod Selection Chart and Data" in the publication for the series of cylinders of interest. The suggested piston rod diameter in these charts must be followed in order to avoid piston rod buckling.

Piston rods are not normally designed to absorb bending moments or loads which are perpendicular to the axis of piston rod motion. These additional loads can cause the piston rod to fail. If these types of additional loads are expected to be imposed on the piston rod, their magnitude should be made known to our engineering department.

The cylinder user should always make sure that the piston rod is securely attached to the machine member.

On occasion cylinders are ordered with double rods (a piston rod extended from both ends of the cylinder). In some cases a stop is threaded on to one of the piston rods and used as an external stroke adjuster. On occasions spacers are attached to the machine member connected to the piston rod and also used as a stroke adjuster. In both cases the stops will create a pinch point and the user should consider appropriate use of guards. If these external stops are not perpendicular to the mating contact surface, or if debris is trapped between the contact surfaces, a bending moment will be placed on the piston rod, which can lead to piston rod failure. An external stop will also negate the effect of cushioning and will subject the piston rod to impact loading. Those two (2) conditions can cause piston rod failure. Internal stroke adjusters are available with and without cushions. The use of external stroke adjusters should be reviewed with our engineering department.

The piston rod to piston and the stud to piston rod threaded connections are secured with an anaerobic adhesive. The strength of the adhesive decreases with increasing temperature. Cylinders which can be exposed to temperatures above +250°F (+121°C) are to be ordered with a non studded piston rod and a pinned piston to rod joint.

2.3 Cushions – Cushions should be considered for cylinder applications when the piston velocity is expected to be over 4 inches/second.

Cylinder cushions are normally designed to absorb the energy of a linear applied load. A rotating mass has considerably more energy than the same mass moving in a linear mode. Cushioning for a rotating mass application should be review by our engineering department.

2.4 Cylinder Mountings – Some cylinder mounting configurations may have certain limitations such as but not limited to minimum stroke for side or foot mounting cylinders or pressure de-ratings for certain mounts. Carefully review the catalog for these types of restrictions.

Always mount cylinders using the largest possible high tensile alloy steel socket head cap screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

2.5 Port Fittings – Hydraulic cylinders applied with meter out or deceleration circuits are subject to intensified pressure at piston rod end.

The rod end pressure is approximately equal to:

$$\frac{\text{operating pressure x effective cap end area}}{\text{effective rod end piston area}}$$

Contact your connector supplier for the pressure rating of individual connectors.

3.0 Cylinder and Accessories Installation and Mounting

3.1 Installation

3.1.1 – Cleanliness is an important consideration, and cylinders are shipped with the ports plugged to protect them from contaminants entering the ports. These plugs should not be removed until the piping is to be installed. Before making the connection to the cylinder ports, piping should be thoroughly cleaned to remove all chips or burrs which might have resulted from threading or flaring operations.

P

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

3.1.2 – Cylinders operating in an environment where air drying materials are present such as fast-drying chemicals, paint, or weld splatter, or other hazardous conditions such as excessive heat, should have shields installed to prevent damage to the piston rod and piston rod seals.

3.1.3 – Proper alignment of the cylinder piston rod and its mating component on the machine should be checked in both the extended and retracted positions. Improper alignment will result in excessive rod gland and/or cylinder bore wear. On fixed mounting cylinders attaching the piston rod while the rod is retracted will help in achieving proper alignment.

3.1.4 – Sometimes it may be necessary to rotate the piston rod in order to thread the piston rod into the machine member. This operation must always be done with zero pressure being applied to either side of the piston. Failure to follow this procedure may result in loosening the piston to rod-threaded connection. In some rare cases the turning of the piston rod may rotate a threaded piston rod gland and loosen it from the
cylinder head. Confirm that this condition is not occurring. If it does, re-tighten the piston rod gland firmly against the cylinder head.

For double rod cylinders it is also important that when attaching or detaching the piston rod from the machine member that the torque be applied to the piston rod end of the cylinder that is directly attaching to the machine member with the opposite end unrestrained. If the design of the machine is such that only the rod end of the cylinder opposite to where the rod attaches to the machine member can be rotated, consult the factory for further instructions.

3.2 Mounting Recommendations

3.2.1 – Always mount cylinders using the largest possible high tensile alloy steel socket head screws that can fit in the cylinder mounting holes and torque them to the manufacturer's recommendations for their size.

3.2.2 – Side-Mounted Cylinders – In addition to the mounting bolts, cylinders of this type should be equipped with thrust keys or dowel pins located so as to resist the major load.

3.2.3 – Tie Rod Mounting – Cylinders with tie rod mountings are recommended for applications where mounting space is limited. The standard tie rod extension is shown as BB in dimension tables. Longer or shorter extensions can be supplied. Nuts used for this mounting style should be torqued to the same value as the tie rods for that bore size.

3.2.4 – Flange Mount Cylinders – The controlled diameter of the rod gland extension on head end flange mount cylinders can be used as a pilot to locate the cylinders in relation to the machine. After alignment has been obtained, the flanges may be drilled for pins or dowels to prevent shifting.

3.2.5 – Trunnion Mountings – Cylinders require lubricated bearing blocks with minimum bearing clearances. Bearing blocks should be carefully aligned and rigidly mounted so the trunnions will not be subjected to bending moments. The rod end should also be pivoted with the pivot pin in line and parallel to axis of the trunnion pins.

3.2.6 – Clevis Mountings – Cylinders should be pivoted at both ends with centerline of pins parallel to each other. After cylinder is mounted, be sure to check to assure that the cylinder is free to swing through its working arc without interference from other machine parts.

4.0 Cylinder and Accessories Maintenance, Troubleshooting and Replacement

4.1 Storage – At times cylinders are delivered before a customer is ready to install them and must be stored for a period of time. When storage is required the following procedures are recommended.

4.1.1 – Store the cylinders in an indoor area which has a dry, clean and noncorrosive atmosphere. Take care to protect the cylinder from both internal corrosion and external damage.

4.1.2 – Whenever possible cylinders should be stored in a vertical position (piston rod up). This will minimize corrosion due to possible condensation which could occur inside the cylinder. This will also minimize seal damage.

4.1.3 – Port protector plugs should be left in the cylinder until the time of installation.

4.1.4 – If a cylinder is stored full of hydraulic fluid, expansion of the fluid due to temperature changes must be considered. Installing a check valve with free flow out of the cylinder is one method.

4.1.5 – When cylinders are mounted on equipment that is stored outside for extended periods, exposed unpainted surfaces, e.g. piston rod, must be coated with a rust-inhibiting compound to prevent corrosion.

4.2 Cylinder Trouble Shooting

4.2.1 – **External Leakage**

4.2.1.1 – Rod seal leakage can generally be traced to worn or damaged seals. Examine the piston rod for dents, gouges or score marks, and replace piston rod if surface is rough.

Rod seal leakage could also be traced to gland wear. If clearance is excessive, replace rod bushing and seal. Rod seal leakage can also be traced to seal deterioration. If seals are soft or gummy or brittle, check compatibility of seal material with lubricant used if air cylinder, or operating fluid if hydraulic cylinder. Replace with seal material, which is compatible with these fluids. If the seals are hard or have lost elasticity, it is usually due to exposure to temperatures in excess of 165°F. (+74°C). Shield the cylinder from the heat source to limit temperature to 350°F. (+177°C.) and replace with fluorocarbon seals.

4.2.1.2 – Cylinder body seal leak can generally be traced to loose tie rods. Torque the tie rods to manufacturer's recommendation for that bore size.

Excessive pressure can also result in cylinder body seal leak. Determine maximum pressure to rated limits. Replace seals and retorque tie rods as in paragraph above. Excessive pressure can also result in cylinder body seal leak. Determine if the pressure rating of the cylinder has been exceeded. If so, bring the operating pressure down to the rating of the cylinder and have the tie rods replaced.

Pinched or extruded cylinder body seal will also result in a leak. Replace cylinder body seal and retorque as in paragraph above.

Cylinder body seal leakage due to loss of radial squeeze which shows up in the form of flat spots or due to wear on the O.D. or I.D. – Either of these are symptoms of normal wear due to high cycle rate or length of service. Replace seals as per paragraph above.

4.2.2 – **Internal Leakage**

4.2.2.1 – Piston seal leak (by-pass) 1 to 3 cubic inches per minute leakage is considered normal for piston ring construction. Virtually no static leak with lipseal type seals on piston should be expected. Piston seal wear is a usual cause of piston seal leakage. Replace seals as required.

4.2.2.2 – With lipseal type piston seals excessive back pressure due to over-adjustment of speed control valves could be a direct cause of rapid seal wear. Contamination in a hydraulic system can result in a scored cylinder bore, resulting in rapid seal wear. In either case, replace piston seals as required.

4.2.2.3 – What appears to be piston seal leak, evidenced by the fact that the cylinder drifts, is not always traceable to the piston. To make sure, it is suggested that one side of the cylinder piston be pressurized and the fluid line at the opposite port be disconnected. Observe leakage. If none is evident, seek the cause of cylinder drift in other component parts in the circuit.

4.2.3 – **Cylinder Fails to Move the Load**

4.2.3.1 – Pneumatic or hydraulic pressure is too low. Check the pressure at the cylinder to make sure it is to circuit requirements.

4.2.3.2 – Piston Seal Leak – Operate the valve to cycle the cylinder and observe fluid flow at valve exhaust ports at end of cylinder stroke. Replace piston seals if flow is excessive.

4.2.3.3 – Cylinder is undersized for the load – Replace cylinder with one of a larger bore size.

4.3 Erratic or Chatter Operation

4.3.1 – Excessive friction at rod gland or piston bearing due to load misalignment – Correct cylinder-to-load alignment.

4.3.2 – Cylinder sized too close to load requirements – Reduce load or install larger cylinder.

4.3.3 – Erratic operation could be traced to the difference between static and kinetic friction. Install speed control valves to provide a back pressure to control the stroke.

4.4 Cylinder Modifications, Repairs, or Failed Component – Cylinders as shipped from the factory are not to be disassembled and or modified. If cylinders require modifications, these modifications must be done at company locations or by The Company's certified facilities. The Cylinder Division Engineering Department must be notified in the event of a mechanical fracture or permanent deformation of any cylinder component (excluding seals). This includes a broken piston rod, tie rod, mounting accessory or any other cylinder component. The notification should include all operation and application details. This information will be used to provide an engineered repair that will prevent recurrence of the failure.

It is allowed to disassemble cylinders for the purpose of replacing seals or seal assemblies. However, this work must be done by strictly following all the instructions provided with the seal kits.

P

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics

Offer of Sale

The items described in this document and other documents or descriptions provided by Parker Hannifin Corporation, its subsidiaries and Divisions ("Company") and its authorized distributors, are hereby offered for sale at prices to be established by the Company, its subsidiaries and its authorized distributors. This offer and its acceptance by any customer ("Buyer") shall be governed by all of the following Terms and Conditions. Buyer's order for any such item, when communicated to the Company, its subsidiary or an authorized distributor ("Seller") verbally or in writing, shall constitute acceptance of this offer.

1. Terms and Conditions of Sale: All descriptions, quotations, proposals, offers, acknowledgments, acceptances and sales of Seller's products are subject to and shall be governed exclusively by the terms and conditions stated herein. Buyer's acceptance of any offer to sell is limited to these terms and conditions. Any terms or conditions in addition to, or inconsistent with those stated herein, proposed by Buyer in any acceptance of an offer by Seller, are hereby objected to. No such additional, different or inconsistent terms and conditions shall become part of the contract between Buyer and Seller unless expressly accepted in writing by Seller. Seller's acceptance of any offer to purchase by Buyer is expressly conditional upon Buyer's assent to all the terms and conditions stated herein, including any terms in addition to, or inconsistent with those contained in Buyer's offer. Acceptance of Seller's products shall in all events constitute such assent.

2. Payment: Payment shall be made by Buyer net 30 days from the date of delivery of the items purchased hereunder. Amounts not timely paid shall bear interest at the maximum rate permitted by law for each month or portion thereof that the Buyer is late in making payment. Any claims by Buyer for omissions or shortages in a shipment shall be waived unless Seller receives notice thereof within 30 days after Buyer's receipt of the shipment.

3. Delivery: Unless otherwise provided on the face hereof, delivery shall be made F.O.B. Seller's plant. Regardless of the method of delivery, however, risk of loss shall pass to Buyer upon Seller's delivery to a carrier. Any delivery dates shown are approximate only and Seller shall have no liability for any delays in delivery.

4. Warranty: Seller warrants that the items sold hereunder shall be free from defects in material or workmanship for a period of 18 months from date of shipment from the Company. **THIS WARRANTY COMPRISES THE SOLE AND ENTIRE WARRANTY PERTAINING TO ITEMS PROVIDED HEREUNDER. SELLER MAKES NO OTHER WARRANTY, GUARANTEE, OR REPRESENTATION OF ANY KIND WHATSOEVER. ALL OTHER WARRANTIES, INCLUDING BUT NOT LIMITED TO, MERCHANTABILITY AND FITNESS FOR PURPOSE, WHETHER EXPRESS, IMPLIED, OR ARISING BY OPERATION OF LAW, TRADE USAGE, OR COURSE OF DEALING ARE HEREBY DISCLAIMED.**

NOTWITHSTANDING THE FOREGOING, THERE ARE NO WARRANTIES WHATSOEVER ON ITEMS BUILT OR ACQUIRED WHOLLY OR PARTIALLY, TO BUYER'S DESIGN OR SPECIFICATIONS.

5. Limitation of Remedy: SELLER'S LIABILITY ARISING FROM OR IN ANY WAY CONNECTED WITH THE ITEMS SOLD OR THIS CONTRACT SHALL BE LIMITED EXCLUSIVELY TO REPAIR OR REPLACEMENT OF THE ITEMS SOLD OR REFUND OF THE PURCHASE PRICE PAID BY BUYER, AT SELLER'S SOLE OPTION. IN NO EVENT SHALL SELLER BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES OF ANY KIND OR NATURE WHATSOEVER, INCLUDING BUT NOT LIMITED TO LOST PROFITS ARISING FROM OR IN ANY WAY CONNECTED WITH THIS AGREEMENT OR ITEMS SOLD HEREUNDER, WHETHER ALLEGED TO ARISE FROM BREACH OF CONTRACT, EXPRESS OR IMPLIED WARRANTY, OR IN TORT, INCLUDING WITHOUT LIMITATION, NEGLIGENCE, FAILURE TO WARN OR STRICT LIABILITY.

6. Changes, Reschedules and Cancellations: Buyer may request to modify the designs or specifications for the items sold hereunder as well as the quantities and delivery dates thereof, or may request to cancel all or part of this order, however, no such requested modification or cancellation shall become part of the contract between Buyer and Seller unless accepted by Seller in a written amendment to this Agreement. Acceptance of any such requested modification or cancellation shall be at Seller's discretion, and shall be upon such terms and conditions as Seller may require.

7. Special Tooling: A tooling charge may be imposed for any special tooling, including without limitations, dies, fixtures, molds and patterns, acquired to manufacture items sold pursuant to this contract. Such special tooling shall be and remain Seller's property notwithstanding payment of any charges by Buyer. In no event will Buyer acquire any interest in apparatus belonging to Seller which is utilized in the manufacture of the items sold hereunder, even if such apparatus has been specially converted or adapted for such manufacture and notwithstanding any charges paid by Buyer. Unless otherwise agreed, Seller shall have the right to alter, discard or otherwise dispose of any special tooling or other property in its sole discretion at any time.

8. Buyer's Property: Any designs, tools, patterns, materials, drawings, confidential information or equipment furnished by Buyer, or any other items which become Buyer's property, may be considered obsolete and may be destroyed by Seller after two (2) consecutive years have elapsed without Buyer placing an order for the items which are manufactured using such property. Seller shall not be responsible for any loss or damage to such property while it is in Seller's possession or control.

9. Taxes: Unless otherwise indicated on the face hereof, all prices and charges are exclusive of excise, sales, use, property, occupational or like taxes which may be imposed by any taxing authority upon the manufacture, sale or delivery of the items sold hereunder. If any such taxes must be paid by Seller or if Seller is liable for the collection of such tax, the amount thereof shall be in addition to the amounts for the items sold. Buyer agrees to pay all such taxes or to reimburse Seller therefore upon receipt of its invoice. If Buyer claims exemption from any sales, use or other tax imposed by any taxing authority, Buyer shall save Seller harmless from and against any such tax, together with any interest or penalties thereon which may be assessed if the items are held to be taxable.

10. Indemnity For Infringement of Intellectual Property Rights: Seller shall have no liability for infringement of any patents, trademarks, copyrights, trade dress, trade secrets or similar rights except as provided in this Part 10. Seller will defend and indemnify Buyer against allegations of infringement of U.S. patents, U.S. trademarks, copyrights, trade dress and trade secrets (hereinafter "Intellectual Property Rights"). Seller will defend at its expense and will pay the cost of any settlement or damages awarded in an action brought against Buyer based on an allegation that an item sold pursuant to this contract infringes the Intellectual Property Rights of a third party. Seller's obligation to defend and indemnify Buyer is contingent on Buyer notifying Seller within ten (10) days after Buyer becomes aware of such allegations of infringement, and Seller having sole control over the defense of any allegations or actions including all negotiations for settlement or compromise. If an item sold hereunder is subject to a claim that it infringes the Intellectual Property Rights of a third party, Seller may, at its sole expense and option, procure for Buyer the right to continue using said item, replace or modify said item so as to make it noninfringing, or offer to accept return of said item and return the purchase price less a reasonable allowance for depreciation. Notwithstanding the foregoing, Seller shall have no liability for claims of infringement based on information provided by Buyer, or directed to items delivered hereunder for which the designs are specified in whole or part by Buyer, or infringements resulting from the modification, combination or use in a system of any item sold hereunder. The foregoing provisions of this Part 10 shall constitute Seller's sole and exclusive liability and Buyer's sole and exclusive remedy for infringement of Intellectual Property Rights.

If a claim is based on information provided by Buyer or if the design for an item delivered hereunder is specified in whole or in part by Buyer, Buyer shall defend and indemnify Seller for all costs, expenses or judgements resulting from any claim that such item infringes any patent, trademark, copyright, trade dress, trade secret or any similar right.

11. Force Majeure: Seller does not assume the risk of and shall not be liable for delay or failure to perform any of Seller's obligations by reason of circumstances beyond the reasonable control of Seller (hereinafter "Events of Force Majeure"). Events of Force Majeure shall include without limitation, accidents, acts of God, strikes or labor disputes, acts, laws, rules or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials and any other cause beyond Seller's control.

12. Entire Agreement/Governing Law: The terms and conditions set forth herein, together with any amendments, modifications and any different terms or conditions expressly accepted by Seller in writing, shall constitute the entire Agreement concerning the items sold, and there are no oral or other representations or agreements which pertain thereto. This Agreement shall be governed in all respects by the law of the State of Ohio. No actions arising out of sale of the items sold hereunder or this Agreement may be brought by either party more than two (2) years after the cause of action accrues.

Printed in U.S.A.
May, 2009

Parker Hannifin Corporation
Pneumatic Division
Wadsworth, Ohio
www.parker.com/pneumatics