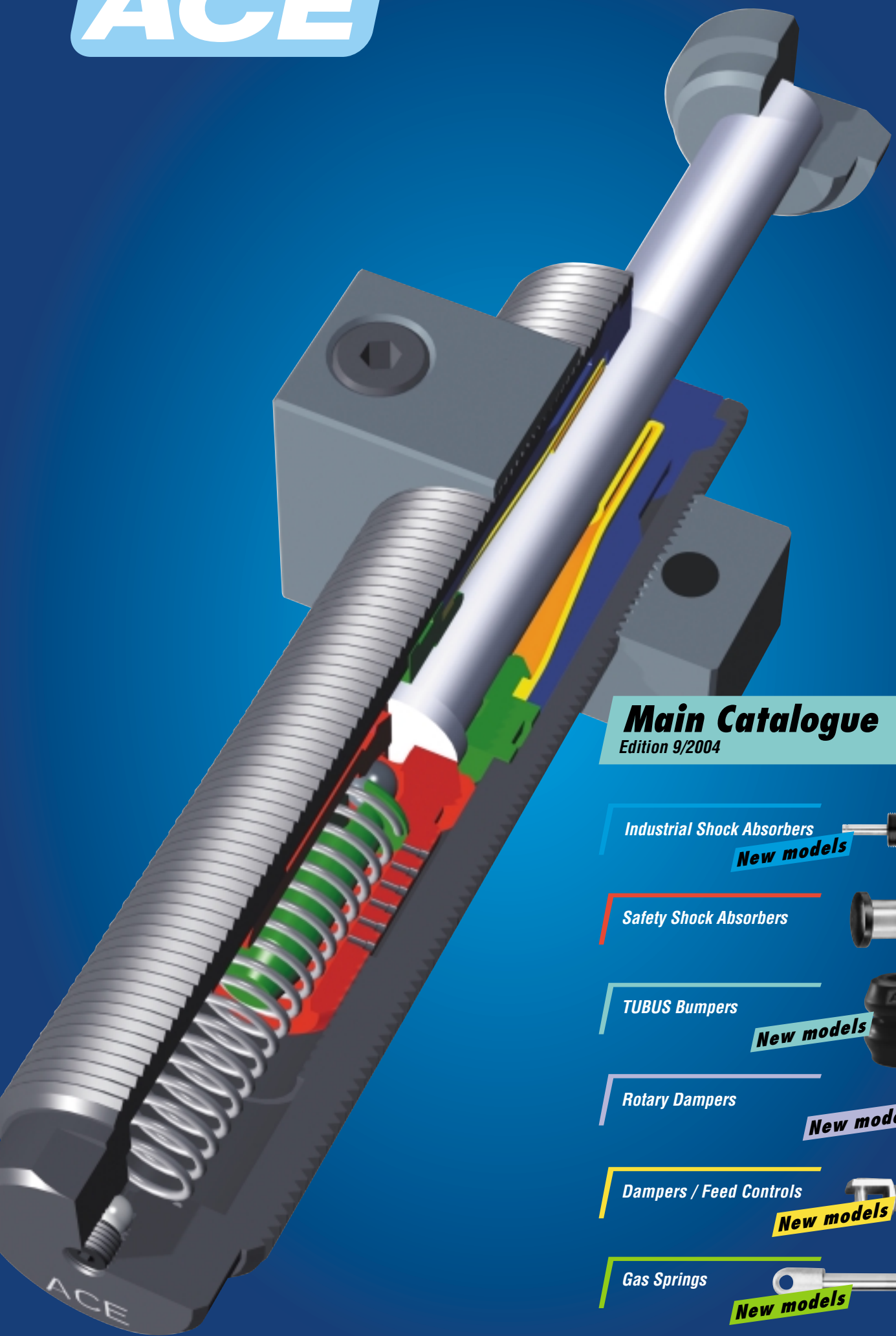


ACE

Automation Control Equipment



Main Catalogue Edition 9/2004

Industrial Shock Absorbers
New models



Safety Shock Absorbers



TUBUS Bumpers
New models



Rotary Dampers
New models



Dampers / Feed Controls
New models



Gas Springs
New models





VOLKSWAGEN AG



MICHELIN



DaimlerChrysler Aerospace
Airbus

DAIMLERCHRYSLER



RENAULT



PEUGEOT



BMW AG



engineering
mannesmann
Dematic

ThyssenKrupp Stahl



DECKEL MAHO GILDEMEISTER

DMG



Continental 

Canon

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FEDERAL
MOGUL
LIGHTING PRODUCTS

ABB
ABB



PHILIPS

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Rexroth
Bosch Group

KUKA



AUDI AG

IBM



chiron



SCHUNK
Spann- und Greiftechnik

Tetra Pak



Heinz



SCHENCK

Parker



NORGREN



Dow
Dow Plastics

Dear Reader,

This catalogue presents all aspects of damping and deceleration methods you need to reduce harmful and destructive energies effectively. ACE offers coordinated deceleration systems that help you to attain increased productivity, longer service life, greater power and speeds for your drives, motors, or systems.

ACE maintains its position as the Market Leader in motion control technology and sets the trend towards smaller and higher performance control components.

Please note the "A" of ACE throughout the catalogue. It will point out advantages, characteristics and new products which we consider important for you.



NEW
page 19

MC 30

320 % more Energy Absorption Capacity for Greater Productivity

With the weight of only 10 gm, the MC 30 provides energy capacity of 3.5 Nm and covers an effective weight range from 0.4 up to 15 kg.



NEW
page 27

MA 30 / MA 50

Adjustable Miniatures

Adjustable with thread sizes M8x1 and M10x1, they combine energy capacity of 3.5 Nm and 5.5 Nm per cycle with a very small package size.

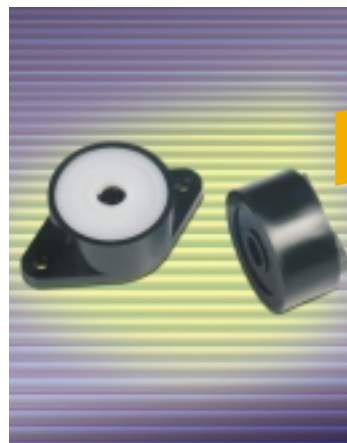


NEW
page 77

Mini-TUBUS

Profile Dampers for the Small Emergency Stop

3 new models complete the range of products for small applications and provide energy capacity from 12 Nm up to 30 Nm.



NEW
page 85

FFD 25 to 30

Oiless Rotary Dampers

These dampers provide damping torque from 0.1 up to 3 Nm, damping in one or both directions. Having no pivot axis allows the installation of multiple units together to increase the damping torque.

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General

$$a = \frac{0,6 \cdot v \cdot D^2}{s}$$

The **calculation bases** have been developed over 40 years, tested in cooperation with universities and successfully confirmed in thousands of individual cases. User-friendly **software solutions** are provided free of charge as support. **Sales** are focused on **customer benefits** and cover a large range of services through a trained network of distribution partners, technical sales representatives and professional office duty

staff. Technical advice, design, documentation, construction support and onsite or telephone training are all available.

Industrial Shock Absorbers



Industrial shock absorbers are used as hydraulic machine components for slowing down moving loads with minimal machine load. ACE shock absorbers are characterized by the use of the most recent and innovative technologies such as the piston tube or rolling diaphragm technique. Thus, the shock absorbers offer the highest service life in connection with high energy absorp-

tion. ACE industrial shock absorbers are machine components that are easy to use and also flexible in use with their multitude of optional parts.

Safety Shock Absorbers



Safety shock absorbers are used to provide security in emergency stop applications. Auto warehouse units, conveyors, or crane equipment, they are an inexpensive alternative to industrial shock absorbers. Safety shock absorbers are maintenance-free, self-contained and constructed with an integrated positive stop. They feature an integrated diaphragm accumulator or work with a compressed nitrogen bladder. ACE offers

safety shock absorbers with strokes from 23 to 1200 mm. At the same time we calculate and manufacture the layout of the damping orifices for your individual requirements.

TUBUS-Profile Dampers



The innovative **TUBUS profile dampers** are a cost-efficient alternative for emergency stop applications. They are made from a special co-polyester elastomer. They constantly absorb energies in areas in which other materials fail. The excellent damping characteristics are achieved as a result of the special elastomer material and the worldwide-patented design. The profile dampers are constructed to absorb the

emerging energy with a damping curve that is declining (TA-series), almost linear (TS-series) or progressive (TR-series). The TUBUS series comprises five main types with over 80 individual models.

Rotary Dampers



The **rotary damper** is a maintenance-free machine component for controlling rotary or linear motion. ACE rotary dampers ensure a controlled opening of small lids, flaps and drawers. The harmonic, soft motion sequence protects sensitive components and increases the quality and value of the product.

Hydraulic Dampers and Feed Controls



Hydraulic dampers are infinitely adjustable and provide accurate feed rate control. They are ideal for sawing, grinding and boring machines.

security element, they prevent the sudden retraction of devices.

Feed controls are used to control traverse rates. They can control the parallel feed in both directions or be used as a compensating element for moving loads. As a

Industrial Gas Springs



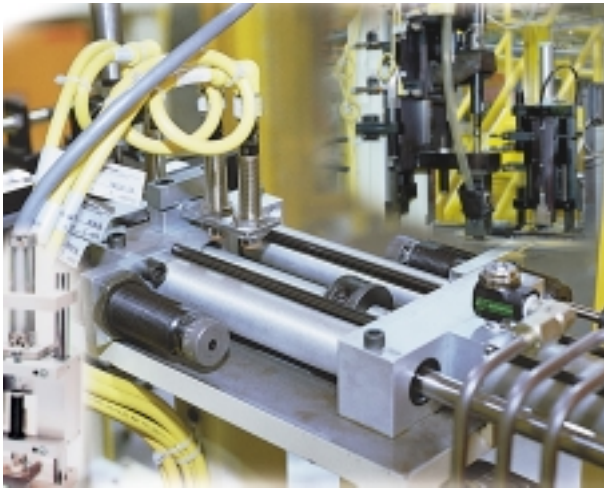
Gas springs (push type) can be used with all applications in which the lifting and lowering of loads must be controlled. They support manual forces and are used to control the lifting and lowering of lids, flaps, hoods etc. They are maintenance-free, self-contained and deliverable ex stock. Their integral grease chamber provides a lower break-out force, reduced friction and extremely long life. **Industrial traction gas springs** are

effective in the pulling direction. **Lockable gas springs** can be blocked and released in each position of the stroke. They can be delivered in rigid or springy lockable design.



			Page
Your advantages: <ul style="list-style-type: none"> • Calculation safety • Low customer expenditure • Construction safety • High additional benefits • Operational support service • Supplementary services 	All products from one source Free of charge Made from one piece 170 models	Major customers Editorial Unbeatable range Unbeatable range Technical support Function of shock absorbers Conventional damping systems Comparison of design and function Formulae and calculations Capacity chart	2 3 6 7 8 9 10 11 - 12 13 - 15 16 - 17
Your advantages: <ul style="list-style-type: none"> • Safe and reliable production • High service life of the machine • Lightweight and low cost construction • Low operating costs • Quiet and economic machines • Low machine load • Increased profits 	High service life Low strain on machines Innovative technology Continuously adjustable New areas of application High-capacity Shortest cycle times Suited for clean room technology Low profile Useful hints	MC 9 to 600 SC 190 to 925 SC ² -Series MA 30 to 900 Accessories M6 to M25 Mounting, installation & app. examples MAGNUM-Series Air/Oil tanks and installation hints Special shock absorbers CA 2 to 4 and A1½ to 3 Installation examples	18 - 21 NEW 22 - 23 24 - 25 26 - 27 NEW 28 - 30 31 - 33 34 - 44 45 - 46 47 48 - 53 54 - 55
Your advantages: <ul style="list-style-type: none"> • Optimal machine protection • Lightweight and low cost construction • Maximum traverse paths • State-of-the-art damping technology • Almost universally applicable • Always ready to use 	Maximum stroke length Customised performance Robust and self-contained	SCS-33 to 64 SCS-38 to 63 CB-63 to 160 Operating instructions Application examples	56 - 59 60 - 63 64 - 67 68 69
Your advantages: <ul style="list-style-type: none"> • Inexpensive • Smaller and lighter constructions • Space-saving design • Production safety • Usable with temperatures from -30°C to 90°C • Resistant to grease, oils, petrol, microbes, chemicals, sea-water 	Compact design Soft contact characteristics For crane equipment Production safety	TA 12 to 116 TS 14 to 107 TR 29 to 100 TR-L 29 to 188 TC 64 to 176 Profile dampers – overview Application examples	70 - 71 72 - 73 74 - 75 76 - 77 NEW 78 - 79 80 81
Your advantages: <ul style="list-style-type: none"> • Maintenance-free and self-contained • Safe motion • Design-oriented • Economical construction • Broad range of application • Increased value of your product thanks to high component quality 	Miniature Medium-damping torque High-damping torque Compact design Adjustable Low profile design	FRT-E2 and FRT-G2 FRT/FRN-C2 and -D2 FRT/FRN-K2, FRT/FRN-F2 and FFD FYN-N1 and FYN-K1 FYT/FYN-H1 and -LA3 FDT and FDN Calculations and application examples	82 - 83 84 85 NEW 86 NEW 87 88 89 - 91
Your advantages with hydraulic dampers: <ul style="list-style-type: none"> • Sensitive adjustment • Immediately deliverable from stock • Stick-slip-free • Shorter processing times Your advantages with feed controls: <ul style="list-style-type: none"> • Constant speed rates • Standard version, ex stock • Bi-directional damping • Easy to mount 	Precision feed controls Easy to mount Dual feed speed Long stroke adjustable damper Door dampers	VC 25 FA, MA and MVC Application examples DVC HB-15 to 70 TD-28 and TDE-28 Application examples	92 - 93 94 - 95 NEW 95 96 - 97 98 - 103 104 105
Your advantages: <ul style="list-style-type: none"> • Immediately deliverable from stock with valve • Individual filling by valve technology • Calculation program for individual design • Maintenance-free • No customer construction expenditure 	Fully adjustable Pull type gas springs Lockable Easy installation Suited for clean room technology	Function, calculation & mounting tips GS-8 to 70 GZ-19 to 28 GBF-28 and GBS-28 Acc's for gas springs & feed controls Industrial gas springs/stainless steel Calculation formulae Application examples Notes Fax request	106 - 108 109 - 117 118 - 119 120 - 121 NEW 122 - 125 126 127 128 129 - 130 131

6 Industrial Shock Absorbers



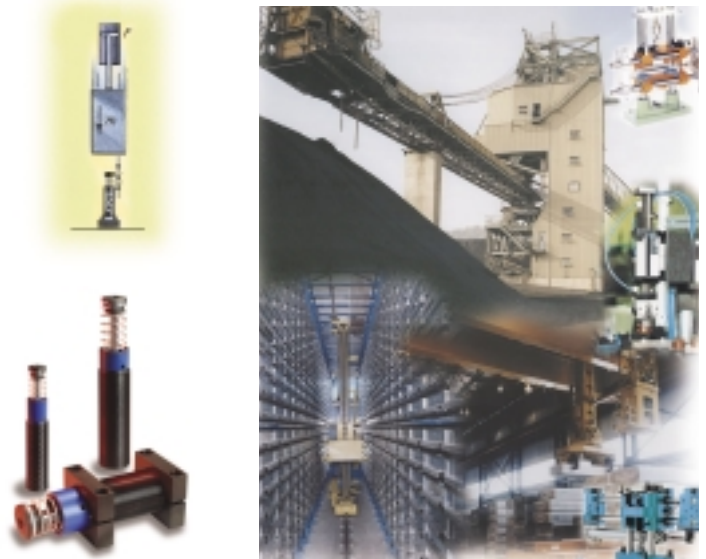
Sizes from
6 to 190 mm dia.
Stroke lengths from
5 to 406 mm

Increase production – Reduce wear & tear – Minimise down time – Save money

Safety Shock Absorbers

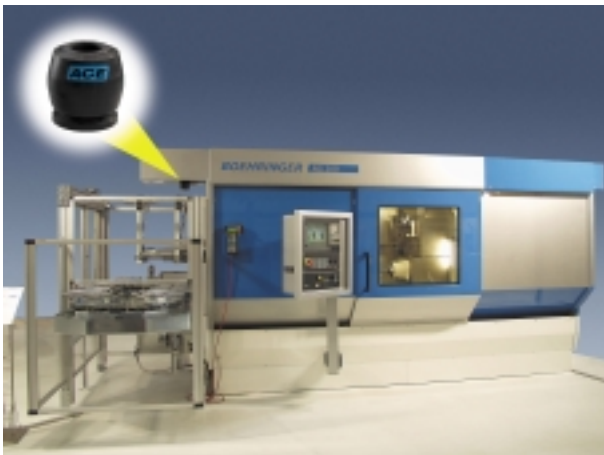


Sizes from
33 to 230 mm dia.
Stroke lengths from
25 to 1200 mm



Increase safety – Minimise risk – Prevent damage – Reduce repair costs – Peace of mind

TUBUS Bumpers



Sizes from
12 to 176 mm dia.
Stroke lengths from
5 to 198 mm



Increase safety – Compact size – Prevent damage – Special Elastomer – Peace of mind

Industrial Gas Springs



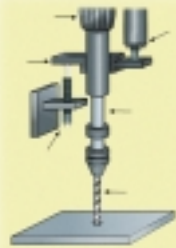
Sizes from
8 to 70 mm Body dia.
Stroke lengths from
20 to 1000 mm



7

Increase safety – Fingertip control – Reduce operator effort – Gain Peace of mind

Hydraulic Dampers and Feed Controls



Sizes from
10 to 70 mm Body dia.
Stroke lengths from
8 to 800 mm



Increased control – Improved product finish – Reduce running costs – Increase accuracy

Rotary Dampers



Sizes from
10 to 80 mm Body dia.
Rotary damping
about 105° to 360°



Controlled rotary motion – High quality damping – Low cost – Improved “Feel” of product

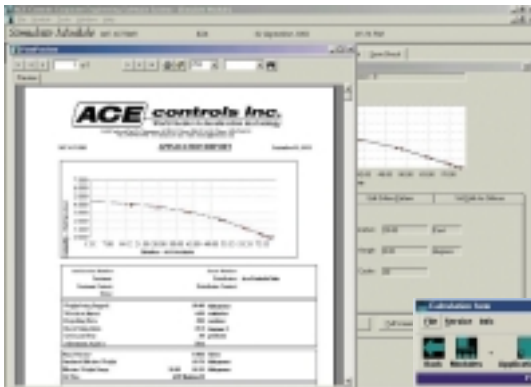
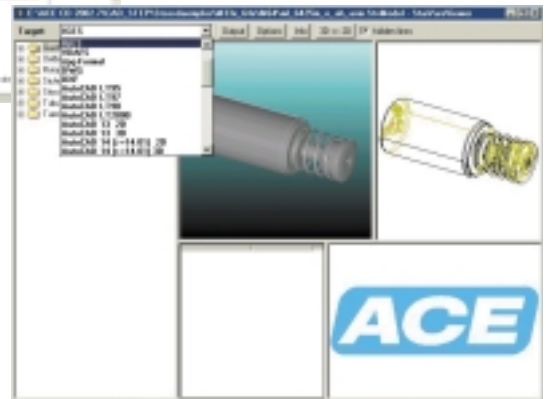


Up-to-date, Product Information, News, Technical Advice, Application Enquiry E-mail Service and Local Distributor Contact Details



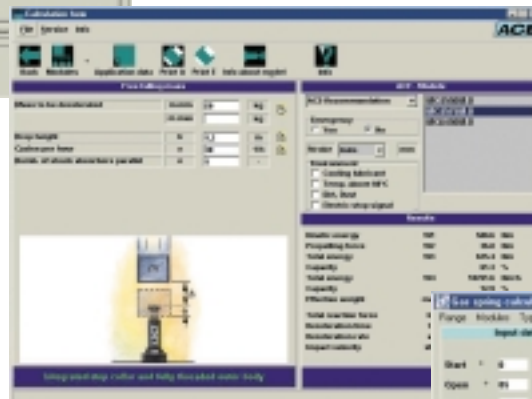
Online Shock Absorber Selection Program

2D & 3D CAD Viewer

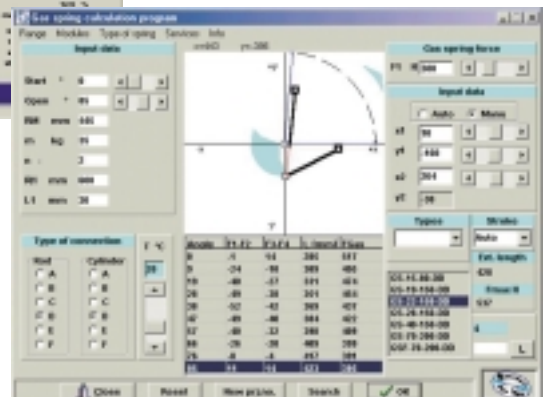


In-house Shock Absorber Unique Application Simulation Service

Shock Absorber Selection Program



In-house Gas Spring Application Geometry & Selection Service



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

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

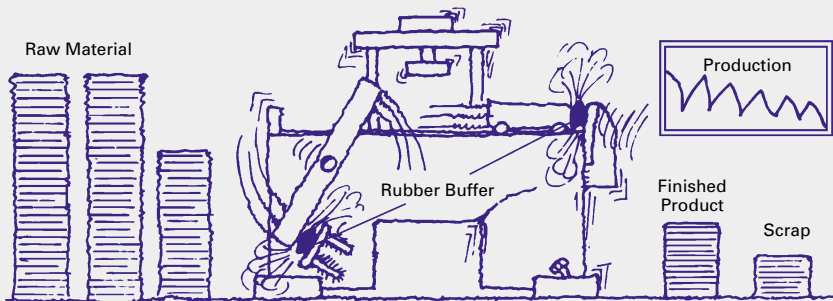
Kinetic energy increases as the square of the speed and the heavier the object, or the faster it travels, the more energy it has. An increase in production rates is only possible by dissipating this kinetic energy smoothly and thereby eliminating destructive deceleration forces.

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

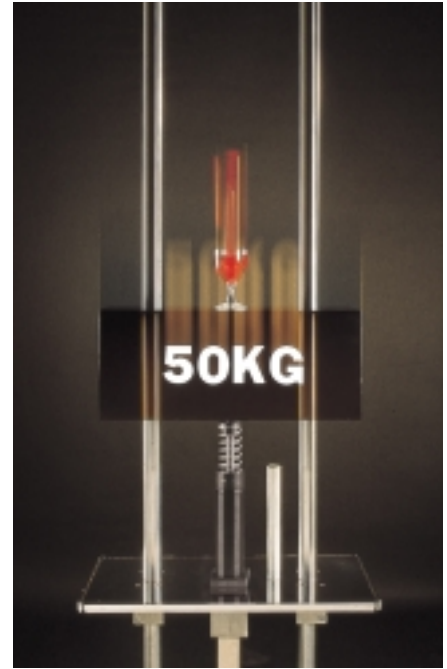
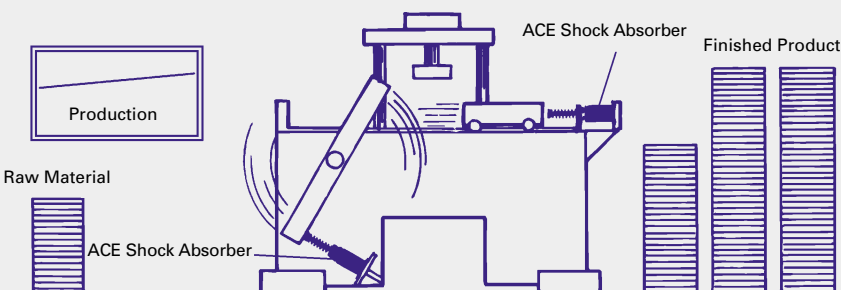
The optimum solution is achieved by an **ACE industrial shock absorber**. This utilises a series of metering orifices spaced throughout its stroke length and provides a **constant linear deceleration** with the lowest possible reaction force in the shortest stopping time.

ACE Controlled Linear Deceleration

Stopping with Rubber Buffers, Springs, Dashpots or Cylinder Cushions



Stopping with ACE Shock Absorbers



ACE demo showing a wine glass dropping free fall 1.3 m. Decelerated by an ACE shock absorber not a drop of wine is spilled.

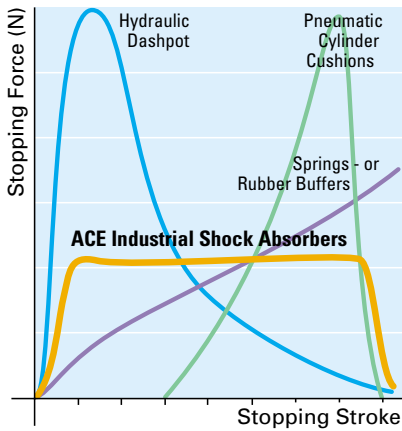
Result:

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

Benefits:

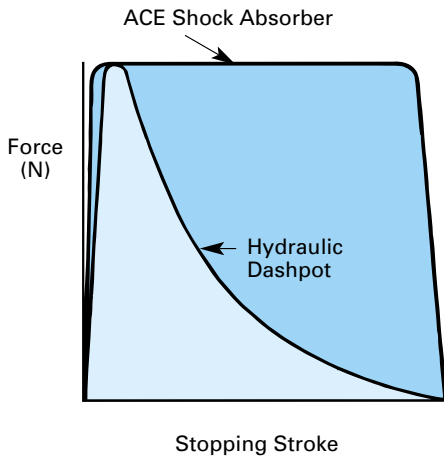
- Increased Production
- Increased Operating Life of the Machine
- Improved Machine Efficiency
- Reduced Construction Costs of the Machine
- Reduced Maintenance Costs
- Reduced Noise Pollution
- Reduced Energy Costs

Comparison



- 1. Hydraulic Dashpot (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 Buffers (High stopping forces at end of stroke).**
At full compression. Also they store energy rather than dissipating it, causing the load to rebound back again.
- 3. Air Buffers, Pneumatic Cylinder Cushions (High stopping force at end of stroke).**
Due to the compressibility of air these have a sharply rising force characteristic towards the end of the stroke. The majority of the energy is absorbed near the end of the stroke.
- 4. ACE Industrial Shock Absorbers (Uniform stopping force through the entire stroke).**
The moving load is smoothly and gently brought to rest by a constant resisting force throughout the entire shock absorber stroke. The load is decelerated with the lowest possible force in the shortest possible time eliminating damaging force peaks and shock damage to machines and equipment. This is a linear deceleration force stroke curve and is the curve provided by ACE industrial shock absorbers. In addition they considerably reduce noise pollution.

Energy Capacity

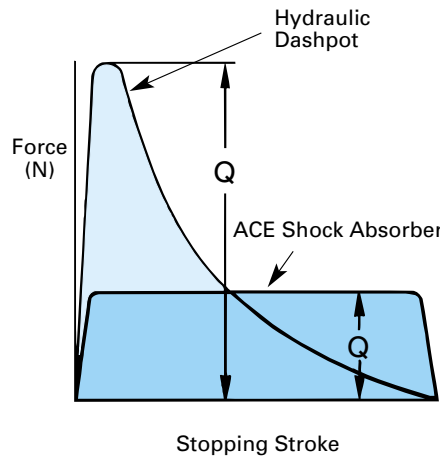


Assumption:
Same maximum reaction force.

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

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

Reaction Force (Stopping Force)

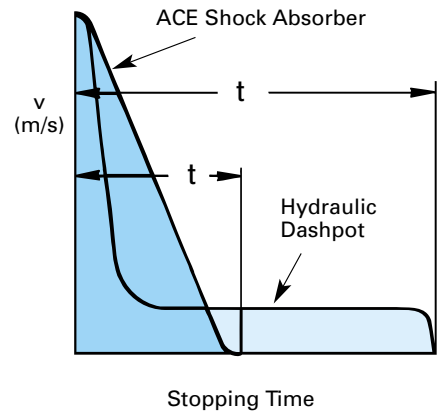


Assumption:
Same energy absorption (area under the curve).

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

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

Stopping Time

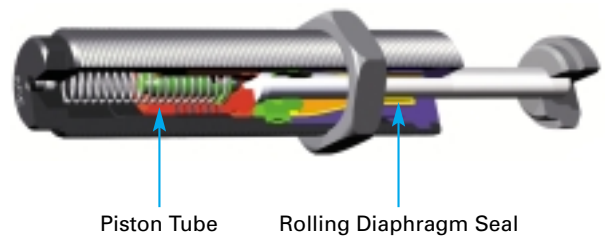
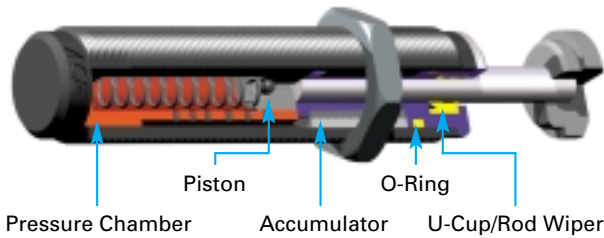


Assumption:
Same energy absorption.

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

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

Comparison of Design



Standard Design of ACE Miniature Shock Absorbers

These miniature shock absorbers have a static pressure chamber. The dynamic piston forces the hydraulic oil to escape through the metering orifices.

The displaced oil is absorbed by the accumulator.

A static seal system containing a U-cup and a wiper seals the shock absorber internally.

The outer body and the pressure chamber are fully machined from solid with closed rear end.

ACE Design for Higher Demands

ACE Piston Tube Technology:

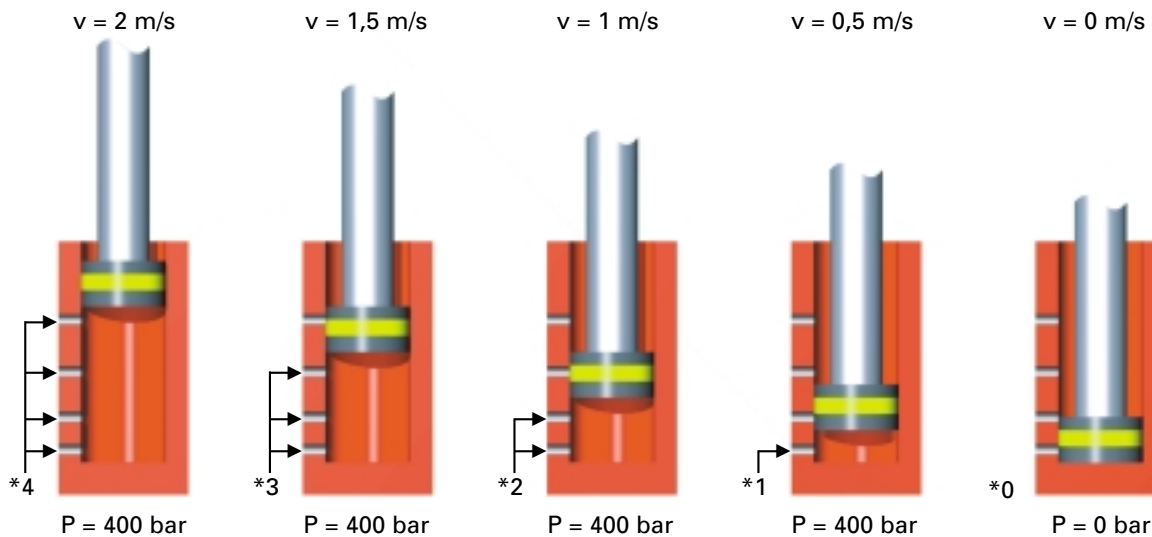
The increased volume of displaced hydraulic oil provides **200 % more energy absorption capacity** in comparison with the standard design. The wider effective weight range enables these dampers to cover a much wider range of applications. The piston and inner tube are combined into a single component.

ACE Rolling Diaphragm System:

By the proven dynamic ACE rolling diaphragm seal system the shock absorber becomes hermetically sealed and provides **up to 25 million cycles**. The rolling diaphragm seal allows direct installation into the end cover of pneumatic cylinders (up to 7 Bar).

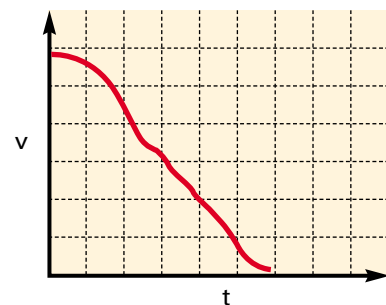
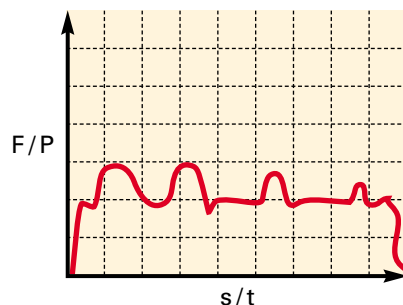
These technologies are used separately or combined on the **MC 150 M to MC 600 M** and **SC² 25 M to SC² 650 M** model ranges.

General Function



* The load velocity reduces continuously as you travel through the stroke due to the reduction in the number of metering orifices (*) in action. The internal pressure remains essentially constant and thus the Force vs. stroke curve remains linear.

- F = Force (N)
- P = Internal pressure (bar)
- s = Stroke (m)
- t = Deceleration time (s)
- v = Velocity (m/s)

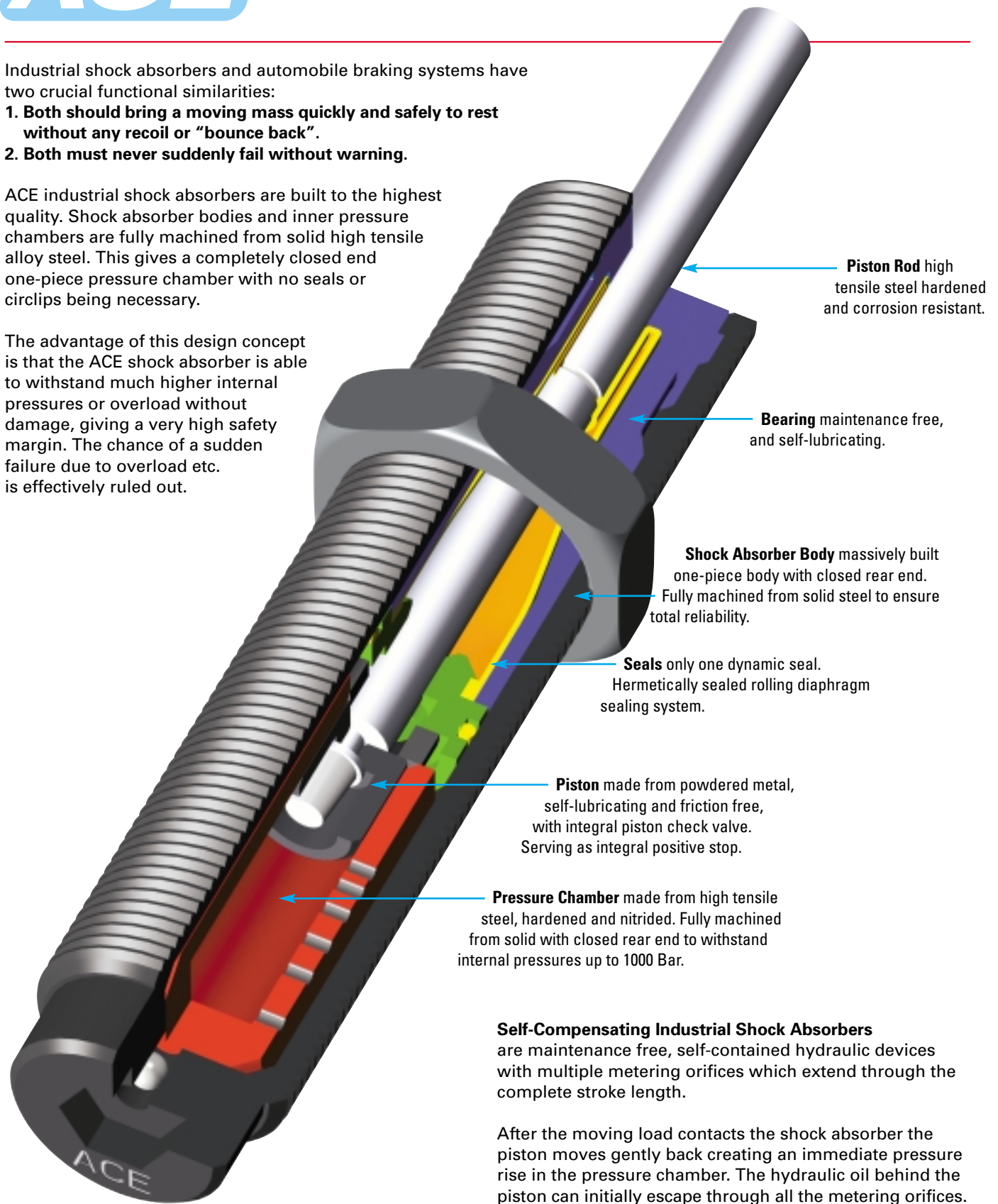


Industrial shock absorbers and automobile braking systems have two crucial functional similarities:

1. **Both should bring a moving mass quickly and safely to rest without any recoil or "bounce back".**
2. **Both must never suddenly fail without warning.**

ACE industrial shock absorbers are built to the highest quality. Shock absorber bodies and inner pressure chambers are fully machined from solid high tensile alloy steel. This gives a completely closed end one-piece pressure chamber with no seals or circlips being necessary.

The advantage of this design concept is that the ACE shock absorber is able to withstand much higher internal pressures or overload without damage, giving a very high safety margin. The chance of a sudden failure due to overload etc. is effectively ruled out.



Piston Rod high tensile steel hardened and corrosion resistant.

Bearing maintenance free, and self-lubricating.

Shock Absorber Body massively built one-piece body with closed rear end. Fully machined from solid steel to ensure total reliability.

Seals only one dynamic seal. Hermetically sealed rolling diaphragm sealing system.

Piston made from powdered metal, self-lubricating and friction free, with integral piston check valve. Serving as integral positive stop.

Pressure Chamber made from high tensile steel, hardened and nitrided. Fully machined from solid with closed rear end to withstand internal pressures up to 1000 Bar.

Self-Compensating Industrial Shock Absorbers

are maintenance free, self-contained hydraulic devices with multiple metering orifices which extend through the complete stroke length.

After the moving load contacts the shock absorber the piston moves gently back creating an immediate pressure rise in the pressure chamber. The hydraulic oil behind the piston can initially escape through all the metering orifices.

The number of metering orifices in action decreases proportionally to the distance travelled through the stroke.

The impact velocity of the moving load is smoothly reduced. The internal pressure and thus the reaction force (Q) remain essentially constant throughout the complete stroke length providing a constant deceleration rate or:

—————> **Linear Deceleration**

Issue 9.2004 Specifications subject to change

ACE shock absorbers provide linear deceleration and are therefore superior to other kinds of damping element. It is easy to calculate around 90 % of applications knowing only the following 5 parameters:

Key to symbols used

W_1	Kinetic energy per cycle	Nm
W_2	Propelling force energy per cycle	Nm
W_3	Total energy per cycle ($W_1 + W_2$)	Nm
W_4	Total energy per hour ($W_3 \cdot c$)	Nm/hr
m_e	Effective weight	kg
m	Mass to be decelerated	kg
n	Number of shock absorbers (in parallel)	
v	Velocity of moving mass	m/s
v_D	Impact velocity at shock absorber	m/s
ω	Angular velocity	rads/s
F	Propelling force	N
c	Cycles per hour	1/hr
P	Motor power	kW

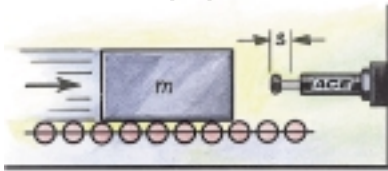
1. Mass to be decelerated (weight)	m	(kg)
2. Impact velocity at shock absorber	v_D	(m/s)
3. Propelling force	F	(N)
4. Cycles per hour	c	(/hr)
5. Number of absorbers in parallel	n	
ST**	Stall torque factor (normally 2.5)	1 to 3
M	Propelling torque	Nm
I	Moment of Inertia	kgm ²
g	Acceleration due to gravity = 9.81	m/s ²
h	Drop height excl. shock absorber stroke	m
s	Shock absorber stroke	m
$L/R/r$	Radius	m
Q	Reaction force	N
μ	Coefficient of friction	
t	Deceleration time	s
a	Deceleration	m/s ²
α	Side load angle	°
β	Angle of incline	°

**ST Δ relation between starting torque and running torque of the motor (depending on the design)

* v or v_D is the final impact velocity of the mass. With accelerating motion the final impact velocity can be 1.5 to 2 times higher than the average. Please take this into account when calculating kinetic energy.

In all the following examples the choice of shock absorbers made from the capacity chart is based upon the values of (W_3), (W_4), (m_e) and the desired shock absorber stroke (s).

1 Mass without propelling force



Formulae

$$\begin{aligned} W_1 &= m \cdot v^2 \cdot 0,5 \\ W_2 &= 0 \\ W_3 &= W_1 + W_2 \\ W_4 &= W_3 \cdot c \\ v_D &= v \\ m_e &= m \end{aligned}$$

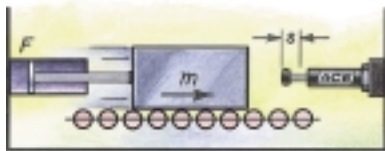
Example

$$\begin{aligned} m &= 100 \text{ kg} \\ v &= 1,5 \text{ m/s} \\ c &= 500 \text{ /hr} \\ s &= 0,05 \text{ m (chosen)} \end{aligned}$$

$$\begin{aligned} W_1 &= 100 \cdot 1,5^2 \cdot 0,5 &= 113 \text{ Nm} \\ W_2 &= 0 \\ W_3 &= 113 + 0 &= 113 \text{ Nm} \\ W_4 &= 113 \cdot 500 &= 56\,500 \text{ Nm/hr} \end{aligned}$$

Chosen from capacity chart:
Model MC 3350 M-2 self-compensating

2 Mass with propelling force



Formulae

$$\begin{aligned} W_1 &= m \cdot v^2 \cdot 0,5 \\ W_2 &= F \cdot s \\ W_3 &= W_1 + W_2 \\ W_4 &= W_3 \cdot c \\ v_D &= v \\ m_e &= \frac{2 \cdot W_3}{v_D^2} \\ W_2 &= (F - m \cdot g) \cdot s \\ W_2 &= (F + m \cdot g) \cdot s \end{aligned}$$

Example

$$\begin{aligned} m &= 36 \text{ kg} \\ v &= 1,5 \text{ m/s} \\ F &= 400 \text{ N} \\ c &= 1000 \text{ /hr} \\ s &= 0,025 \text{ m (chosen)} \end{aligned}$$

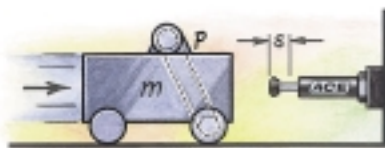
$$\begin{aligned} W_1 &= 36 \cdot 1,5^2 \cdot 0,5 &= 41 \text{ Nm} \\ W_2 &= 400 \cdot 0,025 &= 10 \text{ Nm} \\ W_3 &= 41 + 10 &= 51 \text{ Nm} \\ W_4 &= 51 \cdot 1000 &= 51\,000 \text{ Nm/hr} \\ m_e &= 2 \cdot 51 : 1,5^2 &= 45 \text{ kg} \end{aligned}$$

Chosen from capacity chart:
Model MC 600 M self-compensating

* v is the final impact velocity of the mass: With pneumatically propelled systems this can be 1.5 to 2 times the average velocity. Please take this into account when calculating energy.

- 2.1 bei senkrechter Bewegung nach oben \rightarrow
- 2.2 bei senkrechter Bewegung nach unten \rightarrow

3 Mass with motor drive



Formulae

$$\begin{aligned} W_1 &= m \cdot v^2 \cdot 0,5 \\ W_2 &= \frac{1000 \cdot P \cdot ST \cdot s}{v} \\ W_3 &= W_1 + W_2 \\ W_4 &= W_3 \cdot c \\ v_D &= v \\ m_e &= \frac{2 \cdot W_3}{v_D^2} \end{aligned}$$

Example

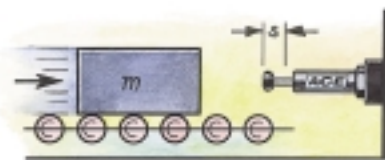
$$\begin{aligned} m &= 800 \text{ kg} \\ v &= 1,2 \text{ m/s} \\ ST &= 2,5 \\ P &= 4 \text{ kW} \\ c &= 100 \text{ /hr} \\ s &= 0,1 \text{ m (chosen)} \end{aligned}$$

$$\begin{aligned} W_1 &= 800 \cdot 1,2^2 \cdot 0,5 &= 576 \text{ Nm} \\ W_2 &= 1000 \cdot 4 \cdot 2,5 \cdot 0,1 : 1,2 &= 834 \text{ Nm} \\ W_3 &= 576 + 834 &= 1410 \text{ Nm} \\ W_4 &= 1410 \cdot 100 &= 141\,000 \text{ Nm/hr} \\ m_e &= 2 \cdot 1410 : 1,2^2 &= 1958 \text{ kg} \end{aligned}$$

Chosen from capacity chart:
Model MC 64100 M-2 self-compensating

Note: Do not forget to include the rotational energy of motor, coupling and gearbox into calculation for W_1 .

4 Mass on driven rollers



Formulae

$$\begin{aligned} W_1 &= m \cdot v^2 \cdot 0,5 \\ W_2 &= m \cdot \mu \cdot g \cdot s \\ W_3 &= W_1 + W_2 \\ W_4 &= W_3 \cdot c \\ v_D &= v \\ m_e &= \frac{2 \cdot W_3}{v_D^2} \end{aligned}$$

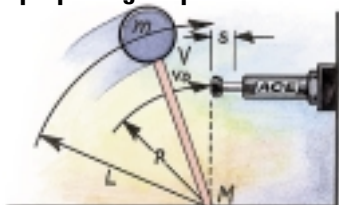
Example

$$\begin{aligned} m &= 250 \text{ kg} \\ v &= 1,5 \text{ m/s} \\ c &= 180 \text{ /hr} \\ (\text{Steel/Steel}) \mu &= 0,2 \\ s &= 0,05 \text{ m (chosen)} \end{aligned}$$

$$\begin{aligned} W_1 &= 250 \cdot 1,5^2 \cdot 0,5 &= 281 \text{ Nm} \\ W_2 &= 250 \cdot 0,2 \cdot 9,81 \cdot 0,05 &= 25 \text{ Nm} \\ W_3 &= 281 + 25 &= 306 \text{ Nm} \\ W_4 &= 306 \cdot 180 &= 55\,080 \text{ Nm/hr} \\ m_e &= 2 \cdot 306 : 1,5^2 &= 272 \text{ kg} \end{aligned}$$

Chosen from capacity chart:
Model MC 4550 M-2 self-compensating

5 Swinging mass with propelling torque



Formulae

$$\begin{aligned} W_1 &= m \cdot v^2 \cdot 0,5 = 0,5 \cdot I \cdot \omega^2 \\ W_2 &= \frac{M \cdot s}{R} \\ W_3 &= W_1 + W_2 \\ W_4 &= W_3 \cdot c \\ v_D &= \frac{v \cdot R}{L} = \omega \cdot R \\ m_e &= \frac{2 \cdot W_3}{v_D^2} \end{aligned}$$

Example

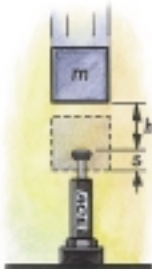
$$\begin{aligned} m &= 20 \text{ kg} \\ v &= 1 \text{ m/s} \\ M &= 50 \text{ Nm} \\ R &= 0,5 \text{ m} \\ L &= 0,8 \text{ m} \\ c &= 1500 \text{ /hr} \\ s &= 0,012 \text{ m (chosen)} \end{aligned}$$

$$\begin{aligned} W_1 &= 20 \cdot 1^2 \cdot 0,5 &= 10 \text{ Nm} \\ W_2 &= 50 \cdot 0,012 : 0,5 &= 1,2 \text{ Nm} \\ W_3 &= 10 + 1,2 &= 11,2 \text{ Nm} \\ W_4 &= 11,2 \cdot 1500 &= 16\,800 \text{ Nm/hr} \\ v_D &= 1 \cdot 0,5 : 0,8 &= 0,63 \text{ m/s} \\ m_e &= 2 \cdot 11,2 : 0,63^2 &= 56 \text{ kg} \end{aligned}$$

Chosen from capacity chart:
Model MC 150 MH self-compensating

Check the side load angle, $\tan \alpha = s/R$, with regard to "Max. Side Load Angle" in the capacity chart (see example 6.2)

6 Free falling mass



Formulae

$$W_1 = m \cdot g \cdot h$$

$$W_2 = m \cdot g \cdot s$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \sqrt{2 \cdot g \cdot h}$$

$$m_e = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m = 30 \text{ kg}$$

$$h = 0.5 \text{ m}$$

$$c = 400 \text{ /hr}$$

$$s = 0.05 \text{ m (chosen)}$$

$$W_1 = 30 \cdot 0.5 \cdot 9.81 = 147 \text{ Nm}$$

$$W_2 = 30 \cdot 9.81 \cdot 0.05 = 15 \text{ Nm}$$

$$W_3 = 147 + 15 = 162 \text{ Nm}$$

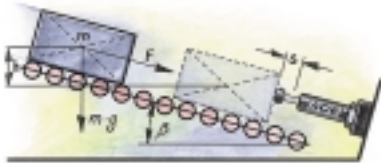
$$W_4 = 162 \cdot 400 = 64800 \text{ Nm/hr}$$

$$v_D = \sqrt{2 \cdot 9.81 \cdot 0.5} = 3.13 \text{ m/s}$$

$$m_e = \frac{2 \cdot 162}{3.13^2} = 33 \text{ kg}$$

Chosen from capacity chart:
Model MC 3350 M-1 self-compensating

6.1 Mass rolling/sliding down incline



Formulae

$$W_1 = m \cdot g \cdot h = m \cdot v_D^2 \cdot 0.5$$

$$W_2 = m \cdot g \cdot \sin \beta \cdot s$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \sqrt{2 \cdot g \cdot h}$$

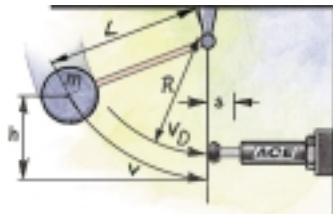
$$m_e = \frac{2 \cdot W_3}{v_D^2}$$

$$W_2 = (F - m \cdot g \cdot \sin \beta) \cdot s$$

$$W_2 = (F + m \cdot g \cdot \sin \beta) \cdot s$$

6.2 Mass free falling about a pivot point

Side load angle from shock absorber axis



$$\tan \alpha = \frac{s}{R}$$

Calculation as per example 6.1 except $W_2 = 0$

$$W_1 = m \cdot g \cdot h$$

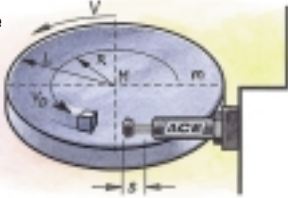
$$v_D = \sqrt{2 \cdot g \cdot h} \cdot \frac{R}{L}$$

Check the side load angle, $\tan \alpha = s/R$, with regard to "Max. Side Load Angle" in the capacity chart (see example 6.2)

6.1 a propelling force up incline →
6.1 b propelling force down incline →

7 Rotary index table with propelling torque

Note: Formulae given are only valid for circular table with uniform weight distribution.



Formulae

$$W_1 = m \cdot v^2 \cdot 0.25 = 0.5 \cdot I \cdot \omega^2$$

$$W_2 = \frac{M \cdot s}{R}$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \frac{v \cdot R}{L} = \omega \cdot R$$

$$m_e = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m = 1000 \text{ kg}$$

$$v = 1.1 \text{ m/s}$$

$$M = 1000 \text{ Nm}$$

$$s = 0.05 \text{ m (chosen)}$$

$$L = 1.25 \text{ m}$$

$$R = 0.8 \text{ m}$$

$$c = 100 \text{ /hr}$$

$$W_1 = 1000 \cdot 1.1^2 \cdot 0.25 = 303 \text{ Nm}$$

$$W_2 = 1000 \cdot 0.05 \cdot 0.8 = 63 \text{ Nm}$$

$$W_3 = 303 + 63 = 366 \text{ Nm}$$

$$W_4 = 366 \cdot 100 = 36600 \text{ Nm/hr}$$

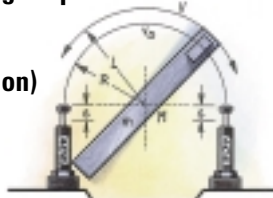
$$v_D = 1.1 \cdot 0.8 : 1.25 = 0.7 \text{ m/s}$$

$$m_e = 2 \cdot 366 \cdot 0.7^2 = 1494 \text{ kg}$$

Chosen from capacity chart:
Model MC 4550 M-3 self-compensating

Check the side load angle, $\tan \alpha = s/R$, with regard to "Max. Side Load Angle" in the capacity chart (see example 6.2)

8 Swinging arm with propelling torque (uniform weight distribution)



Formulae

$$W_1 = m \cdot v^2 \cdot 0.18 = 0.5 \cdot I \cdot \omega^2$$

$$W_2 = \frac{M \cdot s}{R}$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \frac{v \cdot R}{L} = \omega \cdot R$$

$$m_e = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$I = 56 \text{ kgm}^2$$

$$\omega = 1 \text{ rad/s}$$

$$M = 300 \text{ Nm}$$

$$s = 0.025 \text{ m (chosen)}$$

$$L = 1.5 \text{ m}$$

$$R = 0.8 \text{ m}$$

$$c = 1200 \text{ /hr}$$

$$W_1 = 0.5 \cdot 56 \cdot 1^2 = 28 \text{ Nm}$$

$$W_2 = 300 \cdot 0.025 \cdot 0.8 = 9 \text{ Nm}$$

$$W_3 = 28 + 9 = 37 \text{ Nm}$$

$$W_4 = 37 \cdot 1200 = 44400 \text{ Nm/hr}$$

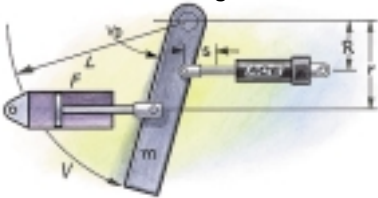
$$v_D = 1 \cdot 0.8 = 0.8 \text{ m/s}$$

$$m_e = 2 \cdot 37 \cdot 0.8^2 = 116 \text{ kg}$$

Chosen from capacity chart:
Model MC 600 M self-compensating

Check the side load angle, $\tan \alpha = s/R$, with regard to "Max. Side Load Angle" in the capacity chart (see example 6.2)

9 Swinging arm with propelling force (uniform weight distribution)



Formulae

$$W_1 = m \cdot v^2 \cdot 0.18 = 0.5 \cdot I \cdot \omega^2$$

$$W_2 = \frac{F \cdot r \cdot s}{R} = \frac{M \cdot s}{R}$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \frac{v \cdot R}{L} = \omega \cdot R$$

$$m_e = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m = 1000 \text{ kg}$$

$$v = 2 \text{ m/s}$$

$$F = 7000 \text{ N}$$

$$M = 4200 \text{ Nm}$$

$$s = 0.05 \text{ m (chosen)}$$

$$r = 0.6 \text{ m}$$

$$R = 0.8 \text{ m}$$

$$L = 1.2 \text{ m}$$

$$c = 900 \text{ /hr}$$

$$W_1 = 1000 \cdot 2^2 \cdot 0.18 = 720 \text{ Nm}$$

$$W_2 = 7000 \cdot 0.6 \cdot 0.05 \cdot 0.8 = 263 \text{ Nm}$$

$$W_3 = 720 + 263 = 983 \text{ Nm}$$

$$W_4 = 983 \cdot 900 = 884700 \text{ Nm/hr}$$

$$v_D = 2 \cdot 0.8 : 1.2 = 1.33 \text{ m/s}$$

$$m_e = 2 \cdot 983 \cdot 1.33^2 = 1111 \text{ kg}$$

Chosen from capacity chart:
Model CA 2 x 2 - 1 self-compensating

10 Mass lowered at controlled speed



Formulae

$$W_1 = m \cdot v^2 \cdot 0.5$$

$$W_2 = m \cdot g \cdot s$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = v$$

$$m_e = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m = 6000 \text{ kg}$$

$$v = 1.5 \text{ m/s}$$

$$s = 0.305 \text{ m (chosen)}$$

$$c = 60 \text{ /hr}$$

$$W_1 = 6000 \cdot 1.5^2 \cdot 0.5 = 6750 \text{ Nm}$$

$$W_2 = 6000 \cdot 9.81 \cdot 0.305 = 17952 \text{ Nm}$$

$$W_3 = 6750 + 17952 = 24702 \text{ Nm}$$

$$W_4 = 24702 \cdot 60 = 1482120 \text{ Nm/hr}$$

$$m_e = 2 \cdot 24702 : 1.5^2 = 21957 \text{ kg}$$

Chosen from capacity chart:
Model CA 3 x 12-2 self-compensating

Reaction force Q (N)

$$Q = \frac{1.5 \cdot W_3}{s}$$

Stopping time t (s)

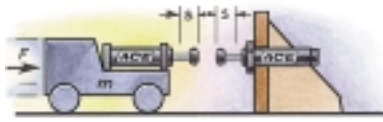
$$t = \frac{2.6 \cdot s}{v_D}$$

Deceleration rate a (m/s²)

$$a = \frac{0.75 \cdot v_D^2}{s}$$

Approximate values assuming correct adjustment. Add safety margin if necessary.
(Exact values will depend upon actual application data and can be provided on request.)

19 Wagon against 2 shock absorbers



Formulae

$$W_1 = m \cdot v^2 \cdot 0.25$$

$$W_2 = F \cdot s$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \frac{v}{2}$$

$$me = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m = 5000 \text{ kg}$$

$$v = 2 \text{ m/s}$$

$$c = 10 \text{ /hr}$$

$$F = 3500 \text{ N}$$

$$s = 0.150 \text{ m (chosen)}$$

$$W_1 = 5000 \cdot 2^2 \cdot 0.25 = 5000 \text{ Nm}$$

$$W_2 = 3500 \cdot 0.150 = 525 \text{ Nm}$$

$$W_3 = 5000 + 525 = 5525 \text{ Nm}$$

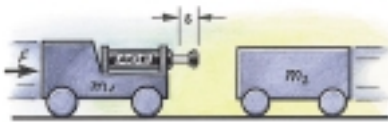
$$W_4 = 5525 \cdot 10 = 55250 \text{ Nm/hr}$$

$$v_D = 2 : 2 = 1 \text{ m/s}$$

$$me = 2 \cdot 5525 : 1^2 = 11050 \text{ kg}$$

Chosen from capacity chart:
Model CA 2 x 6-2 self-compensating

20 Wagon against wagon



Formulae

$$W_1 = \frac{m_1 \cdot m_2}{(m_1 + m_2)} \cdot (v_1 + v_2)^2 \cdot 0.5$$

$$W_2 = F \cdot s$$

$$W_3 = W_1 + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = v_1 + v_2$$

$$me = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m_1 = 7000 \text{ kg}$$

$$v_1 = 1.2 \text{ m/s}$$

$$c = 20 \text{ /hr}$$

$$m_2 = 10000 \text{ kg}$$

$$v_2 = 0.5 \text{ m/s}$$

$$F = 5000 \text{ N}$$

$$s = 0.127 \text{ m (chosen)}$$

$$W_1 = \frac{7000 \cdot 10000}{(7000 + 10000)} \cdot 1.7^2 \cdot 0.5 = 5950 \text{ Nm}$$

$$W_2 = 5000 \cdot 0.127 = 635 \text{ Nm}$$

$$W_3 = 5950 + 635 = 6585 \text{ Nm}$$

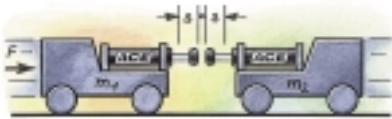
$$W_4 = 6585 \cdot 20 = 131700 \text{ Nm/hr}$$

$$v_D = 1.2 + 0.5 = 1.7 \text{ m/s}$$

$$me = 2 \cdot 6585 : 1.7^2 = 4557 \text{ kg}$$

Chosen from capacity chart:
Model CA 3 x 5-1 self-compensating

21 Wagon against wagon 2 shock absorbers



Formulae

$$W_1 = \frac{m_1 \cdot m_2}{(m_1 + m_2)} \cdot (v_1 + v_2)^2 \cdot 0.5$$

$$W_2 = F \cdot s$$

$$W_3 = \frac{W_1}{2} + W_2$$

$$W_4 = W_3 \cdot c$$

$$v_D = \frac{v_1 + v_2}{2}$$

$$me = \frac{2 \cdot W_3}{v_D^2}$$

Example

$$m_1 = 7000 \text{ kg}$$

$$v_1 = 1.2 \text{ m/s}$$

$$c = 20 \text{ /hr}$$

$$m_2 = 10000 \text{ kg}$$

$$v_2 = 0.5 \text{ m/s}$$

$$F = 5000 \text{ N}$$

$$s = 0.100 \text{ m (chosen)}$$

$$W_1 = \frac{7000 \cdot 10000}{(7000 + 10000)} \cdot 1.7^2 \cdot 0.5 = 5950 \text{ Nm}$$

$$W_2 = 5000 \cdot 0.100 = 500 \text{ Nm}$$

$$W_3 = (5950 : 2) + 500 = 3475 \text{ Nm}$$

$$W_4 = 3475 \cdot 20 = 69500 \text{ Nm/hr}$$

$$v_D = (1.2 + 0.5) : 2 = 0.85 \text{ m/s}$$

$$me = 2 \cdot 3475 : 0.85^2 = 9619 \text{ kg}$$

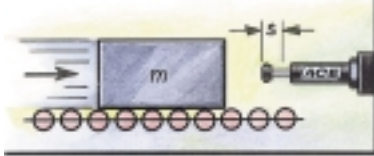
Chosen from capacity chart:
Model CA 2 x 4-2 self-compensating

Note: When using several shock absorbers in parallel, the values W_3 , W_4 and me are divided according to the number of units used.

Effective weight (me)

A Mass without propelling force

Formula
 $me = m$



Example:

$$m = 100 \text{ kg}$$

$$v_D = v = 2 \text{ m/s}$$

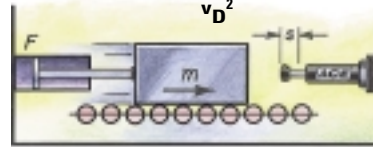
$$W_1 = W_3 = 200 \text{ Nm}$$

$$me = \frac{2 \cdot 200}{4} = 100 \text{ kg}$$

$$me = m$$

B Mass with propelling force

Formula
 $me = \frac{2 \cdot W_3}{v_D^2}$



Example:

$$m = 100 \text{ kg}$$

$$F = 2000 \text{ N}$$

$$v_D = v = 2 \text{ m/s}$$

$$s = 0.1 \text{ m}$$

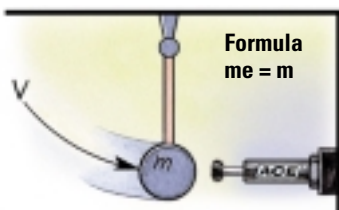
$$W_1 = 200 \text{ Nm}$$

$$W_2 = 200 \text{ Nm}$$

$$W_3 = 400 \text{ Nm}$$

$$me = \frac{2 \cdot 400}{4} = 200 \text{ kg}$$

C Mass without propelling force direct against shock absorber



Example:

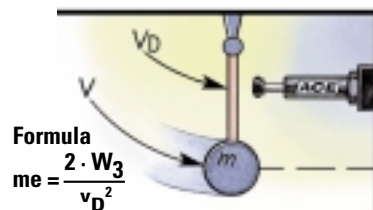
$$m = 20 \text{ kg}$$

$$v_D = v = 2 \text{ m/s}$$

$$W_1 = W_3 = 40 \text{ Nm}$$

$$me = \frac{2 \cdot 40}{2^2} = 20 \text{ kg}$$

D Mass without propelling force with mechanical advantage



Example:

$$m = 20 \text{ kg}$$

$$v = 2 \text{ m/s}$$

$$v_D = 0.5 \text{ m/s}$$

$$W_1 = W_3 = 40 \text{ Nm}$$

$$me = \frac{2 \cdot 40}{0.5^2} = 320 \text{ kg}$$

The effective weight (me) can either be the same as the actual weight (Examples A and C), or it can be an imaginary weight representing a combination of the propelling force or lever action plus the actual weight (Examples B and D).

Capacity Chart

Energy Capacity					Effective Weight me						
Model	Stroke	Nm per Cycle	Self-Compensating		Page	Model	Stroke	Nm per Cycle	Self-Compensating		Page
Part number	mm	W ₃	min	max		Part number	mm	W ₃	min	max	
MC 9 M-1-B	5	1	0.6	3.2	19	MC 4525 M-0	25	340	7	27	38
MC 9 M-2-B	5	1	0.8	4.1	19	MC 4525 M-1	25	340	20	90	38
MC 10 ML-B	5	0.5	0.3	2.7	19	MC 4525 M-2	25	340	80	310	38
MC 10 MH-B	5	0.8	0.7	5	19	MC 4525 M-3	25	340	260	1050	38
MC 30 M-1	8	3.5	0.4	1.9	19	MC 4525 M-4	25	340	890	3540	38
MC 30 M-2	8	3.5	1.8	5.4	19	MC 4550 M-0	50	680	13	54	38
MC 30 M-3	8	3.5	5	15	19	MC 4550 M-1	50	680	45	180	38
MC 25 ML	6	2.8	0.7	2.2	19	MC 4550 M-2	50	680	150	620	38
MC 25 M	6	2.8	1.8	5.4	19	MC 4550 M-3	50	680	520	2090	38
MC 25 MH	6	2.8	4.6	13.6	19	MC 4550 M-4	50	680	1800	7100	38
MC 75 M-1	10	9	0.3	1.1	19	MC 4575 M-0	75	1020	20	80	38
MC 75 M-2	10	9	0.9	4.8	19	MC 4575 M-1	75	1020	70	270	38
MC 75 M-3	10	9	2.7	36.2	19	MC 4575 M-2	75	1020	230	930	38
MC 150 M	12	20	0.9	10	21	MC 4575 M-3	75	1020	790	3140	38
MC 150 MH	12	20	8.6	86	21	MC 4575 M-4	75	1020	2650	10600	38
MC 150 MH2	12	20	70	200	21	MC 6450 M-0	50	1700	35	140	40
MC 225 M	12	41	2.3	25	21	MC 6450 M-1	50	1700	140	540	40
MC 225 MH	12	41	23	230	21	MC 6450 M-2	50	1700	460	1850	40
MC 225 MH2	12	41	180	910	21	MC 6450 M-3	50	1700	1600	6300	40
MC 600 M	25	136	9	136	21	MC 6450 M-4	50	1700	5300	21200	40
MC 600 MH	25	136	113	1130	21	MC 64100 M-0	100	3400	70	280	40
MC 600 MH2	25	136	400	2300	21	MC 64100 M-1	100	3400	270	1100	40
SC 25 M-5	8	10	1	5	25	MC 64100 M-2	100	3400	930	3700	40
SC 25 M-6	8	10	4	44	25	MC 64100 M-3	100	3400	3150	12600	40
SC 25 M-7	8	10	42	500	25	MC 64100 M-4	100	3400	10600	42500	40
SC 75 M-5	10	16	1	8	25	MC 64150 M-0	150	5100	100	460	40
SC 75 M-6	10	16	6.8	78	25	MC 64150 M-1	150	5100	410	1640	40
SC 75 M-7	10	16	75	800	25	MC 64150 M-2	150	5100	1390	5600	40
SC 190 M-0	16	25	0.7	4	23	MC 64150 M-3	150	5100	4700	18800	40
SC 190 M-1	16	25	1.4	7	23	MC 64150 M-4	150	5100	16000	63700	40
SC 190 M-2	16	25	3.6	18	23	CA 2 x 2-1	50	3600	700	2200	51
SC 190 M-3	16	25	9	45	23	CA 2 x 2-2	50	3600	1800	5400	51
SC 190 M-4	16	25	23	102	23	CA 2 x 2-3	50	3600	4500	13600	51
SC 190 M-5	12	31	2	16	25	CA 2 x 2-4	50	3600	11300	34000	51
SC 190 M-6	12	31	13	140	25	CA 2 x 4-1	102	7200	1400	4400	51
SC 190 M-7	12	31	136	1550	25	CA 2 x 4-2	102	7200	3600	11000	51
SC 300 M-0	19	33	0.7	4	23	CA 2 x 4-3	102	7200	9100	27200	51
SC 300 M-1	19	33	1.4	8	23	CA 2 x 4-4	102	7200	22600	68000	51
SC 300 M-2	19	33	4.5	27	23	CA 2 x 6-1	152	10800	2200	6500	51
SC 300 M-3	19	33	14	82	23	CA 2 x 6-2	152	10800	5400	16300	51
SC 300 M-4	19	33	32	204	23	CA 2 x 6-3	152	10800	13600	40800	51
SC 300 M-5	15	73	11	45	25	CA 2 x 6-4	152	10800	34000	102000	51
SC 300 M-6	15	73	34	136	25	CA 2 x 8-1	203	14500	2900	8700	51
SC 300 M-7	15	73	91	181	25	CA 2 x 8-2	203	14500	7200	21700	51
SC 300 M-8	15	73	135	680	25	CA 2 x 8-3	203	14500	18100	54400	51
SC 300 M-9	15	73	320	1950	25	CA 2 x 8-4	203	14500	45300	136000	51
SC 650 M-0	25	73	2.3	14	23	CA 2 x 10-1	254	18000	3600	11000	51
SC 650 M-1	25	73	8	45	23	CA 2 x 10-2	254	18000	9100	27200	51
SC 650 M-2	25	73	23	136	23	CA 2 x 10-3	254	18000	22600	68000	51
SC 650 M-3	25	73	68	408	23	CA 2 x 10-4	254	18000	56600	170000	51
SC 650 M-4	25	73	204	1180	23	CA 3 x 5-1	127	14125	2900	8700	52
SC 650 M-5	23	210	23	113	25	CA 3 x 5-2	127	14125	7250	21700	52
SC 650 M-6	23	210	90	360	25	CA 3 x 5-3	127	14125	18100	54350	52
SC 650 M-7	23	210	320	1090	25	CA 3 x 5-4	127	14125	45300	135900	52
SC 650 M-8	23	210	770	2630	25	CA 3 x 8-1	203	22600	4650	13900	52
SC 650 M-9	23	210	1800	6350	25	CA 3 x 8-2	203	22600	11600	34800	52
SC 925 M-0	40	110	4.5	29	23	CA 3 x 8-3	203	22600	29000	87000	52
SC 925 M-1	40	110	14	90	23	CA 3 x 8-4	203	22600	72500	217000	52
SC 925 M-2	40	110	40	272	23	CA 3 x 12-1	305	33900	6950	20900	52
SC 925 M-3	40	110	113	726	23	CA 3 x 12-2	305	33900	17400	52200	52
SC 925 M-4	40	110	340	2088	23	CA 3 x 12-3	305	33900	43500	130450	52
MC 3325 M-0	25	155	3	11	36	CA 3 x 12-4	305	33900	108700	326000	52
MC 3325 M-1	25	155	9	40	36	CA 4 x 6-3	152	47500	3500	8600	53
MC 3325 M-2	25	155	30	120	36	CA 4 x 6-5	152	47500	8600	18600	53
MC 3325 M-3	25	155	100	420	36	CA 4 x 6-7	152	47500	18600	42700	53
MC 3325 M-4	25	155	350	1420	36	CA 4 x 8-3	203	63300	5000	11400	53
MC 3350 M-0	50	310	5	22	36	CA 4 x 8-5	203	63300	11400	25000	53
MC 3350 M-1	50	310	18	70	36	CA 4 x 8-7	203	63300	25000	57000	53
MC 3350 M-2	50	310	60	250	36	CA 4 x 16-3	406	126500	10000	23000	53
MC 3350 M-3	50	310	210	840	36	CA 4 x 16-5	406	126500	23000	50000	53
MC 3350 M-4	50	310	710	2830	36	CA 4 x 16-7	406	126500	50000	115000	53

Issue 9.2004 Specifications subject to change

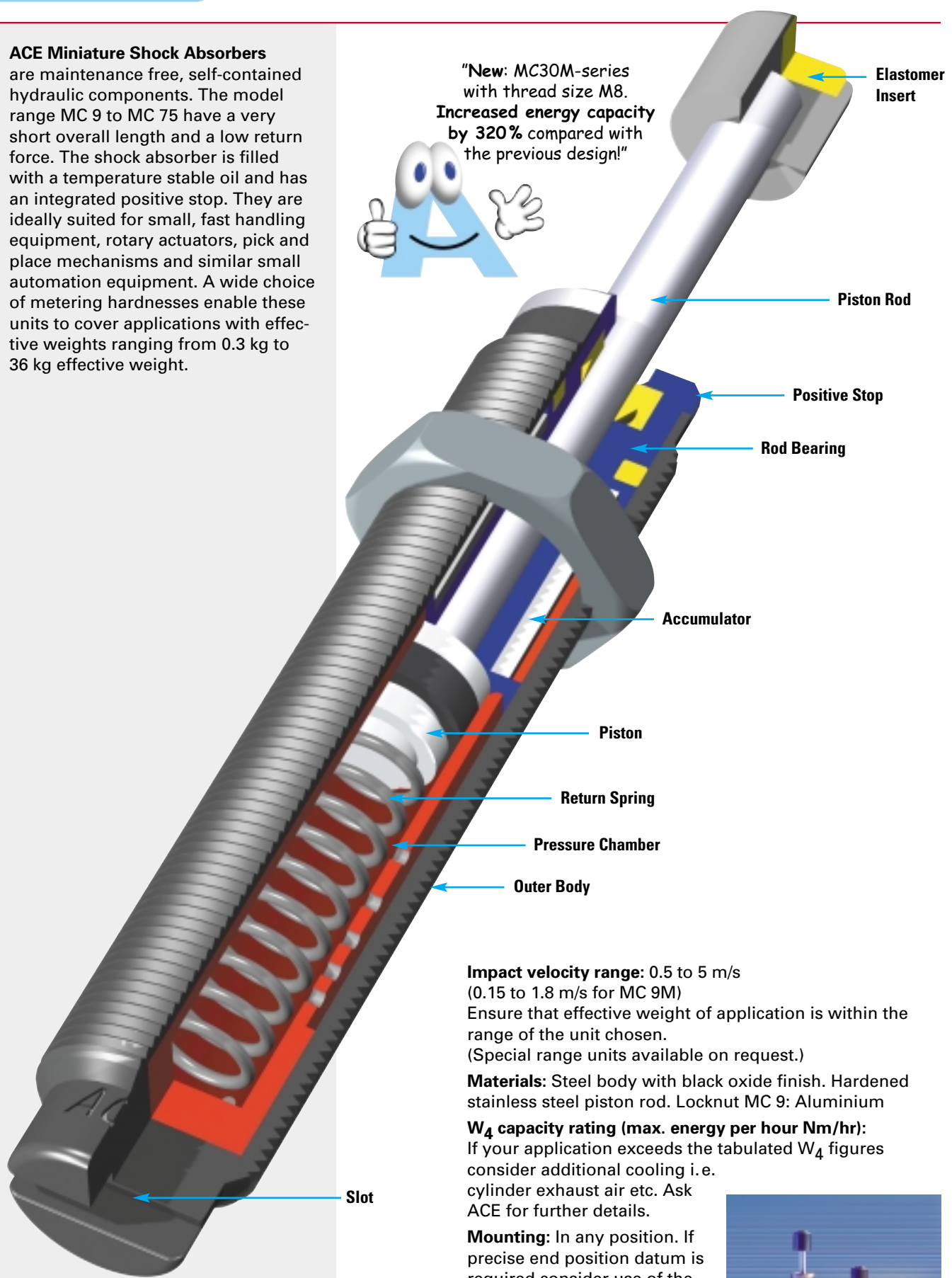
Capacity Chart

Model Part number	Stroke mm	Max. Energy Capacity Nm		Effective Weight me			Page
		per Cycle W ₃	W ₄ per Hour Self Contained	min	Adjustable kg	max	
MA 30 M	8	3.5	5 650	0.3	-	15	27
FA 1008 VD-B	8	1.8	3 600	0.2	-	10	27
MA 50 M	7	5.5	5 100	4.5	-	20	27
MA 35 M	10	4	6 000	5.9	-	57	27
MA 150 M	12	22	35 000	1	-	109	27
MA 225 M	19	25	45 000	2.3	-	226	27
MA 600 M	25	68	68 000	9	-	1 360	27
MA 900 M	40	100	90 000	14	-	2 040	27
MA 3325 M	25	170	75 000	9	-	1 730	36
ML 3325 M	25	170	75 000	300	-	50 000	36
MA 3350 M	50	340	85 000	13	-	2 500	36
ML 3350 M	50	340	85 000	500	-	80 000	36
MA 4525 M	25	390	107 000	40	-	10 000	38
ML 4525 M	25	390	107 000	3 000	-	110 000	38
MA 4550 M	50	780	112 000	70	-	14 500	38
ML 4550 M	50	780	112 000	5 000	-	180 000	38
MA 4575 M	75	1 170	146 000	70	-	15 000	38
ML 6425 M	25	1 020	124 000	7 000	-	300 000	40
MA 6450 M	50	2 040	146 000	220	-	50 000	40
ML 6450 M	50	2 040	146 000	11 000	-	500 000	40
MA 64100 M	100	4 080	192 000	270	-	52 000	40
MA 64150 M	150	6 120	248 000	330	-	80 000	40
A 1 1/2 x 2	50	1 800	632 000	195	-	32 000	50
A 1 1/2 x 3 1/2	89	3 200	633 000	218	-	36 000	50
A 1 1/2 x 5	127	4 500	904 000	227	-	41 000	50
A 1 1/2 x 6 1/2	165	5 900	1 180 000	308	-	45 000	50
A 2 x 2	50	3 600	1 100 000	250	-	32 000	51
A 2 x 4	102	9 000	1 350 000	230	-	72 500	51
A 2 x 6	152	13 500	1 600 000	260	-	86 000	51
A 2 x 8	203	19 200	1 900 000	260	-	90 000	51
A 2 x 10	254	23 700	2 200 000	320	-	113 000	51
A 3 x 5	127	15 800	2 260 000	480	-	154 000	52
A 3 x 8	203	28 200	3 600 000	540	-	181 500	52
A 3 x 12	305	44 000	5 400 000	610	-	204 000	52

ACE Miniature Shock Absorbers are maintenance free, self-contained hydraulic components. The model range MC 9 to MC 75 have a very short overall length and a low return force. The shock absorber is filled with a temperature stable oil and has an integrated positive stop. They are ideally suited for small, fast handling equipment, rotary actuators, pick and place mechanisms and similar small automation equipment. A wide choice of metering hardesses enable these units to cover applications with effective weights ranging from 0.3 kg to 36 kg effective weight.



"New: MC30M-series with thread size M8. Increased energy capacity by 320% compared with the previous design!"



Elastomer Insert

Piston Rod

Positive Stop

Rod Bearing

Accumulator

Piston

Return Spring

Pressure Chamber

Outer Body

Slot

Impact velocity range: 0.5 to 5 m/s

(0.15 to 1.8 m/s for MC 9M)

Ensure that effective weight of application is within the range of the unit chosen.

(Special range units available on request.)

Materials: Steel body with black oxide finish. Hardened stainless steel piston rod. Locknut MC 9: Aluminium

W₄ capacity rating (max. energy per hour Nm/hr):

If your application exceeds the tabulated W₄ figures consider additional cooling i.e. cylinder exhaust air etc. Ask ACE for further details.

Mounting: In any position. If precise end position datum is required consider use of the optional stop collar type AH.

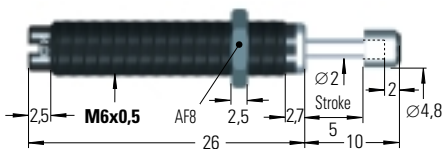
Operating temperature range: 0°C to 65°C.

On request: the MC Series are available with Weartec finish (seawater resistant) or other special finishes.



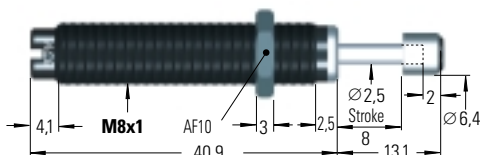
Part Number MC . . .

MC 9 M-B



Accessories, mounting, installation... see pages 28 to 32.

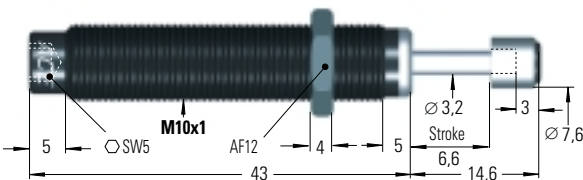
MC 30 M for use on new installations



NEW

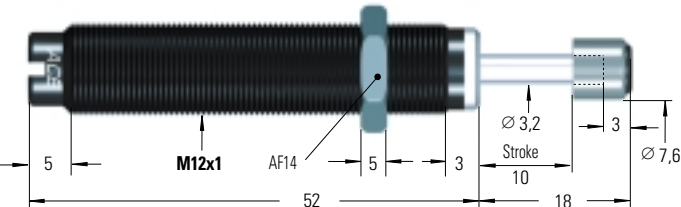
Accessories, mounting, installation... see pages 28 to 32.

MC 25 M

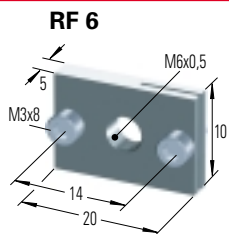


Accessories, mounting, installation... see pages 28 to 32.

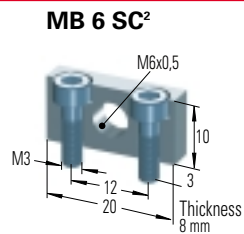
MC 75 M



Accessories, mounting, installation... see pages 28 to 32.

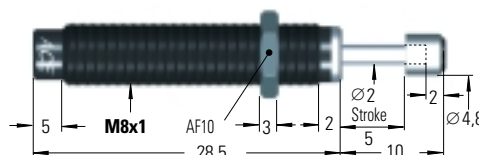


Rectangular Flange

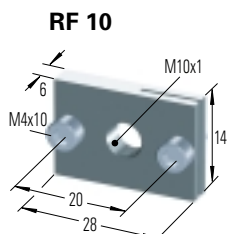


Mounting Block

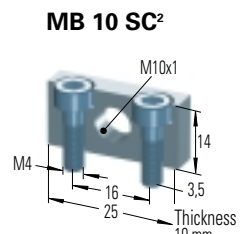
MC 10 M-B still available in future



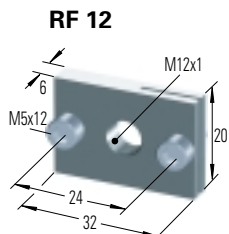
M8x0,75 also available to order



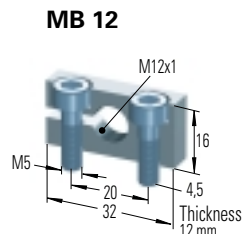
Rectangular Flange



Mounting Block



Rectangular Flange



Clamp Mount

AH Stop Collar



BV Side Load Adaptor



MC 30 M to MC 75 M only

PB Steel Shroud



MC 30 M to MC 75 M only

AS Stop Collar incl Proximity Switch



MC 25 M to MC 75 M only

Mounting, installation... see pages 28 to 32.

Available without rod end button and with shortened piston rod on request (add suffix -NB)

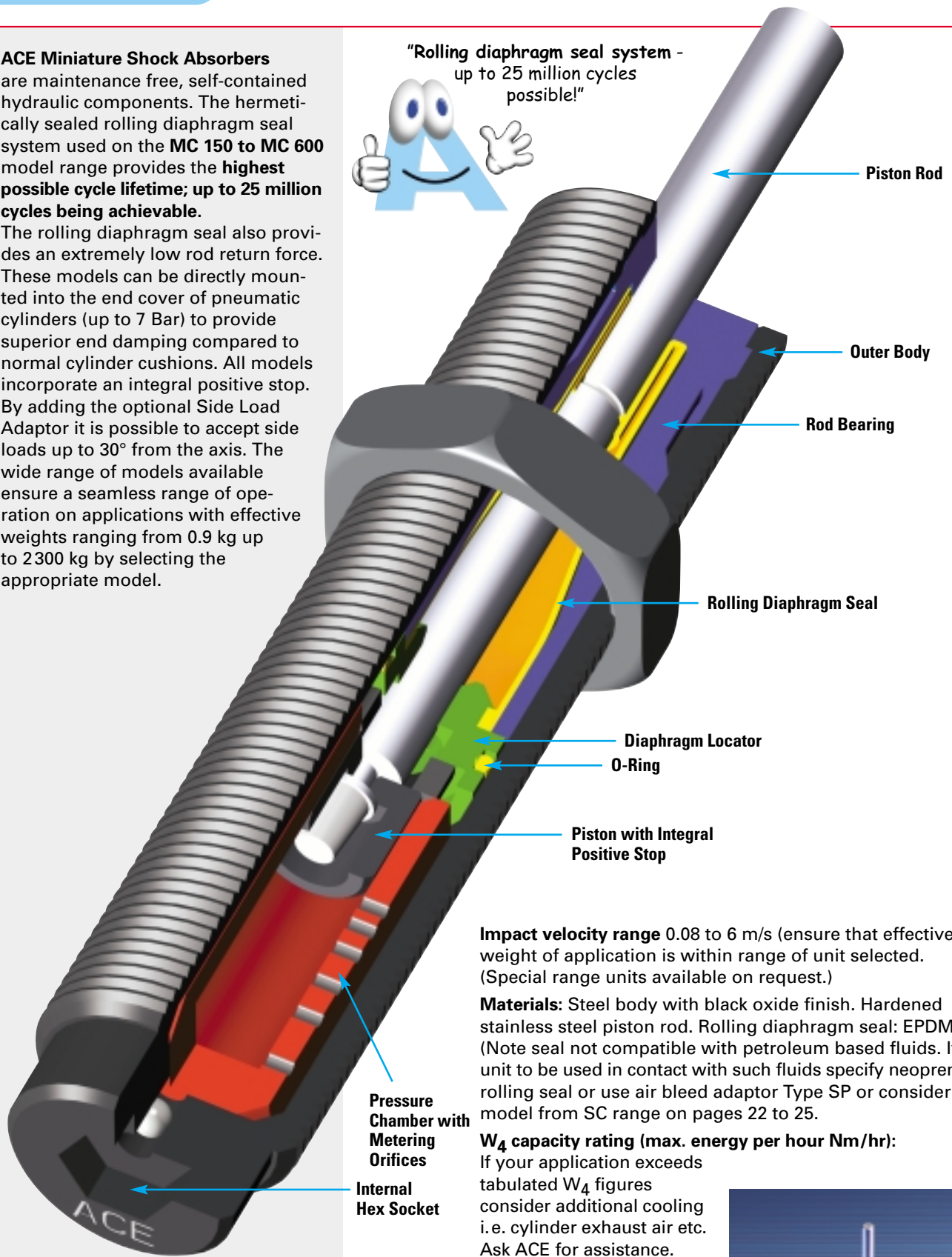
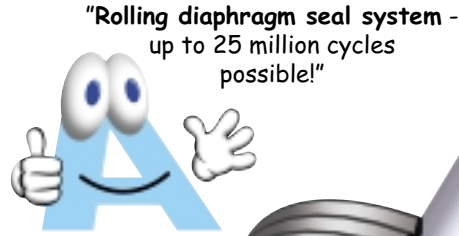
Capacity Chart

Type	Max. Energy Capacity Nm		Effective Weight me		Return Force N	Rod Reset Time s	*Max. Side Load Angle °	Weight kg
	per Cycle W ₃	per Hour W ₄	Self-Compensating min kg	max				
MC 9 M-1-B	1.0	2 000	0.6	3.2	1.38 - 3.78	0.3	2	0.005
MC 9 M-2-B	1.0	2 000	0.8	4.1	1.38 - 3.78	0.3	2	0.005
MC 10 ML-B	0.5	4 000	0.3	2.7	2.00 - 4.00	0.6	3	0.010
MC 10 MH-B	0.8	4 000	0.7	5.0	2.00 - 4.00	0.6	3	0.010
MC 30 M-1	3.5	5 600	0.4	1.9	0.9 - 4.45	0.3	2	0.010
MC 30 M-2	3.5	5 600	1.8	5.4	0.9 - 4.45	0.3	2	0.010
MC 30 M-3	3.5	5 600	5	15	0.9 - 4.45	0.3	2	0.010
MC 25 ML	2.8	22 500	0.7	2.2	3.00 - 6.00	0.3	2	0.020
MC 25 M	2.8	22 500	1.8	5.4	3.00 - 6.00	0.3	2	0.020
MC 25 MH	2.8	22 500	4.6	13.6	3.00 - 6.00	0.3	2	0.020
MC 75 M-1	9.0	28 200	0.3	1.1	4.00 - 9.00	0.3	2	0.030
MC 75 M-2	9.0	28 200	0.9	4.8	4.00 - 9.00	0.3	2	0.030
MC 75 M-3	9.0	28 200	2.7	36.2	4.00 - 9.00	0.3	2	0.030

* With higher side load angles install BV side load adaptor see page 28 and 31.

ACE Miniature Shock Absorbers are maintenance free, self-contained hydraulic components. The hermetically sealed rolling diaphragm seal system used on the **MC 150 to MC 600** model range provides the **highest possible cycle lifetime; up to 25 million cycles being achievable.**

The rolling diaphragm seal also provides an extremely low rod return force. These models can be directly mounted into the end cover of pneumatic cylinders (up to 7 Bar) to provide superior end damping compared to normal cylinder cushions. All models incorporate an integral positive stop. By adding the optional Side Load Adaptor it is possible to accept side loads up to 30° from the axis. The wide range of models available ensure a seamless range of operation on applications with effective weights ranging from 0.9 kg up to 2300 kg by selecting the appropriate model.



Impact velocity range 0.08 to 6 m/s (ensure that effective weight of application is within range of unit selected. (Special range units available on request.)

Materials: Steel body with black oxide finish. Hardened stainless steel piston rod. Rolling diaphragm seal: EPDM (Note seal not compatible with petroleum based fluids. If unit to be used in contact with such fluids specify neoprene rolling seal or use air bleed adaptor Type SP or consider model from SC range on pages 22 to 25.

W₄ capacity rating (max. energy per hour Nm/hr):

If your application exceeds tabulated W₄ figures consider additional cooling i.e. cylinder exhaust air etc. Ask ACE for assistance.

Mounting: In any position. If precise end position datum is required consider use of the optional stop collar type AH.

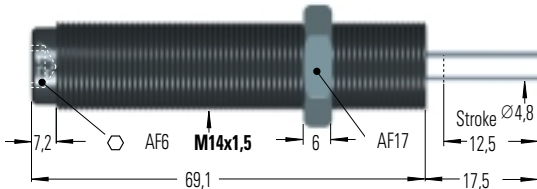
Operating temperature range: 0°C to 66°C.

On request: Stainless Steel outer body. Weartech finish (seawater resistant). Other finishes available to special order.



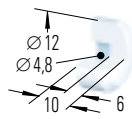
Part Number MC . . .

MC 150 M



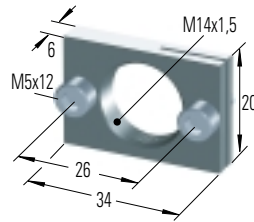
M14x1 also available to special order

PP 150



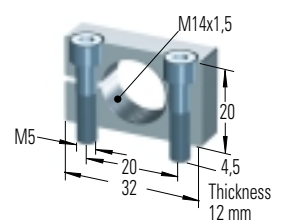
Nylon Button
W₃ max = 14 Nm

RF 14



Rectangular Flange

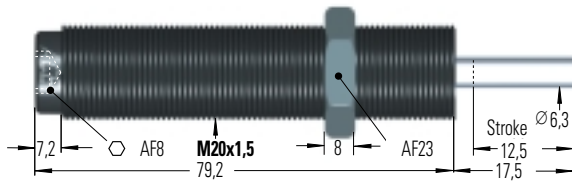
MB 14



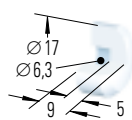
Clamp Mount

Accessories, mounting, installation... see pages 29 to 32.

MC 225 M

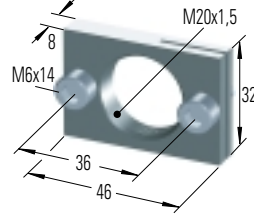


PP 225



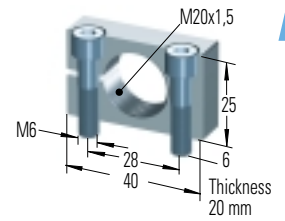
Nylon Button
W₃ max = 33 Nm

RF 20



Rectangular Flange

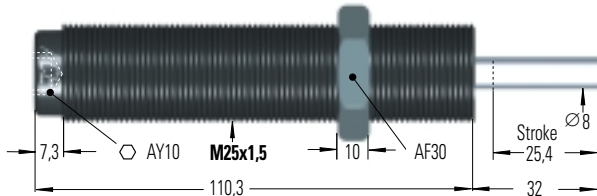
MB 20



Clamp Mount

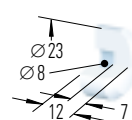
Accessories, mounting, installation... see pages 29 to 32.

MC 600 M



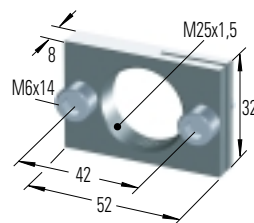
M27x3 also available to special order

PP 600



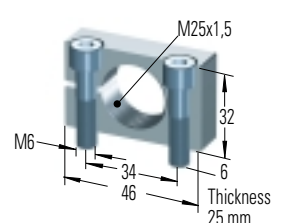
Nylon Button
W₃ max = 68 Nm

RF 25



Rectangular Flange

MB 25



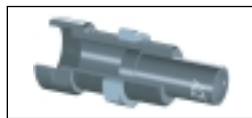
Clamp Mount

Accessories, mounting, installation... see pages 30 to 32.

AH Stop Collar



BV Side Load Adaptor



SP Air Bleed Collar



PB Steel Shroud



PS Steel Button



Mounting, installation... see pages 29 to 32.

AS Switch Stop Collar

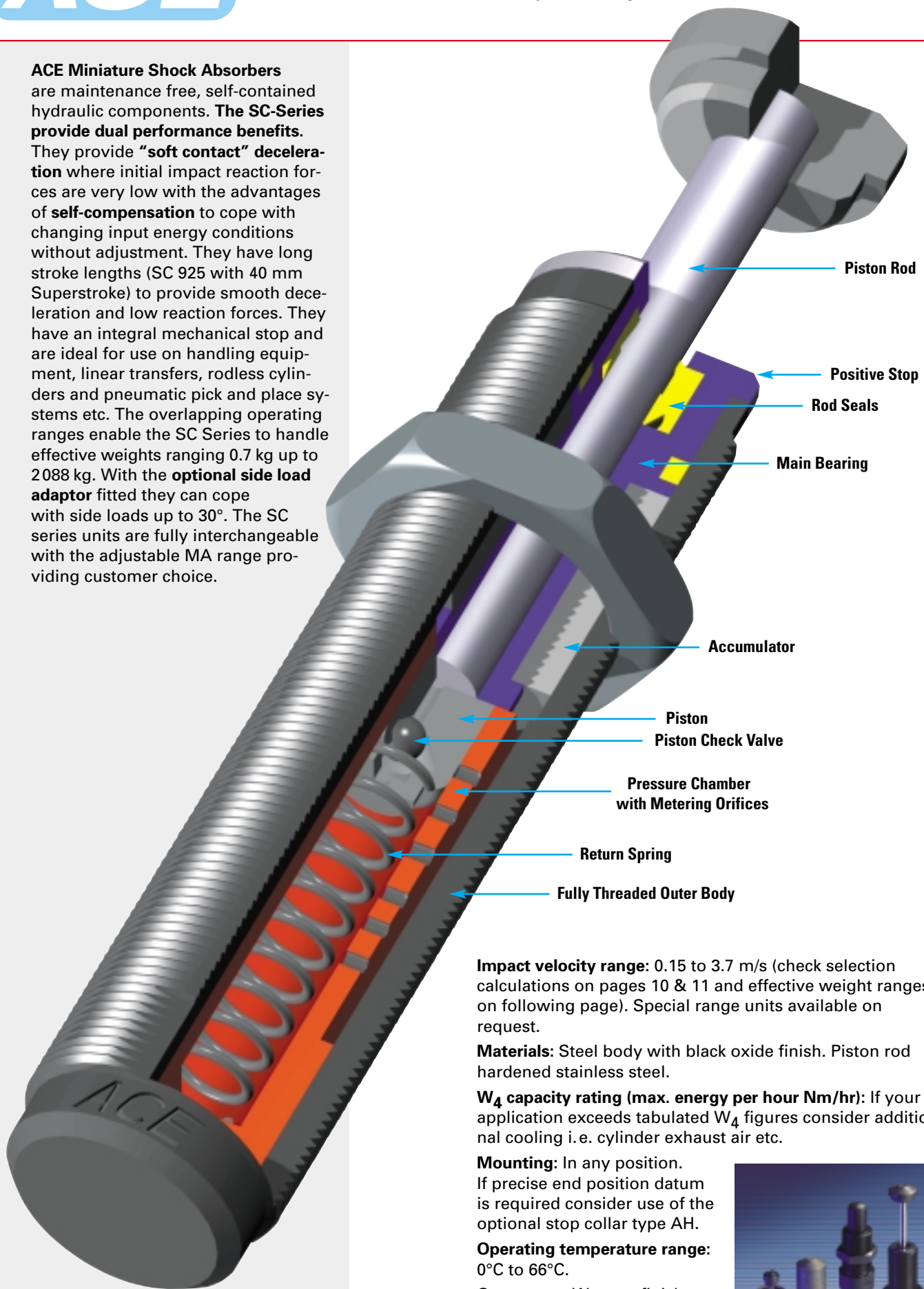


Capacity Chart

Type	Max. Energy Capacity Nm		Effective Weight me		Return Force N	Rod Reset Time s	*Max. Side Load Angle °	Weight kg
	per Cycle W ₃	per Hour W ₄	Self-Compensating min	kg max				
MC 150 M	20	34 000	0.9	- 10	3 - 5	0.4	4	0.06
MC 150 MH	20	34 000	8.6	- 86	3 - 5	0.4	4	0.06
MC 150 MH2	20	34 000	70	- 200	3 - 5	0.4	4	0.06
MC 225 M	41	45 000	2.3	- 25	4 - 6	0.3	4	0.15
MC 225 MH	41	45 000	23	- 230	4 - 6	0.3	4	0.15
MC 225 MH2	41	45 000	180	- 910	4 - 6	0.3	4	0.15
MC 600 M	136	68 000	9	- 136	5 - 9	0.6	2	0.26
MC 600 MH	136	68 000	113	- 1 130	5 - 9	0.6	2	0.26
MC 600 MH2	136	68 000	400	- 2 300	5 - 9	0.6	2	0.26

* For applications with higher side load angles consider using the Side Load Adaptor (BV) pages 29 to 31.

ACE Miniature Shock Absorbers are maintenance free, self-contained hydraulic components. **The SC-Series provide dual performance benefits.** They provide **“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. They have long stroke lengths (SC 925 with 40 mm Superstroke) to provide smooth deceleration and low reaction forces. They have an integral mechanical stop and are ideal for use on handling equipment, linear transfers, rodless cylinders and pneumatic pick and place systems etc. The overlapping operating ranges enable the SC Series to handle effective weights ranging 0.7 kg up to 2088 kg. With the **optional side load adaptor** fitted they can cope with side loads up to 30°. The SC series units are fully interchangeable with the adjustable MA range providing customer choice.



Impact velocity range: 0.15 to 3.7 m/s (check selection calculations on pages 10 & 11 and effective weight ranges on following page). Special range units available on request.

Materials: Steel body with black oxide finish. Piston rod hardened stainless steel.

W₄ capacity rating (max. energy per hour Nm/hr): If your application exceeds tabulated W₄ figures consider additional cooling i.e. cylinder exhaust air etc.

Mounting: In any position. If precise end position datum is required consider use of the optional stop collar type AH.

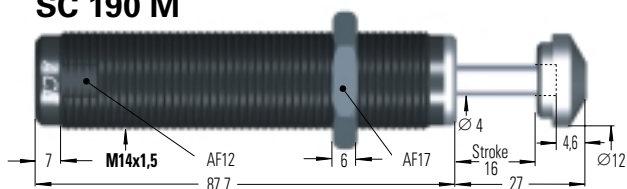
Operating temperature range: 0°C to 66°C.

On request: Weartec finish (seawater resistant) other special finishes available to special order.



Part Number SC . . .

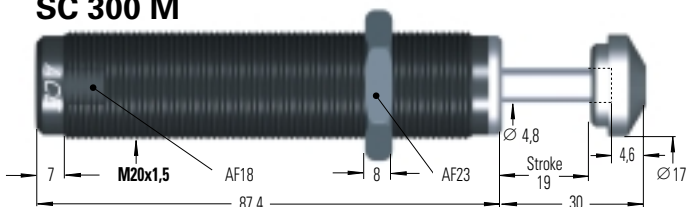
SC 190 M



M14x1 and M16x1 also available to special order

Accessories, mounting, installation... see pages 29 to 32.

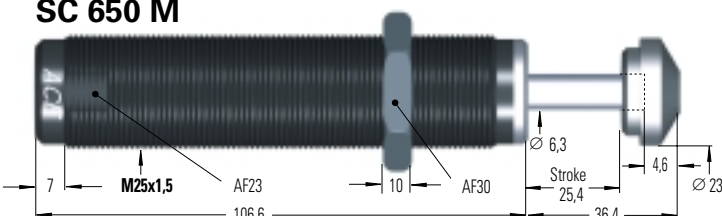
SC 300 M



M22x1,5 also available to special order

Accessories, mounting, installation... see pages 29 to 32.

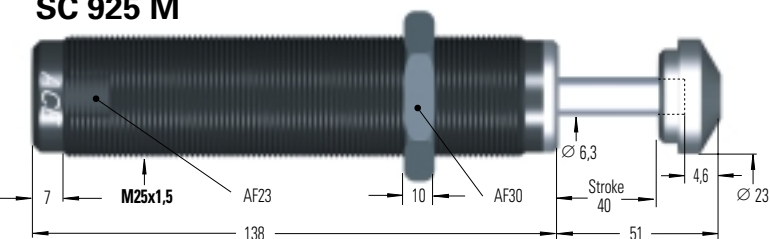
SC 650 M



M26x1,5 also available to special order

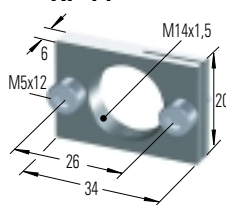
Accessories, mounting, installation... see pages 30 to 32.

SC 925 M



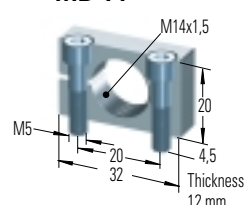
Accessories, mounting, installation... see pages 30 to 32.

RF 14



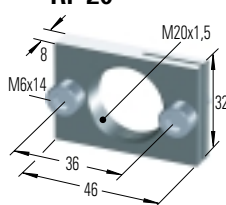
Rectangular Flange

MB 14



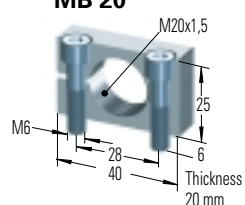
Clamp Mount

RF 20



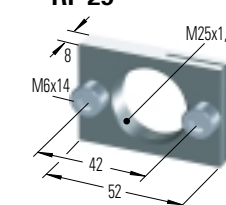
Rectangular Flange

MB 20



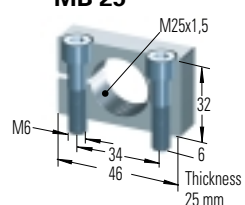
Clamp Mount

RF 25



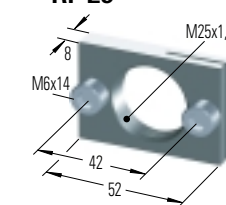
Rectangular Flange

MB 25



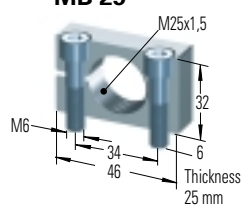
Clamp Mount

RF 25



Rectangular Flange

MB 25



Clamp Mount

AH Stop Collar



BV Side Load Adaptor



PB Steel Shroud



AS Switch Stop Collar



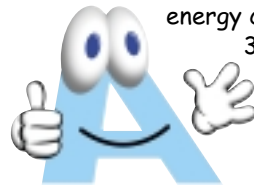
Available without Rod End Button on request. Mounting, installation... see pages 29 to 32.

Capacity Chart

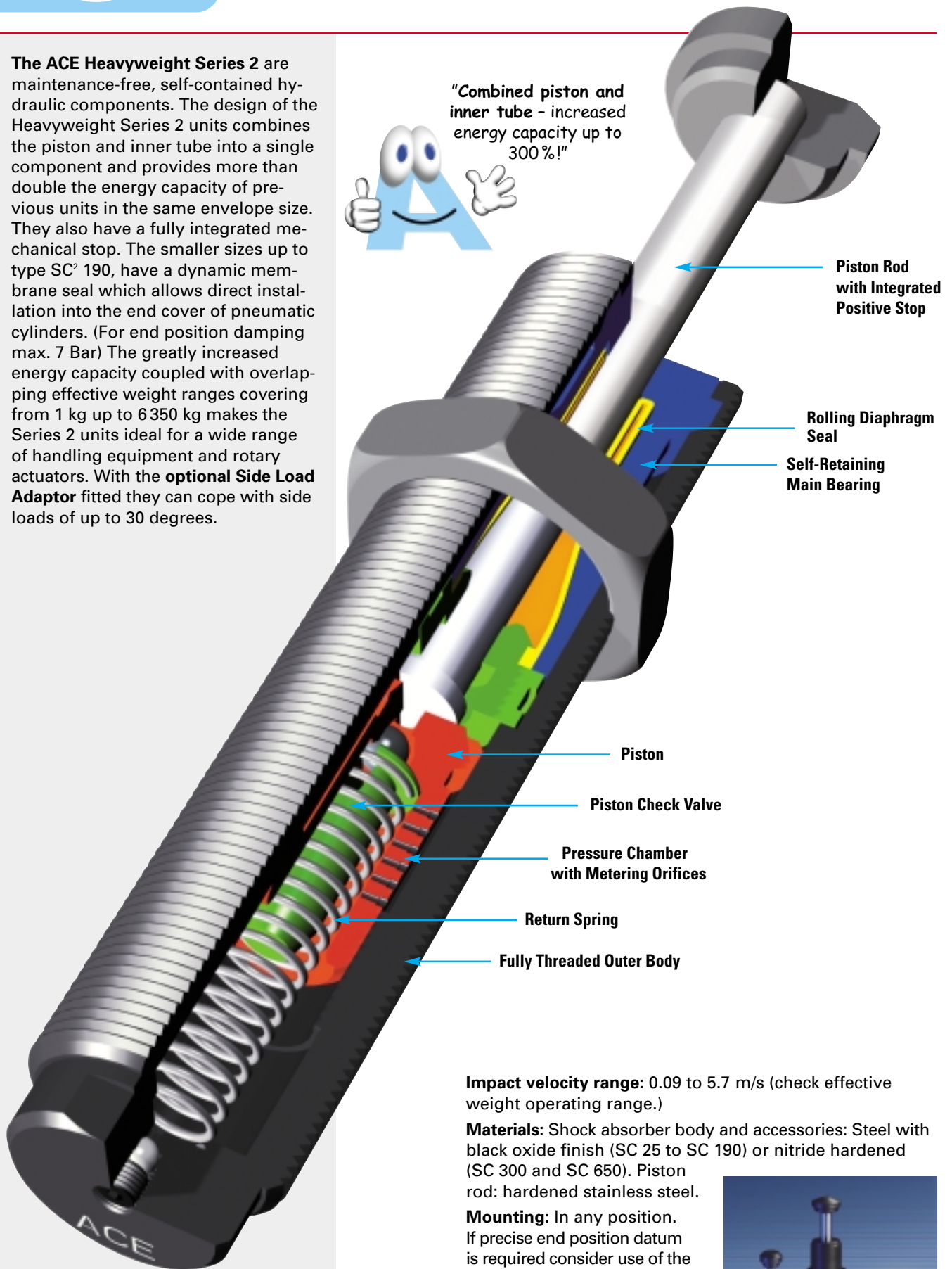
Type	Max. Energy Capacity Nm		Effective Weight me		Return Force N	Rod Reset Time s	*Max. Side Load Angle °	Weight kg	
	per Cycle W ₃	per Hour W ₄	Soft-Contact min kg	max					Self-Compensating min kg
SC 190 M-0	25	34 000	-	-	0.7 - 4	4 - 9	0.25	5	0.08
SC 190 M-1	25	34 000	2.3	6	1.4 - 7	4 - 9	0.25	5	0.08
SC 190 M-2	25	34 000	5.5	16	3.6 - 18	4 - 9	0.25	5	0.08
SC 190 M-3	25	34 000	14	41	9 - 45	4 - 9	0.25	5	0.08
SC 190 M-4	25	34 000	34	91	23 - 102	4 - 9	0.25	5	0.08
SC 300 M-0	33	45 000	-	-	0.7 - 4	5 - 10	0.10	5	0.11
SC 300 M-1	33	45 000	2.3	7	1.4 - 8	5 - 10	0.10	5	0.11
SC 300 M-2	33	45 000	7	23	4.5 - 27	5 - 10	0.10	5	0.11
SC 300 M-3	33	45 000	23	68	14 - 82	5 - 10	0.10	5	0.11
SC 300 M-4	33	45 000	68	181	32 - 204	5 - 10	0.10	5	0.11
SC 650 M-0	73	68 000	-	-	2.3 - 14	11 - 32	0.20	5	0.31
SC 650 M-1	73	68 000	11	36	8 - 45	11 - 32	0.20	5	0.31
SC 650 M-2	73	68 000	34	113	23 - 136	11 - 32	0.20	5	0.31
SC 650 M-3	73	68 000	109	363	68 - 408	11 - 32	0.20	5	0.31
SC 650 M-4	73	68 000	363	1 089	204 - 1 180	11 - 32	0.20	5	0.31
SC 925 M-0	110	90 000	8	25	4.5 - 29	11 - 32	0.40	5	0.39
SC 925 M-1	110	90 000	22	72	14 - 90	11 - 32	0.40	5	0.39
SC 925 M-2	110	90 000	59	208	40 - 272	11 - 32	0.40	5	0.39
SC 925 M-3	110	90 000	181	612	113 - 726	11 - 32	0.40	5	0.39
SC 925 M-4	110	90 000	544	1 952	340 - 2 088	11 - 32	0.40	5	0.39

* For applications with higher side load angles consider using the Side Load Adaptor (BV) pages 29 to 31.

The ACE Heavyweight Series 2 are maintenance-free, self-contained hydraulic components. The design of the Heavyweight Series 2 units combines the piston and inner tube into a single component and provides more than double the energy capacity of previous units in the same envelope size. They also have a fully integrated mechanical stop. The smaller sizes up to type SC² 190, have a dynamic membrane seal which allows direct installation into the end cover of pneumatic cylinders. (For end position damping max. 7 Bar) The greatly increased energy capacity coupled with overlapping effective weight ranges covering from 1 kg up to 6350 kg makes the Series 2 units ideal for a wide range of handling equipment and rotary actuators. With the **optional Side Load Adaptor** fitted they can cope with side loads of up to 30 degrees.



"Combined piston and inner tube - increased energy capacity up to 300%!"



Piston Rod with Integrated Positive Stop

Rolling Diaphragm Seal

Self-Retaining Main Bearing

Piston

Piston Check Valve

Pressure Chamber with Metering Orifices

Return Spring

Fully Threaded Outer Body

Impact velocity range: 0.09 to 5.7 m/s (check effective weight operating range.)

Materials: Shock absorber body and accessories: Steel with black oxide finish (SC 25 to SC 190) or nitride hardened (SC 300 and SC 650). Piston rod: hardened stainless steel.

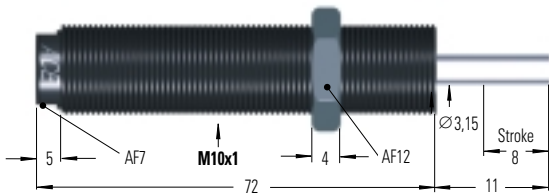
Mounting: In any position. If precise end position datum is required consider use of the optional stop collar type AH.

Operating temperature range: 0°C to 66°C.

On request: Weartec finish (seawater resistant). Other special finishes available to special order.

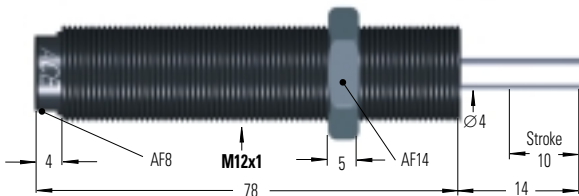


Part Number SC ... SC 25 M



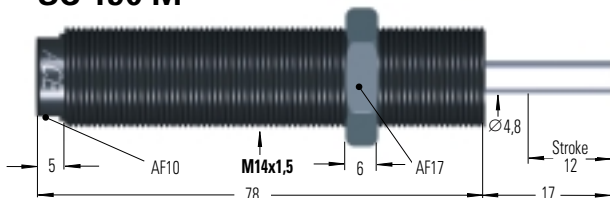
Accessories, mounting, installation... see pages 28 to 32.

SC 75 M



Accessories, mounting, installation... see pages 28 to 32.

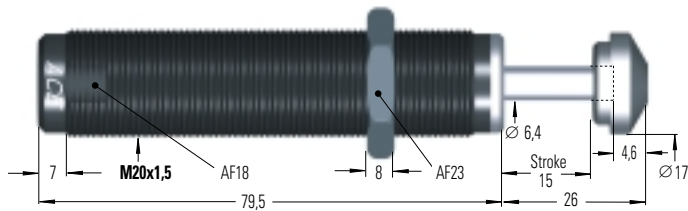
SC 190 M



M14x1 also available to special order

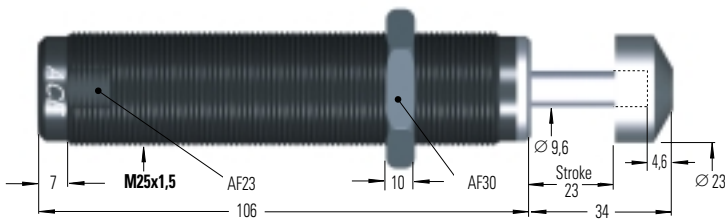
Accessories, mounting, installation... see pages 29 to 32.

SC 300 M



Accessories, mounting, installation... see pages 29 to 32.

SC 650 M

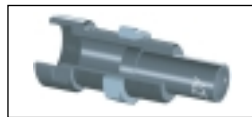


Accessories, mounting, installation... see pages 30 to 32.

AH Stop Collar

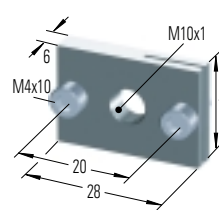


BV Side Load Adaptor



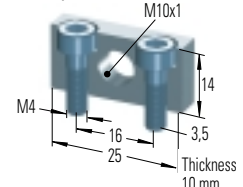
Mounting, installation... see pages 29 to 32.

RF 10



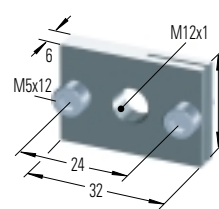
Rectangular Flange

MB 10 SC² c/w KM 10 SC² Locknut



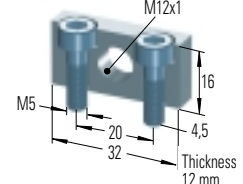
Mounting Block

RF 12



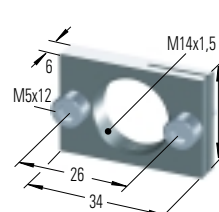
Rectangular Flange

MB 12 SC² c/w KM 12 SC² Locknut



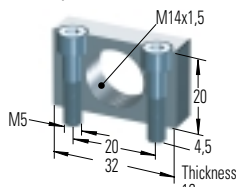
Mounting Block

RF 14



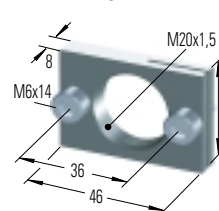
Rectangular Flange

MB 14 SC² c/w KM 14 SC² Locknut



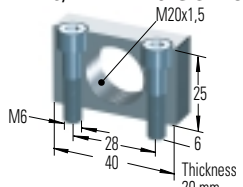
Mounting Block

RF 20



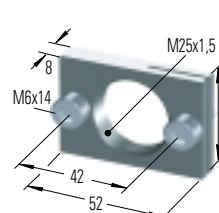
Rectangular Flange

MB 20 SC² c/w KM 20 SC² Locknut



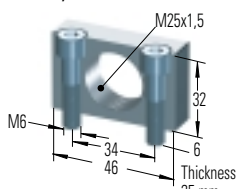
Mounting Block

RF 25



Rectangular Flange

MB 25 SC² c/w KM 25 SC² Locknut



Mounting Block

PB Steel Shroud



AS Switch Stop Collar



Note: Locknut KM ... SC² must be used with Stop Collar AH ... & MB ... SC² in high velocity applications

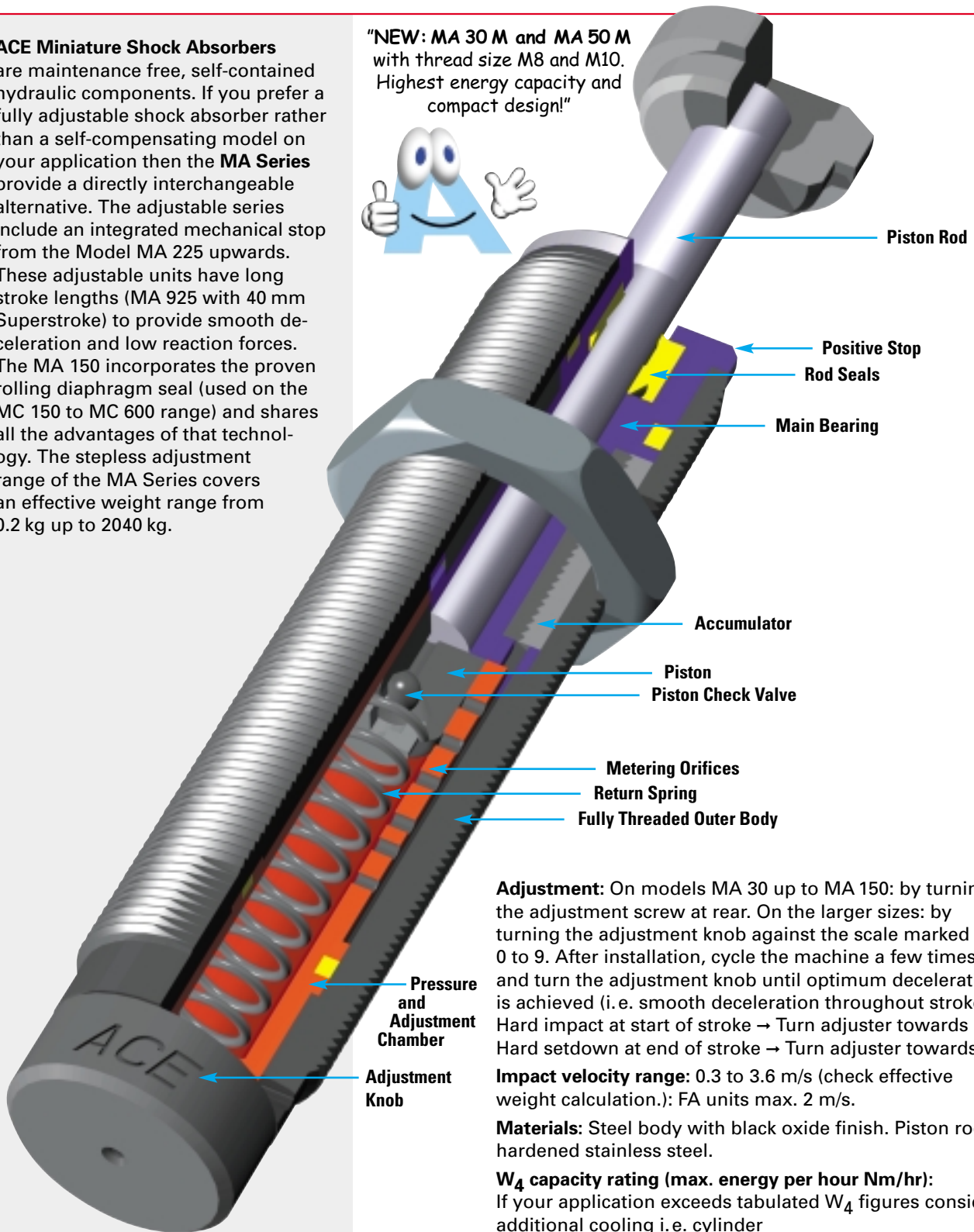
Capacity Chart

Type	Max. Energy Capacity Nm		Effective Weight me					Return Force N	Rod Reset Time s	*Max. Side Load Angle o	Weight kg	
	per Cycle W ₃	per Hour W ₄	soft									hard
			5 min kg max	6 min kg max	7 min kg max	8 min kg max	9 min kg max					
SC 25 M	10	16 000	1 - 5	4 - 44	42 - 500			4.5 - 14	0.3	2	0.03	
SC 75 M	16	30 000	1 - 8	7 - 78	75 - 800			6 - 19	0.3	2	0.045	
SC 190 M	31	50 000	2 - 16	13 - 140	136 - 1550			6 - 19	0.4	2	0.06	
SC 300 M	73	45 000	11 - 45	34 - 136	91 - 181	135 - 680	320 - 1950	8 - 18	0.2	5	0.15	
SC 650 M	210	68 000	23 - 113	90 - 360	320 - 1090	770 - 2 630	1 800 - 6 350	11 - 33	0.3	5	0.35	

* For applications with higher side load angles consider using the Side Load Adaptor (BV) pages 29 to 31.

ACE Miniature Shock Absorbers are maintenance free, self-contained hydraulic components. If you prefer a fully adjustable shock absorber rather than a self-compensating model on your application then the **MA Series** provide a directly interchangeable alternative. The adjustable series include an integrated mechanical stop from the Model MA 225 upwards. These adjustable units have long stroke lengths (MA 925 with 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. The stepless adjustment range of the MA Series covers an effective weight range from 0.2 kg up to 2040 kg.

"NEW: MA 30 M and MA 50 M with thread size M8 and M10. Highest energy capacity and compact design!"



Adjustment: On models MA 30 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 towards "9" Hard setdown at end of stroke → Turn adjuster towards "0"

Impact velocity range: 0.3 to 3.6 m/s (check effective weight calculation.); FA units max. 2 m/s.

Materials: Steel body with black oxide finish. Piston rod hardened stainless steel.

W₄ capacity rating (max. energy per hour Nm/hr): If your application exceeds tabulated W₄ figures consider additional cooling i. e. cylinder exhaust air etc.

Mounting: In any position. If precise end position datum is required consider use of the optional stop collar type AH. Install a mechanical stop 0.5 to 1 mm before end of stroke on FA 1008.

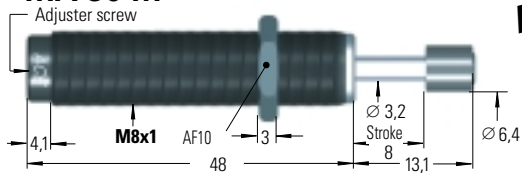
Operating temperature range: 0°C to 66°C.

On request: Weartec finish (seawater resistant) other special finishes available to special order.



Part Number FA, MA . . .

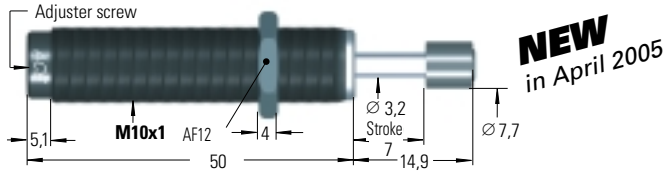
MA 30 M



NEW

Accessories, mounting, installation... see pages 28 to 32.

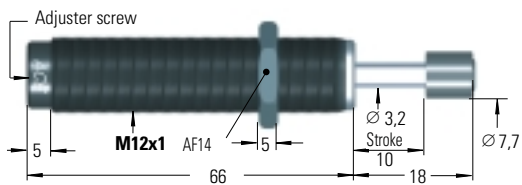
MA 50 M



NEW
in April 2005

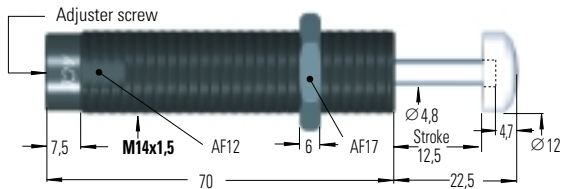
Accessories, mounting, installation... see pages 28 to 32.

MA 35 M



Accessories, mounting, installation... see pages 29 to 32.

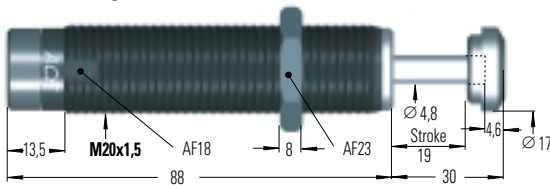
MA 150 M



M14x1 available to special order.

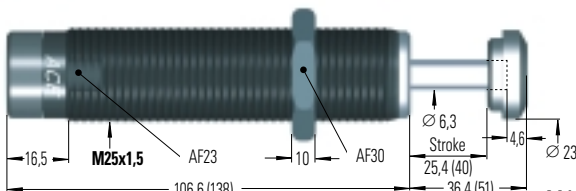
Accessories, mounting, installation... see pages 29 to 32.

MA 225 M



Accessories, mounting, installation... see pages 30 to 32.

MA 600 M and MA 900 M



MA 600 ML with M27x3 available to special order.

Accessories, mounting, installation... see pages 30 to 32.

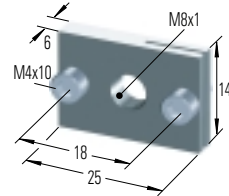
Available without rod end button on request. Models MA 600 M/MA 900 M available with clevis mounting (see page 30).

Capacity Chart

Type	Max. Energy Capacity Nm		Effective Weight me		Return Force N	Rod Reset Time s	*Max. Side Load Angle °	Weight kg
	per Cycle W ₃	per Hour W ₄	Adjustable min	kg max				
MA 30 M	3.5	5 650	0.23	15	1 - 5	0.3	2	0.025
FA 1008 VD-B	1.8	3 600	0.2	10	3 - 6	0.3	2.5	0.026
MA 50 M	5.5	5 100	4.5	20	3 - 6	0.3	2	0.030
MA 35 M	4	6 000	5.9	57	5 - 11	0.2	2	0.043
MA 150 M-B	22	35 000	1.0	109	3 - 5	0.4	5	0.06
MA 225 M	25	45 000	2.3	226	5 - 10	0.1	2	0.13
MA 600 M	68	68 000	9	1 360	10 - 30	0.2	2	0.31
MA 900 M	100	90 000	14	2 040	10 - 35	0.4	1	0.40

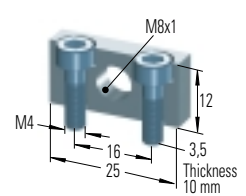
* For applications with higher side load angles consider using the Side Load Adaptor (BV) pages 28 to 31.

RF 8



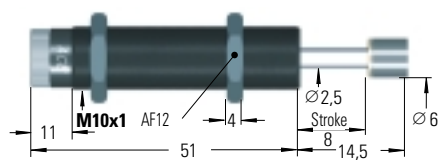
Rectangular Flange

MB 8 SC²



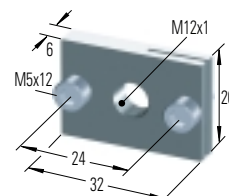
Mounting Block

FA 1008 VD-B



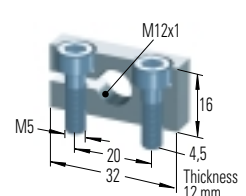
Accessories, mounting, installation... see pages 28 to 32.

RF 12



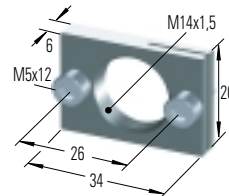
Rectangular Flange

MB 12



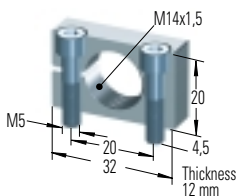
Clamp Mount

RF 14



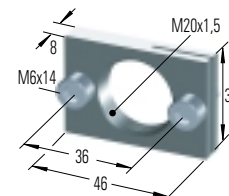
Rectangular Flange

MB 14



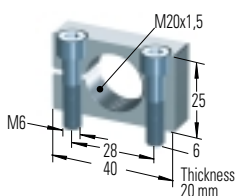
Clamp Mount

RF 20



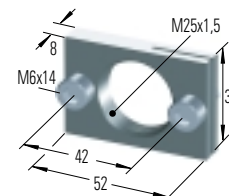
Rectangular Flange

MB 20



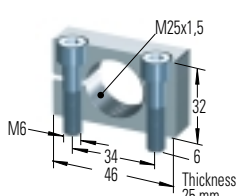
Clamp Mount

RF 25



Rectangular Flange

MB 25



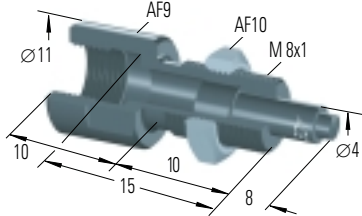
Clamp Mount

M6x0,5 / M8x1

KM 6 / *KM 8

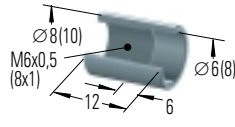


**Locknut
BV 8**



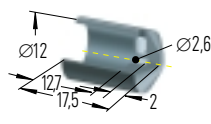
Side Load Adaptor
for MC 30 M-880, BV 8 A
for MC 10 M-880 available on
request

AH 6 / *AH 8



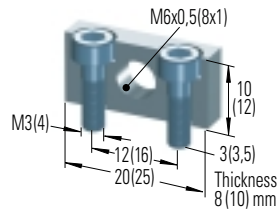
Stop Collar

PB 8



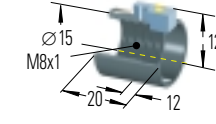
Steel Shroud
for MC 30 M-880, PB 8 A
for MC 10 M-880 available on
request

MB 6 SC² / *MB 8 SC²



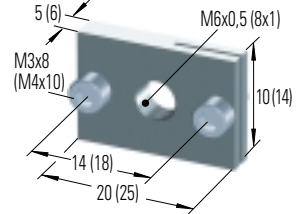
Mounting Block

AS 8



Switch Stop Collar
inc. Proximity Switch

RF 6 / *RF 8

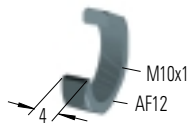


Rectangular Flange

* for M8x1 Dimensions in ()

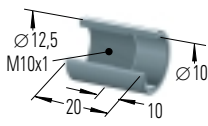
M10x1

KM 10



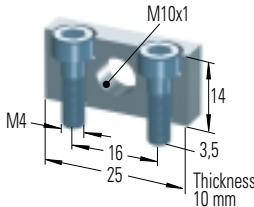
Locknut

AH 10



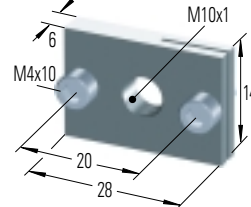
Stop Collar

MB 10 SC²



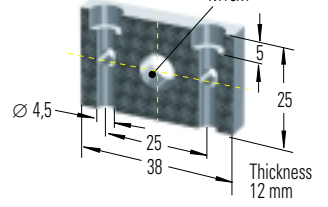
Mounting Block

RF 10



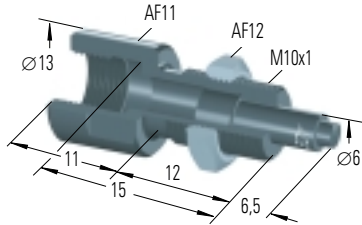
Rectangular Flange

UM 10



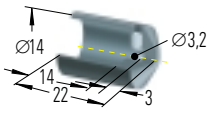
Universal Mount

BV 10



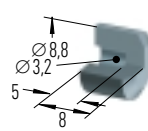
Side Load Adaptor
for MC 25 M-880, BV 10 SC
for SC² 25 M available on
request

PB 10



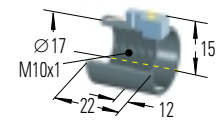
Steel Shroud
for MC 25 M-880, PB 10 SC
for SC² 25 M available on
request

PS 10



Steel Button
for MC 25 M-880, PS 10 SC
for SC² 25 M available on
request

AS 10



Switch Stop Collar
inc. Proximity Switch

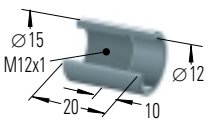
M12x1

KM 12



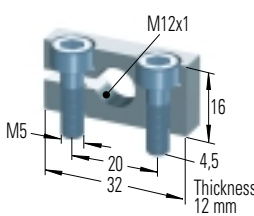
Locknut

AH 12



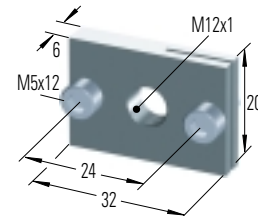
Stop Collar

MB 12



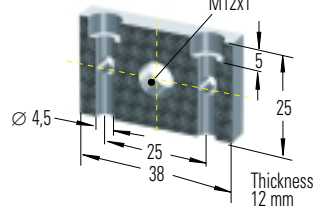
Clamp Mount
not for SC² 75

RF 12



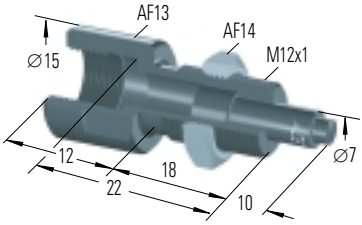
Rectangular Flange

UM 12



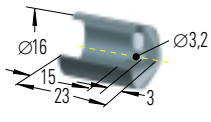
Universal Mount

BV 12



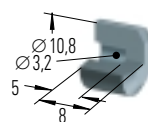
Side Load Adaptor
for MC 75 M-880, BV 12 SC
for SC² 75 M available on
request

PB 12



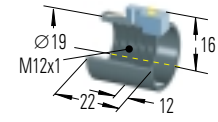
Steel Shroud
for MC 75 M-880, PB 12 SC
for SC² 75 M available on
request

PS 12



Steel Button
for MC 75 M-880, PS 12 SC
for SC² 75 M available on
request

AS 12



Switch Stop Collar
inc. Proximity Switch

Accessories, mounting, installation... see pages 31 to 32.

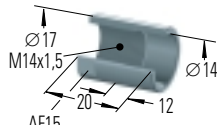
M14x1,5

KM 14



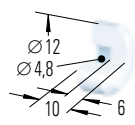
Locknut

AH 14



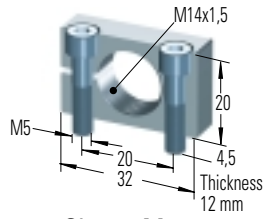
Stop Collar

PP 150



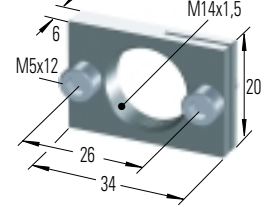
Nylon Button
for MC 150 M
and MA 150 M

MB 14



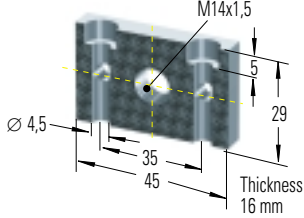
Clamp Mount
not for SC² 190 M 5-7

RF 14



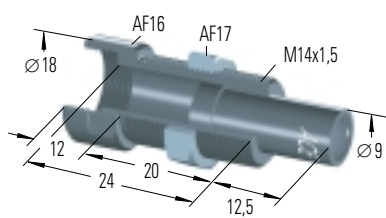
Rectangular Flange

UM 14



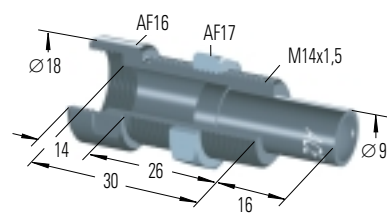
Universal Mount

BV 14



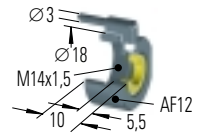
Side Load Adaptor
for MC 150 M, MA 150 M
and SC² 190 M 5-7

BV 14 SC



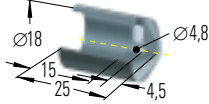
Side Load Adaptor
for SC 190 M 0-4-880

SP 14



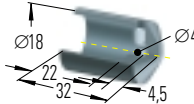
Air Bleed Collar
for MC 150 M,
SC² 190 M 5-7 and
MA 150 M

PB 14



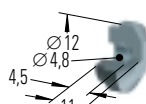
Steel Shroud
PB 14 for MA 150 M, MC 150 M
and SC² 190 M 5-7

PB 14 SC



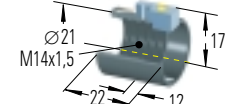
Steel Shroud
PB 14 SC for SC 190 M 0-4-880

PS 14



Steel Button
for MC 150 M, MA 150 M
and SC² 190 M 5-7

AS 14



Switch Stop Collar
inc. Proximity Switch

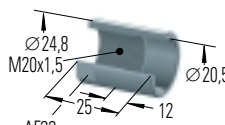
M20x1,5

KM 20



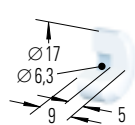
Locknut

AH 20



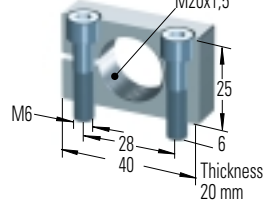
Stop Collar

PP 225



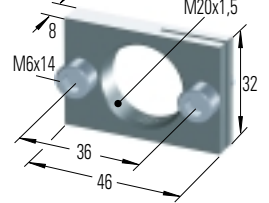
Nylon Button
for MC 225 M

MB 20



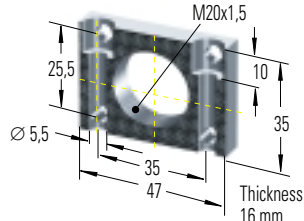
Clamp Mount
not for SC² 300 M 5-9

RF 20



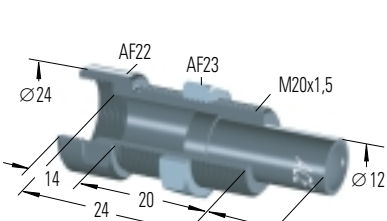
Rectangular Flange

UM 20



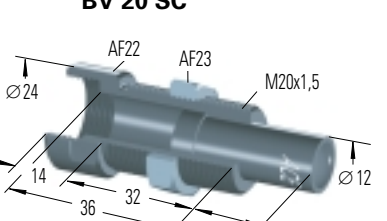
Universal Mount

BV 20



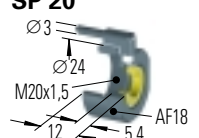
Side Load Adaptor
for MC 225 M

BV 20 SC



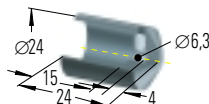
Side Load Adaptor
for SC 300 M 0-4-880, MA/
MVC 225 M-880 and SC 300² M 5-9-880

SP 20



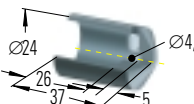
Air Bleed Collar
for MC 225 M

PB 20



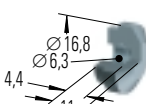
Steel Shroud
PB 20 for MC 225 M

PB 20 SC



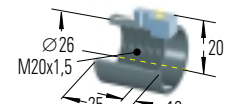
Steel Shroud
PB 20 SC for SC 300 M 0-9
and MA/MVC 225 M-880

PS 20



Steel Button
for MC 225 M

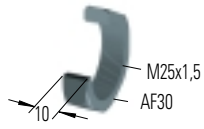
AS 20



Switch Stop Collar
inc. Proximity Switch

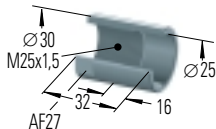
M25x1,5

KM 25



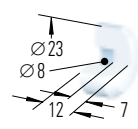
Locknut

AH 25



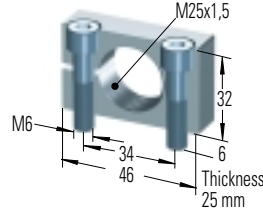
Stop Collar

PP 600



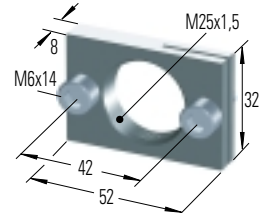
Nylon Button
for MC 600 M

MB 25



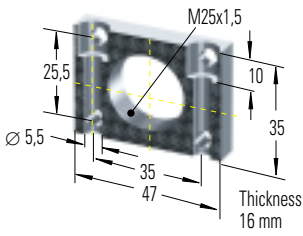
Clamp Mount
not for SC² 650 M 5-9

RF 25



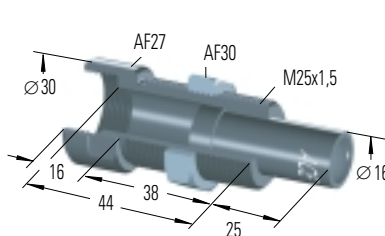
Rectangular Flange

UM 25



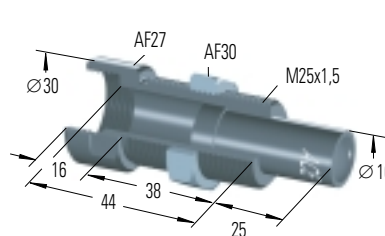
Universal Mount

BV 25



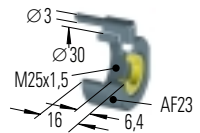
Side Load Adaptor
for MC 600 M

BV 25 SC



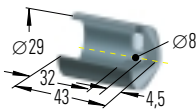
Side Load Adaptor
for SC 650 M 0-4-880, MA/
MVC 600 M-880 and SC² 650 M 5-9

SP 25



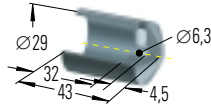
Air Bleed Collar
for MC 600 M

PB 25



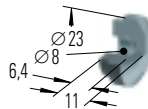
Steel Shroud
PB 25 for MC 600 M
and SC² 650 M 5-9

PB 25 SC



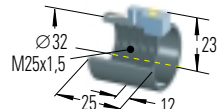
Steel Shroud
PB 25 SC for SC 650 M 0-4-880
and MA/MVC 600 M-880

PS 25



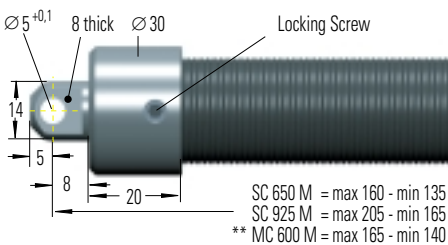
Steel Button
PS 25 for MC 600 M

AS 25



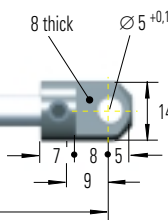
Switch Stop Collar
inc. Proximity Switch

CR 25



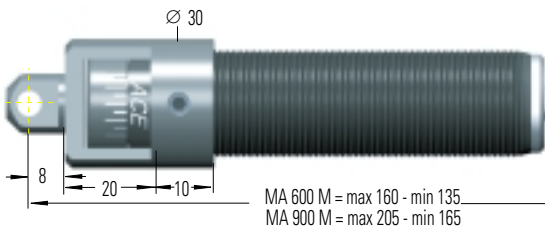
Rear Clevis
for SC 650 M, SC 925 M and MC 600 M

CF 25
****CFC 25**



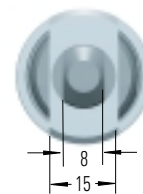
Front Clevis
CF 25 for SC 650 M and SC 925 M
****CFC 25 for MC 600 M**

CRA 25



Rear Clevis
for MA/MVC 600 M and MA/MVC 900 M

CF 25



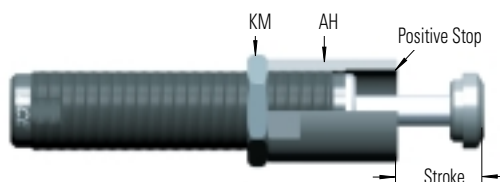
Front Clevis
for MA 600 M and MA 900 M

Installation:

1. Warm standard button and remove from shock absorber.
2. Mount CF 25/CFC 25 and lock in place.
3. Thread on CR or CRA to body and adjust centre to centre length.
4. Lock CR or CRA in place.
5. Mechanical stops must be fitted at both ends of travel. (approx. 0.5 to 1 mm before end of stroke).

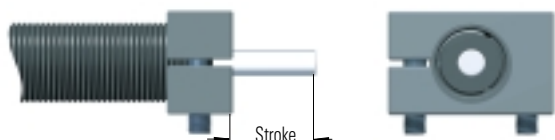
Accessories, mounting, installation... see pages 31 to 32.

AH... Stop Collar



All ACE miniature shock absorbers have an **integral positive stop**. An **optional stop collar (AH...)** can be added if desired to give fine adjustment of final stopping position.

MB... Clamp Mount/ Mounting Block



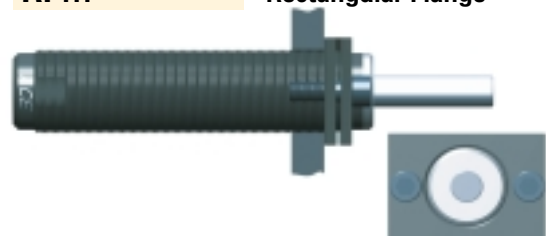
Clamp Slot design not for use with SC² HW 25 to HW 650

When using the MB Clamp mount no lock nut is needed on the shock absorber (split clamp action). The mounting block is very compact and allows fine adjustment of the shock absorber position by turning in and out.

Two socket head screws are included with clamp mount block. When foot mounting the types with combined piston and inner tube SC² HW 25 to SC² HW 650 and the types MC 9 M, MC 30 M, MC 25 M and MA 30 M, the **NEW MB 10, 12, 14, 20, 25 (SC²)** must be used.

Type	Screw Size	Max. Torque	Type	Screw Size	Max. Torque
MB10	M4x14	4 Nm	MB20	M6x25	11 Nm
MB12	M5x16	6 Nm	MB25	M6x30	11 Nm
MB14	M5x20	6 Nm			

RF... Rectangular Flange



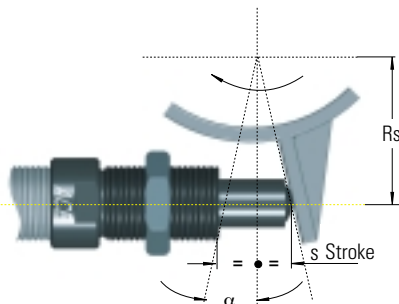
The Rectangular Flange provides a space saving convenient assembly and does not need a lock nut to hold the shock absorber. Therefore achieving a neat, compact and flat surface mounting.

Type	Screw Size	Max. Torque	Type	Screw Size	Max. Torque
RF6	M3x8	3 Nm	RF14	M5x12	6 Nm
RF8	M4x10	4 Nm	RF20	M6x14	11 Nm
RF10	M4x10	4 Nm	RF25	M6x14	11 Nm
RF12	M5x12	6 Nm			

BV; BV... SC Side Load Adaptor

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 BV side load adaptor provides a long lasting solution.

Material: Threaded body and plunger: Hardened high tensile steel



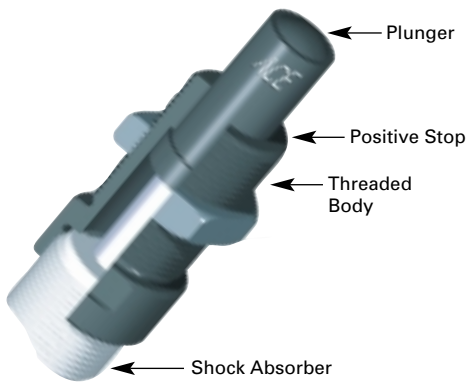
The BV adaptor can only be installed onto a shock absorber without rod end button.

To order shock absorber without button add suffix **-880** to part number.

(Note: Models MA 150 M, MC 150 M to MC 600 M and SC² 25 M to SC² 190 M 5-7 are supplied as standard without buttons.)

To remove button from existing absorber:

Clamp the shock absorber in mounting block and warm button carefully. Grip the button with pliers and pull off along rod axis.



Problem:

Rotating impact motion causes high side load forces on the piston rod. This increases bearing wear and possibly results in rod breakage or bending.

Solution:

Install Side Load Adaptor BV. If possible halve the impact angle as shown.

Formulae:

$$\alpha = \tan^{-1} \left(\frac{s}{2 \cdot R_s} \right) \quad R_{smin} = \frac{s}{2 \cdot \tan \alpha_{max}}$$

Example:

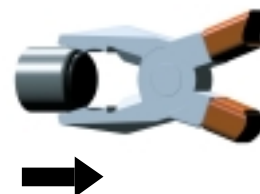
$$s = 0.025 \text{ m} \quad \alpha_{max} = 25^\circ \text{ (Type BV25)}$$

$$R_s = 0.1 \text{ m}$$

$$\alpha = \tan^{-1} \left(\frac{0.025}{2 \cdot 0.1} \right) \quad R_{smin} = \frac{0.025}{2 \cdot \tan 25}$$

$$\alpha = 7.13^\circ \quad R_{smin} = 0.027 \text{ m}$$

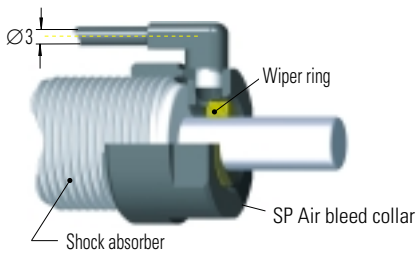
α = side load angle ° R_s = mounting radius m
 α_{max} = max. angle ° R_{smin} = min. possible mounting radius m
 s = absorber stroke m



BV secured onto the Shock Absorber!

NOTE: The BV adaptor can only be installed on shock absorbers without rod end button.

SP... Air Bleed Collar

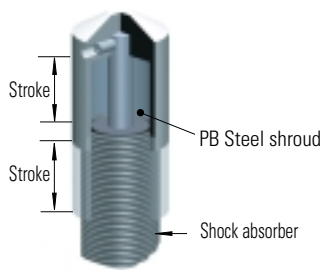


Air Bleed Collar (includes integral stop collar) protects shock absorber from ingress of abrasive contaminants like cement, paper or wood dust into the rod seal area. It also prevents aggressive fluids such as cutting oils, coolants etc. damaging the seals. Air bleed supply 0.5 to 1 bar. Low air consumption. The constant air bleed prevents contaminants passing the wiper ring and entering the shock absorber seal area.

Note: Do not switch off air supply whilst machine is operating!

Warning: The air bleed collar can not be used on all similar body thread sized shock absorbers. The air bleed collar is only for types MC 150 M to MC 600 M, MA 150 M and SC² 190 M 5-7.

PB... Steel Shroud

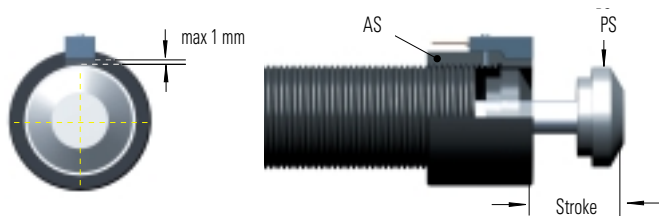


Grinding beads, sand, welding splatter, paints and adhesives etc. can adhere to the piston rod. They then damage the rod seals and the shock absorber quickly fails. In many cases the installation of the optional steel shroud can provide worthwhile protection and increase lifetime.

Note: When installing don't forget to allow **operating space** for the shroud to move as the shock absorber is cycled.

For part numbers MA, MC, SC please order with "M -880" suffix. Part numbers MA 150 M, MC 150 M to MC 600 M and SC² 25 M to SC² 190 M 5-7 are supplied without a button, for advice on removing the button see page 31.

PS... Steel Button, AS... Switch Stop Collar



AS inc. Proximity switch PNP

The new ACE StopLight limit switch combination can be mounted on all popular shock absorber models.

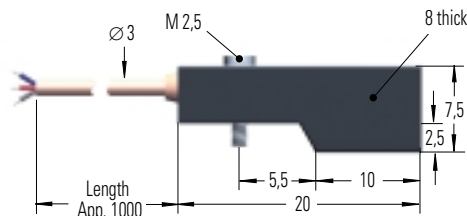
- Features:**
- Very short, compact mounting package.
 - Good Price/Performance combination.
 - Can be fitted to standard shock absorber.
 - Fine adjustment of stroke/signal is possible.

The steel button type PS is fitted as standard on the Models: SC 190 M 0-4, SC 300 M 0-9, SC 650 M 0-9, SC 925 M 0-4, MA/MVC 225 M, MA/MVC 600 M and MA/MVC 900 M.

With all other models you must order the PS button as an optional accessory.

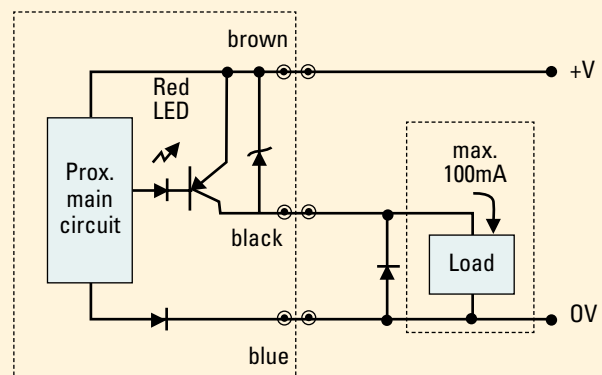
Mounting: We recommend to fix the steel button onto the end of the piston rod using Loctite 290. **Attention!** Take care not to leave any adhesive on the piston rod as this will cause seal damage. Thread the Switch Stop Collar onto the front of the shock absorber and secure in position. Switch cable should not be routed close to power cables.

250-3 PNP Proximity Switch



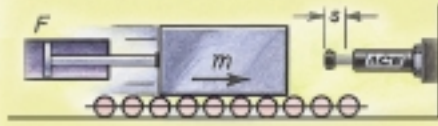
250-3 PNP

Circuit diagram PNP-switch



PNP Proximity Switch Data

- Supply voltage: 10 - 27 VDC
- Ripple < 10 %
- Load current max: 100 mA
- Operating temperature range: -10°C to +60°C
- Residual voltage: max. 1 V
- Protection: IP67 (IEC 144) with LED-Indicator
- Proximity Switch N/Open when shock absorber extended.
- When shock absorber is fully compressed switch closes and LED Indicator lights.

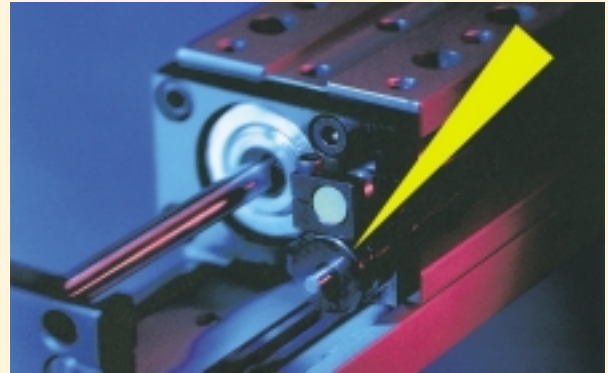


Constant resisting force

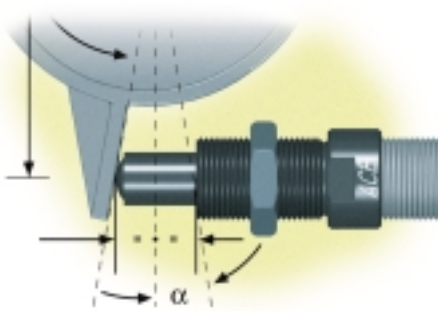
ACE Miniature Shock Absorbers have a distinctly better damping characteristic than air cushions.

This pneumatic linear module for high precision, high speed motion intentionally abandoned pneumatic end-of-travel damping. The compact miniature shock absorbers of the type **MC-25MH-NB** decelerate the linear motion safer and faster when reaching the end-of-travel position. They accept the moving load gently and decelerate it smoothly throughout the entire stroke length.

Additional advantages: simpler construction, smaller pneumatic valves, lower maintenance costs as well as reduced compressed air consumption.



Miniature Shock Absorber in linear pneumatic module

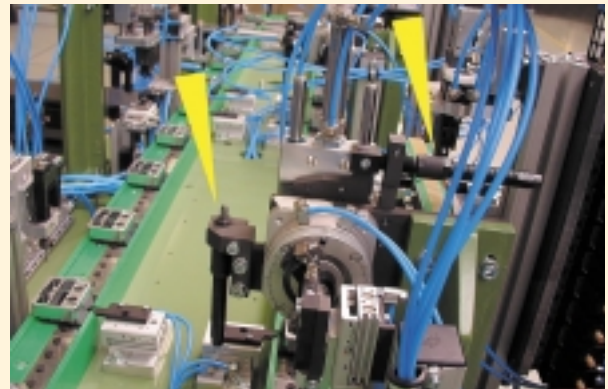


Soft end-of-travel damping on rotary movements

ACE Miniature Shock Absorbers optimise production with minimum expenditure.

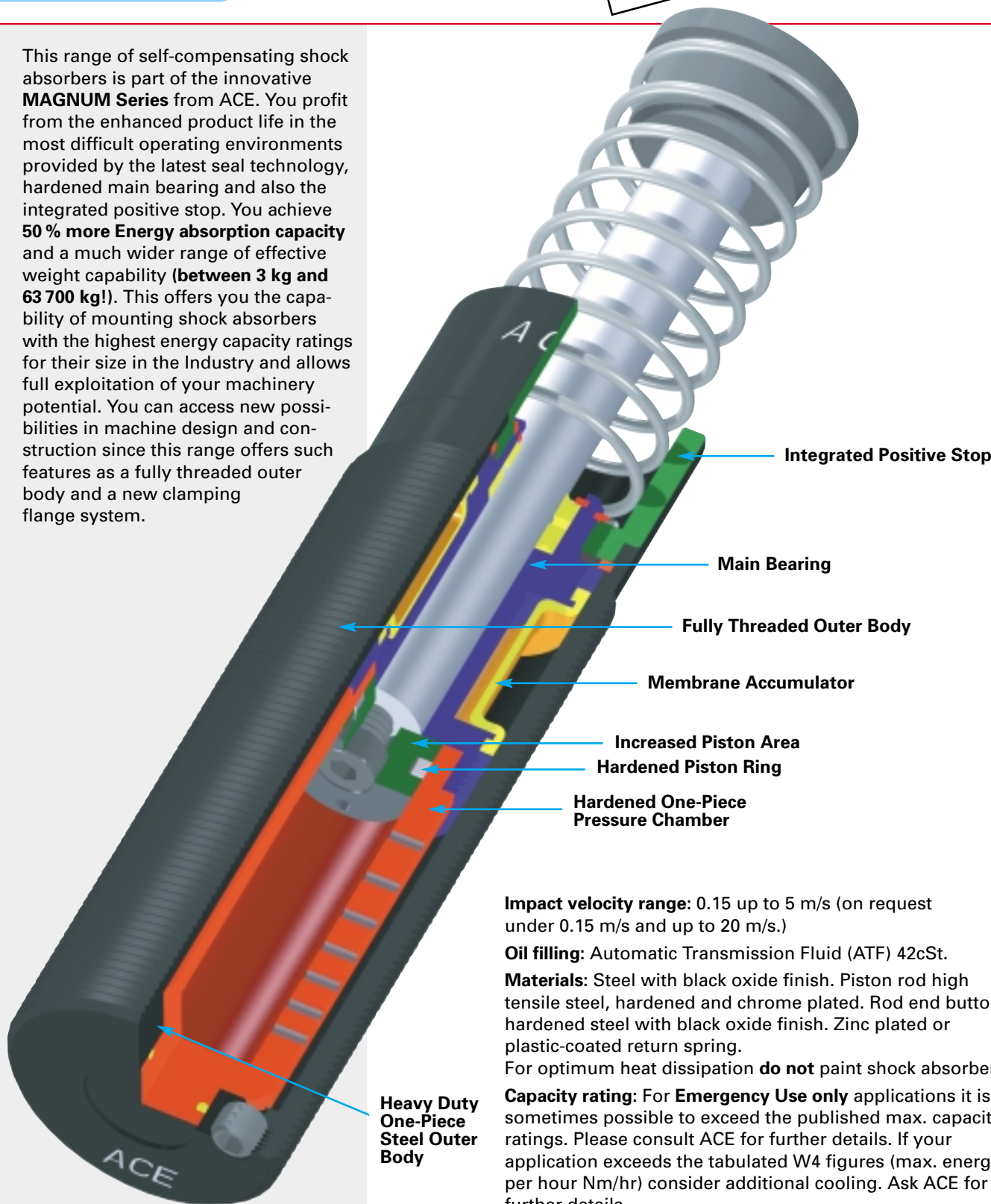
The cycle rate for an assembly line producing electronic components was increased to 3600 units/hr by using ACE shock absorbers. Miniature shock absorbers type **SC-190M1** decelerate the rapid transfer movements on the production line and using soft damping methods optimise the pick up and set down of the components. This soft deceleration technique has increased production and reduced maintenance on the portal and rotary actuator modules. The optional side load adaptor protects the shock absorber from high side load forces and increases the operating lifetime.

Using ACE shock absorbers reduces maintenance costs by 50% and running costs by 20%, diminishing energy consumption.



Optimised production in the electronics industry

This range of self-compensating shock absorbers is part of the innovative **MAGNUM Series** from ACE. You profit from the enhanced product life in the most difficult operating environments provided by the latest seal technology, hardened main bearing and also the integrated positive stop. You achieve **50 % more Energy absorption capacity** and a much wider range of effective weight capability (**between 3 kg and 63 700 kg!**). This offers you the capability of mounting shock absorbers with the highest energy capacity ratings for their size in the Industry and allows full exploitation of your machinery potential. You can access new possibilities in machine design and construction since this range offers such features as a fully threaded outer body and a new clamping flange system.



Integrated Positive Stop

Main Bearing

Fully Threaded Outer Body

Membrane Accumulator

Increased Piston Area

Hardened Piston Ring

Hardened One-Piece Pressure Chamber

Heavy Duty One-Piece Steel Outer Body

Impact velocity range: 0.15 up to 5 m/s (on request under 0.15 m/s and up to 20 m/s.)

Oil filling: Automatic Transmission Fluid (ATF) 42cSt.

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 or plastic-coated return spring.

For optimum heat dissipation **do not** paint shock absorber.

Capacity rating: For **Emergency Use only** applications it is sometimes possible to exceed the published max. capacity ratings. Please consult ACE for further details. If your application exceeds the tabulated W4 figures (max. energy per hour Nm/hr) consider additional cooling. Ask ACE for further details.

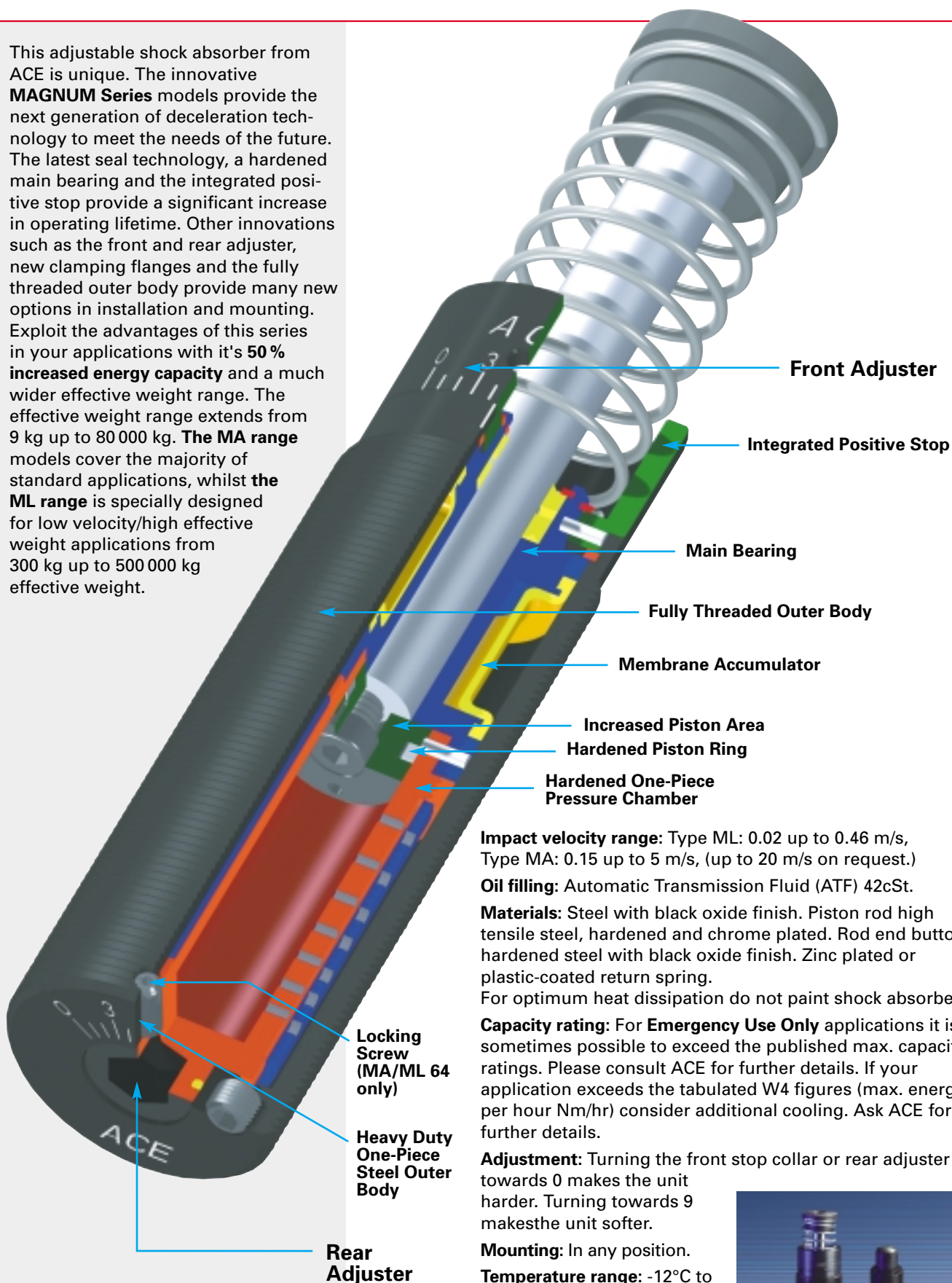
Mounting: In any position.

Temperature range: -12°C to 70°C. For higher temperatures consult ACE.

On request: plated finishes. Weartec finish (seawater resistant), special oils. Mounting inside air cylinders and other special options are available on request.



This adjustable shock absorber from ACE is unique. The innovative **MAGNUM Series** models provide the next generation of deceleration technology to meet the needs of the future. The latest seal technology, a hardened main bearing and the integrated positive stop provide a significant increase in operating lifetime. Other innovations such as the front and rear adjuster, new clamping flanges and the fully threaded outer body provide many new options in installation and mounting. Exploit the advantages of this series in your applications with its **50% increased energy capacity** and a much wider effective weight range. The effective weight range extends from 9 kg up to 80 000 kg. **The MA range** models cover the majority of standard applications, whilst **the ML range** is specially designed for low velocity/high effective weight applications from 300 kg up to 500 000 kg effective weight.



Front Adjuster

Integrated Positive Stop

Main Bearing

Fully Threaded Outer Body

Membrane Accumulator

Increased Piston Area

Hardened Piston Ring

Hardened One-Piece Pressure Chamber

Locking Screw (MA/ML 64 only)

Heavy Duty One-Piece Steel Outer Body

Rear Adjuster

Impact velocity range: Type ML: 0.02 up to 0.46 m/s, Type MA: 0.15 up to 5 m/s, (up to 20 m/s on request.)

Oil filling: Automatic Transmission Fluid (ATF) 42cSt.

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 or plastic-coated return spring.

For optimum heat dissipation do not paint shock absorber.

Capacity rating: For **Emergency Use Only** applications it is sometimes possible to exceed the published max. capacity ratings. Please consult ACE for further details. If your application exceeds the tabulated W4 figures (max. energy per hour Nm/hr) consider additional cooling. Ask ACE for further details.

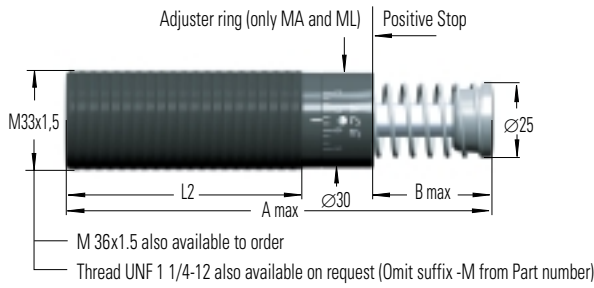
Adjustment: Turning the front stop collar or rear adjuster towards 0 makes the unit harder. Turning towards 9 makes the unit softer.

Mounting: In any position.

Temperature range: -12°C to +70°C. For higher temperatures consult ACE.

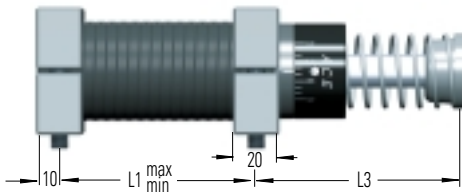
On request: plated finishes. Weartec finish (seawater resistant), special oils. Mounting inside air cylinders and other special options are available on request.



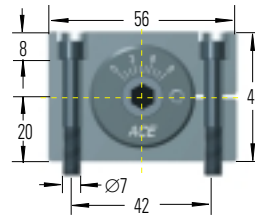


Square Flange and Foot mountings do not require the use of a Locking Ring for installation (new slotted clamping system).

S 33



Because of the thread pitch the fixing holes for the second foot mount should only be drilled and tapped after the first foot mount has been fixed in position.

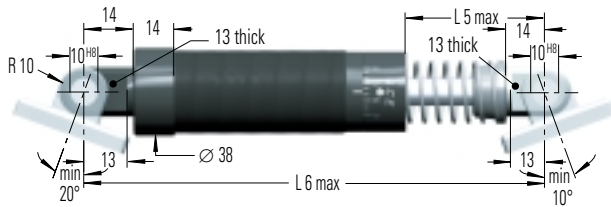


Side Foot Mounting Kit

S 33 = 2 Flanges + 4 Screws M6x40, DIN 912

Tightening torque 11 Nm
Clamping torque > 90 Nm

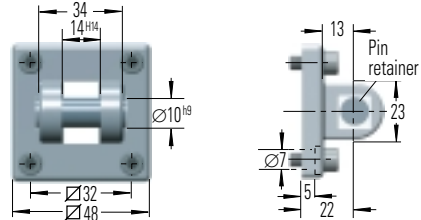
C 33



Clevis Mounting Kit

C 33 = 2 Clevis eyes. Delivered assembled to shock absorber. Use positive stop at both ends of travel

SF 33



Clevis Flange

SF 33 = Flange + 4 screws M6x20 DIN 912
Tightening torque 7.5 Nm
Conforms to: Audi + VW 39D1307/2/032, VDMA 24562 part 2
Daimler Chr. B801520023647, Opel-GM M13911673

Dimensions

Type	*Stroke	A max	B max	L1 min	L1 max	L2	L3	L5 max	L6 max
MC, MA, ML 3325 M	25	138	23	25	60	83	68	39	168
MC, MA, ML 3350 M	50	189	48.5	32	86	108	93	64	218

* Nominal stroke length (without integral stop collar fitted).

Capacity Chart

Type	**per Cycle Self-Compensating W ₃	Max. Energy Capacity Nm			*Effective Weight me					Return Force N min max	Rod Reset Time s	Max. Side Load Angle o	Max. Weight kg
		Self-contained	W ₄ per hour With air/ oil tank	With oil recirculation	Soft	-0	-1	-2	-3				
MC 3325 M	155	75 000	124 000	169 000	3 - 11	9 - 40	30 - 120	100 - 420	350 - 1 420	45 - 90	0.03	4	0.45
MC 3350 M	310	85 000	135 000	180 000	5 - 22	18 - 70	60 - 250	210 - 840	710 - 2 830	45 - 135	0.06	3	0.54

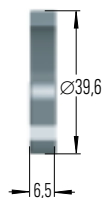
Type Adjustable	Max. Energy Capacity Nm			*Effective Weight me		Return Force N min max	Rod Reset Time s	Max. Side Load Angle o	Max. Weight kg	
**per Cycle Self-Compensating W ₃	Self-contained	W ₄ per hour With air/ oil tank	With oil recirculation	Type MA min kg max	Type ML min kg max					
MA, ML 3325 M	170	75 000	124 000	169 000	9 - 1 700	300 - 50 000	45 - 90	0.03	4	0.45
MA, ML 3350 M	340	85 000	135 000	180 000	13 - 2 500	500 - 80 000	45 - 135	0.06	3	0.54

* The effective weight range limits can be raised or lowered to special order.

** For **Emergency Use Only** applications it is sometimes possible to exceed the above ratings. Please consult ACE for further details. Specifications relate to the effective stroke length (B max.).

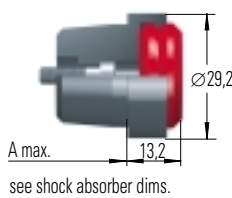
M33x1,5 For use on new installations:

NM 33



Locking Ring

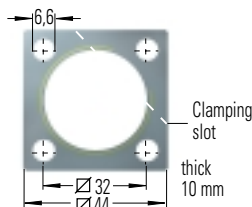
PP 33



Poly Button

Optional button with elastomer insert for noise suppression. Option supplied ready mounted onto the shock absorber. For self installation see mounting instructions on Page 46.

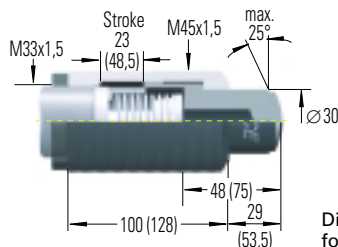
QF 33



Square Flange

Install with 4 machine screws with tightening torque: = 11 Nm
Clamping torque: > 90 Nm

BV 3325 BV 3350

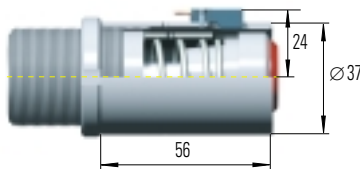


Dims. in ()
for BV 3350

Side Load Adaptor

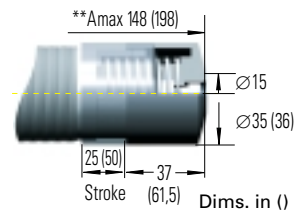
Mounting, installation etc. see pages 32 and 43.

AS 33



Switch Stop Collar
inc. Proximity Switch and Poly Button with elastomer insert

PB 3325 PB 3350

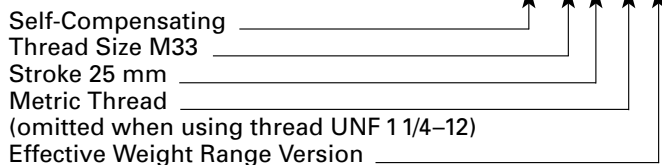


Dims. in ()
for PB 3350

Steel Shroud

**Total installation length of the shock absorber inc. steel shroud

Ordering Example



MC 3325 M-1

Model Type Prefix

Standard Models

Self-Contained with Return Spring

- MC self-compensating
- MA adjustable
- ML adjustable, for lower impact velocity

Special Models

Air/Oil Return without Return Spring

- MCA, MAA, MLA

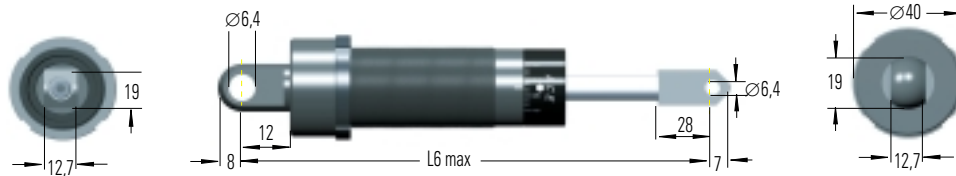
Special Models

Air/Oil Return with Return Spring

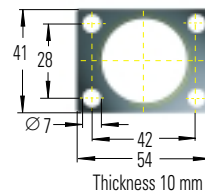
- MCS, MAS, MLS

Interchange Parts for the earlier Types MC 120...

C 1200



RFL 1200

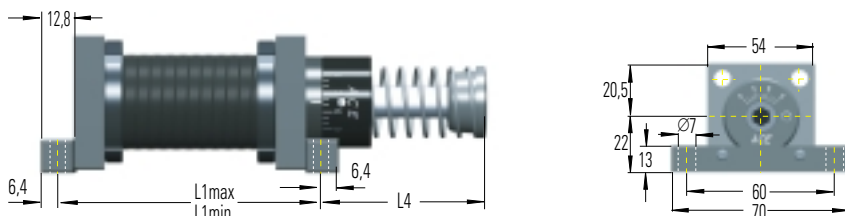


Clevis Mounting (Use positive stop at both ends of travel)

Clevis Mounting Kit C 1200 (250-0323) = 1 Rear clevis flange + 1 Rod clevis + 1 Locking ring (supplied assembled to shock absorber). Locking ring also required

Rectangular Flange

S 1200



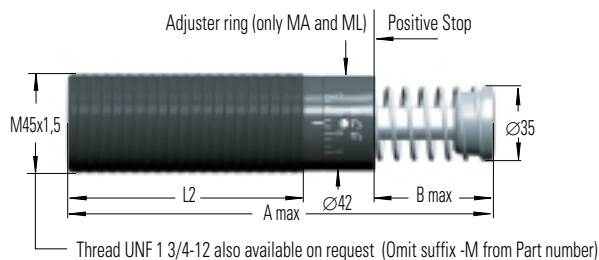
Dimensions

Stroke	L ₁ *	L ₄	L ₆ max.
25	97	47,4	167
50	122	73,4	218

* Dimension can be altered.

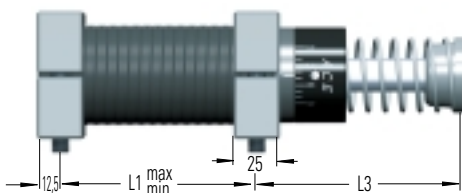
Side Foot Mounting

Foot Mounting Kit S 1200 (250-0294) = 2 Rectangular flanges + 2 Side bars + 2 Locking rings + 4 Socket head screws.



Adjuster (only MA and ML)

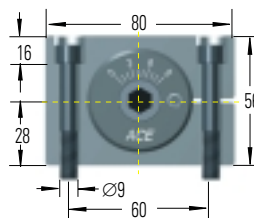
S 45



Side Foot Mounting Kit

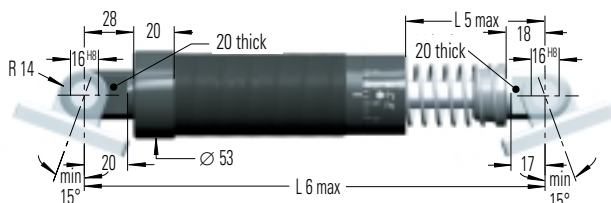
S 45 = 2 Flanges + 4 Screws M 8x50, DIN 912

Because of the thread pitch the fixing holes for the second foot mount should only be drilled and tapped after the first foot mount has been fixed in position.



Tightening torque 27 Nm
Clamping torque > 350 Nm

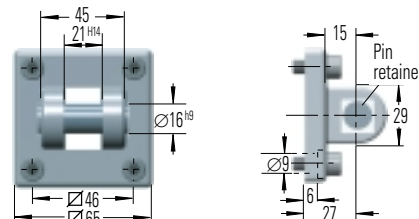
C 45



Clevis Mounting Kit

C 45 = 2 Clevis eyes. Delivered assembled to shock absorber. Use positive stop at both ends of travel

SF 45



Clevis Flange

SF 45 = Flange + 4 screws M 8x20 DIN 912
Tightening torque 7.5 Nm
Conforms to: Audi + VW 39D1307/2/050, VDMA 24562 part 2
Daimler Chr. B801520023647, Opel-GM M13911675

Dimensions

Type	*Stroke	A max	B max	L1 min	L1 max	L2	L3	L5 max	L6 max
MC, MA, ML 4525 M	25	145	23	32	66	95	66	43	200
MC, MA, ML 4550 M	50	195	48,5	40	92	120	91	68	250
MC, MA 4575 M	75	246	74	50	118	145	116	93	300

* Nominal stroke length (without integral stop collar fitted).

Capacity Chart

Type	**per Cycle Self-Compensating W ₃	Max. Energy Capacity Nm		Soft					* Effective Weight me		Hard		Return Force N	Rod Reset Time s	Max. Side Load Angle o	Max. Weight kg
		Self-Contained	W ₄ per Hour with Air/ Oil Tank	with Oil Recirculation	-0 min kg max	-1 min kg max	-2 min kg max	-3 min kg max	-4 min kg max	min	max	min				
MC 4525 M	340	107 000	158 000	192 000	7 - 27	20 - 90	80 - 310	260 - 1 050	890 - 3 540	70	100	0.03	4	1.13		
MC 4550 M	680	112 000	192 000	248 000	13 - 54	45 - 180	150 - 620	520 - 2 090	1 800 - 7 100	70	145	0.08	3	1.36		
MC 4575 M	1 020	146 000	225 000	282 000	20 - 80	70 - 270	230 - 930	790 - 3 140	2 650 - 10 600	50	180	0.11	2	1.59		
Type Adjustable					* Effective Weight me			Type ML								
MA, ML 4525 M	390	107 000	158 000	192 000	Type MA min kg max			min kg max		70	100	0.03	4	1.13		
MA, ML 4550 M	780	112 000	192 000	248 000	70 - 14 500			5 000 - 180 000		70	145	0.08	3	1.36		
MA 4575 M	1 170	146 000	225 000	282 000	70 - 15 000					50	180	0.11	2	1.59		

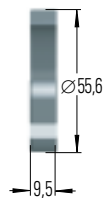
* The effective weight range limits can be raised or lowered to special order.

** For **Emergency Use Only** applications it is sometimes possible to exceed the above ratings. Please consult ACE for further details.

Specifications relate to the effective stroke length (B max.).

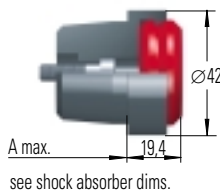
M45x1,5 For use on new installations:

NM 45



Locking Ring

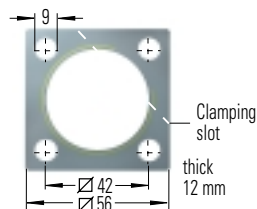
PP 45



Poly Button

Optional button with elastomer insert for noise suppression. Option supplied ready mounted onto the shock absorber. For self installation see mounting instructions on Page 46.

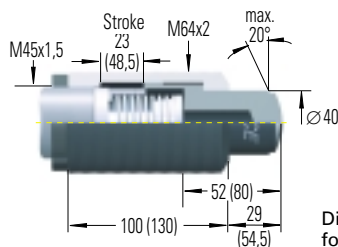
QF 45



Square Flange

Install with 4 machine screws with tightening torque: = 27 Nm
Clamping torque: > 200 Nm

BV 4525 BV 4550

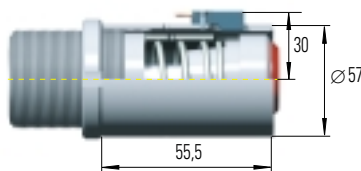


Side Load Adaptor

Mounting, installation etc. see pages 32 and 43.

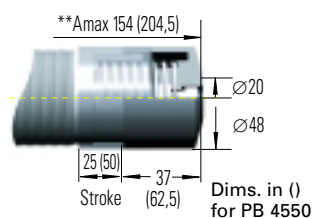
Dims. in ()
for BV 4550

AS 45



Switch Stop Collar
inc. Proximity Switch and Poly Button with elastomer insert

PB 4525 PB 4550



Steel Shroud

**Total installation length of the shock absorber inc. steel shroud

Ordering Example

Adjustable _____
Thread Size M45 _____
Stroke 25 mm _____
Metric Thread _____
(omitted when using thread UNF 13/4-12)

ML 4525 M

Model Type Prefix

Standard Models Self-Contained with Return Spring

MC self-compensating
MA adjustable
ML adjustable, for lower impact velocity

Special Models Air/Oil Return without Return Spring

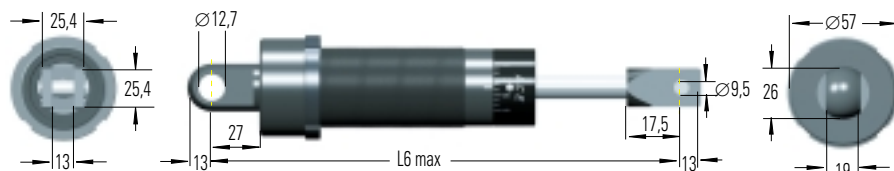
MCA, MAA, MLA

Special Models Air/Oil Return with Return Spring

MCS, MAS, MLS

Interchange Parts for the earlier Types MC 140...

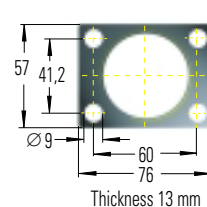
C 1400



Clevis Mounting (Use positive stop at both ends of travel)

Clevis Mounting Kit C 1400 (250-0325) = 1 Rear clevis flange + 1 Rod clevis + 1 Locking ring (supplied assembled to shock absorber).

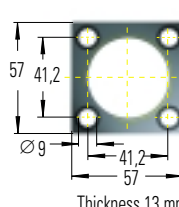
RFL 1400



Rectangular Flange

Locking ring also required

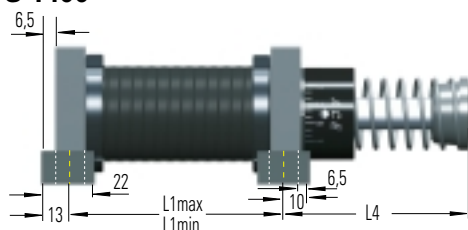
QFL 1400



Square Flange

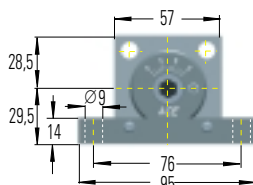
Locking ring also required

S 1400



Side Foot Mounting

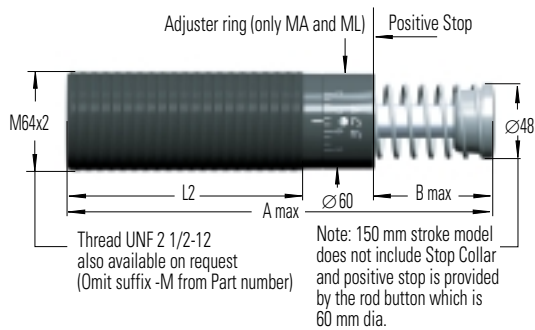
Foot Mounting Kit S 1400 (250-0300) = 2 Square flanges + 2 Side bars + 2 Locking rings + 4 Socket head screws.



Dimensions

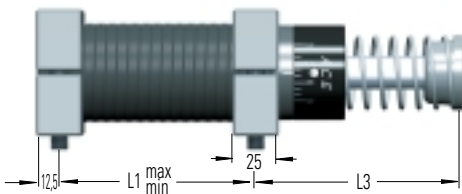
Stroke	L ₁ *	L ₄	L ₆ max.
25	89	49.5	200
50	111	77.5	250
75	136	103.5	301

* Dimension can be altered.

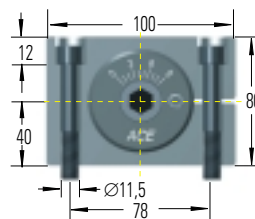


Adjuster (only MA and ML)

S 64



Because of the thread pitch the fixing holes for the second foot mount should only be drilled and tapped after the first foot mount has been fixed in position.

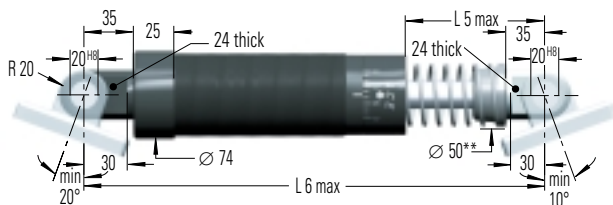


Side Foot Mounting Kit

S 64 = 2 Flanges + 4 Screws M10x80, DIN 912

Tightening torque 50 Nm
Clamping torque > 350 Nm

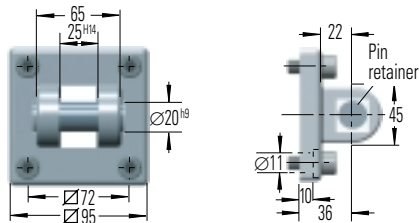
C 64



Clevis Mounting Kit

C 64 = 2 Clevis eyes. Delivered assembled to shock absorber.
** with 150 mm stroke Dia. 60 mm. Order C 64/150.
Use positive stop at both ends of travel

SF 64



Clevis Flange

SF 64 = Flange + 4 Screws M 10x20 DIN 912
Tightening torque 15 Nm
Conforms to: Audi + VW 39D1307/2/050, VDMA 24562 part 2
Daimler Chr. B801520023647, Opel-GM M13911675

Dimensions

Type	*Stroke	A max	B max	L1 min	L1 max	L2	L3	L5 max	L6 max
ML 6425 M	25	174	23	40	86	114	75.5	60	260
MC, MA, ML 6450 M	50	225	48.5	50	112	140	100	85	310
MC, MA 64100 M	100	326	99.5	64	162	191	152	136	410
MC, MA 64150 M	150	450	150	80	212	241	226	187	530

* Nominal stroke length (without integral stop collar fitted).

Capacity Chart

Type	**per Cycle	Max. Energy Capacity Nm				Soft					*Effective Weight me		Hard		Return Force N	Rod Reset Time s	Max. Side Load o	Weight kg
		Self-Compensating	W ₃	Self-Contained	W ₄ per Hour	with Air/Oil Tank	with Oil Recirculation	-0	-1	-2	-3	-4	min	max				
MC 6450 M	1 700	146 000	293 000	384 000	35 - 140	140 - 540	460 - 1 850	1 600 - 6 300	5 300 - 21 200	90 - 155	0.12	4	2.90					
MC 64100 M	3 400	192 000	384 000	497 000	70 - 280	270 - 1 100	930 - 3 700	3 150 - 12 600	10 600 - 42 500	105 - 270	0.34	3	3.70					
MC 64150 M	5 100	248 000	497 000	644 000	100 - 460	410 - 1 640	1 390 - 5 600	4 700 - 18 800	16 000 - 63 700	75 - 365	0.48	2	5.10					

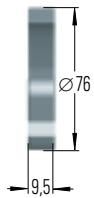
Type	Adjustable	*Effective Weight me				Return Force N	Rod Reset Time s	Max. Side Load o	Weight kg		
		Type MA	Type ML		Type ML						
		min	kg	max	min	kg	max	min	kg	max	
ML 6425 M	1 020	124 000	248 000	332 000	7 000	-	300 000	120 - 155	0.06	5	2.50
MA, ML 6450 M	2 040	146 000	293 000	384 000	11 000	-	500 000	90 - 155	0.12	4	2.90
MA 64100 M	4 080	192 000	384 000	497 000	270	-	52 000	105 - 270	0.34	3	3.70
MA 64150 M	6 120	248 000	497 000	644 000	330	-	80 000	75 - 365	0.48	2	5.10

* The effective weight range limits can be raised or lowered to special order.

** For **Emergency Use Only** applications it is sometimes possible to exceed the above ratings. Please consult ACE for further details. Specifications relate to the effective stroke length (B max.).

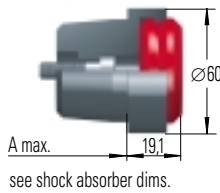
M64x2 For use on new installations:

NM 64



Locking Ring

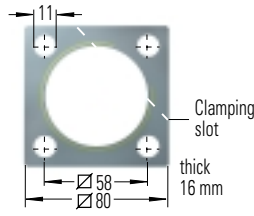
PP 64



Poly Button

Optional button with elastomer insert for noise suppression. Option supplied ready mounted onto the shock absorber. For self installation see mounting instructions on Page 46.

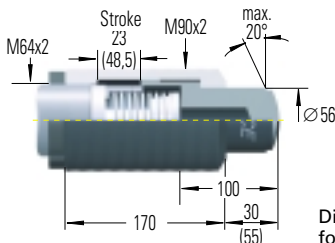
QF 64



Square Flange

Install with 4 machine screws with tightening torque: = 50 Nm
Clamping torque: > 210 Nm

BV 6425 BV 6450

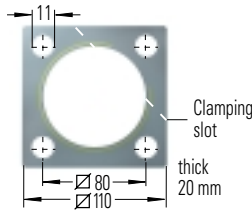


Side Load Adaptor

Mounting, installation etc. see pages 43.

Dims. in ()
for BV 6450

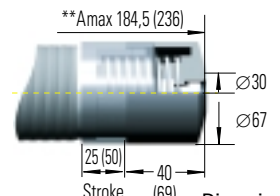
QF 90



Square Flange

Install with 4 machine screws with tightening torque: = 50 Nm
Clamping torque: > 210 Nm

PB 6425 PB 6450

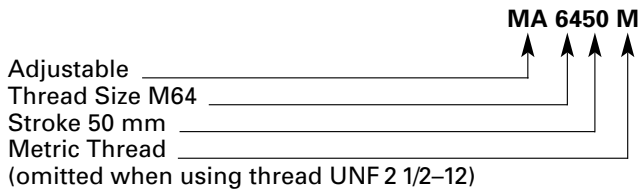


Steel Shroud

**Total installation length of the shock absorber inc. steel shroud

Dims. in ()
for PB 6450

Ordering Example



Model Type Prefix

Standard Models Self-Contained with Return Spring

- MC self-compensating
- MA adjustable
- ML adjustable, for lower impact velocity

Special Models Air/Oil Return without Return Spring

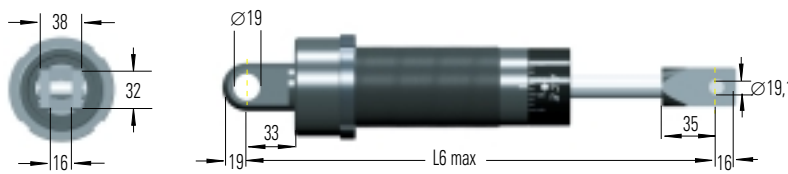
- MCA, MAA, MLA

Special Models Air/Oil Return with Return Spring

- MCS, MAS, MLS

Interchange Parts for the earlier Types MC 160...

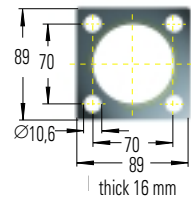
C 1600 (1 1/8)



Clevis Mounting (Use positive stop at both ends of travel)

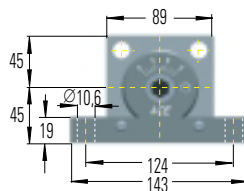
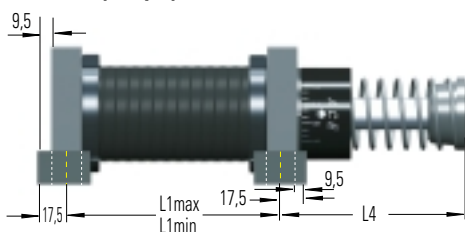
Clevis Mounting Kit C 1600 (250-0327) = 1 Rear clevis flange + 1 Rod clevis + 1 Locking ring (supplied assembled to shock absorber). Locking ring also required

QFL 1600



Square Flange

S 1600 (1 1/8)



Side Foot Mounting

Foot Mounting Kit S 1600 (250-0303) = 2 Square flanges + 2 Side bars + 2 Locking rings + 4 Socket head screws.

Dimensions

Stroke	L ₁ *	L ₄	L ₆ max.
25	102	64	257
50	127	90	309
100	178	140	410
150	229	214	530

* Dimension can be altered.

* Earlier Model

Code	Adjustable	*W ₃	Stroke mm
1	A 1 1/2x2 ...	1800	50
2	A 1 1/2x3 1/2 ...	3200	89
3	A 1 1/2x5 ...	4500	127
4	A 1 1/2x6 1/2 ...	5900	165

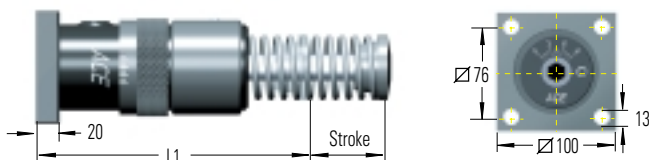
MAGNUM Series

Adjustable	*W ₃	Stroke mm	Self-Compensating	*W ₃	Stroke mm
MA 6450 M ...	2 040	50	MC 6450 M ...	1 700	50
MA 64100 M...	4 080	100	MC 64100 M ...	3 400	100
MA 64100 M ...	4 080	100	MC 64100 M ...	3 400	100
MA 64150 M ...	6 120	150	MC 64150 M ...	5 100	150

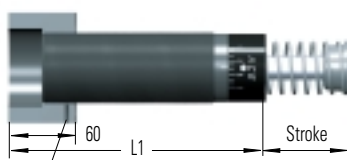
* W₃ = Max. energy capacity per cycle in Nm.

42

A 1 1/2 x ...-R (Rear Flange)



MA 64 ..., MC 64 ...

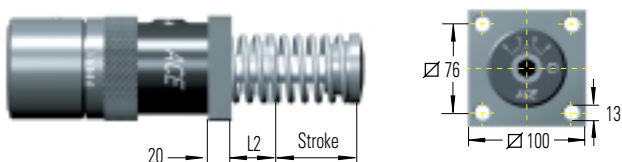


Dimensions

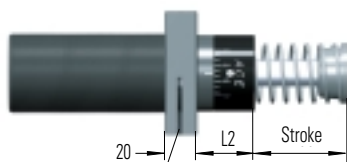
Code	L1
1	196
2	233
3	271
4	329

Flange QFR 64-1 1/2

A 1 1/2 x ...-F (Front Flange)



MA 64 ..., MC 64 ...

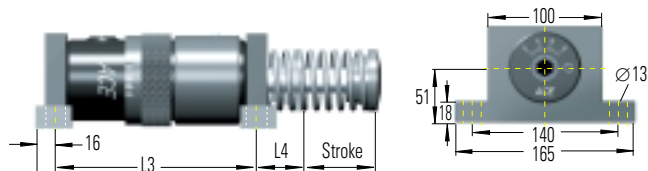


Dimensions

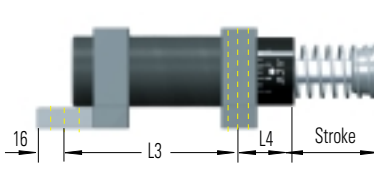
Code	L2
1	55
2	54
3	54
4	73

Flange QFF 64-1 1/2

A 1 1/2 x ...-S (Side Foot Mounting)



MA 64 ..., MC 64 ...

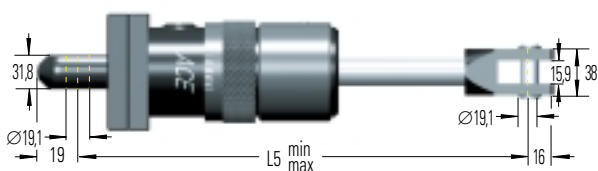


Dimensions

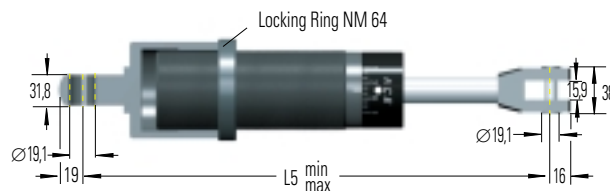
Code	L3	L4
2	170	59
3	208	59
4	246	78

Foot Mount Set S 64-1 1/2

A 1 1/2 x ...-C (Clevis Mounting)



MA 64 ..., MC 64 ...



Clevis Mount Set C 64-1 1/2

Dimensions

Code	L5 min	*A1 1/2 L5 max	*MA 64 L5 max
1	278.0	328.6	328.0
2	317.0	405.6	417.0
3	353.0	481.8	453.0
4	412.0	577.0	562.0

* Note! L5 max. is not the same.

Issue 9.2004 Specifications subject to change

BV... Side Load Adaptor

For side load impact angles from 3° to 25°.

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 BV side load adaptor provides a long lasting solution. For mounting the adaptor has the same outer thread as the next larger size of standard shock absorber i.e.:

BV 3325 (M45x1,5) for MC, MA, ML 3325 M (M33x1,5)

BV 3350 (M45x1,5) for MC, MA, ML 3350 M (M33x1,5)

BV 4525 (M64x2) for MC, MA, ML 4525 M (M45x1,5)

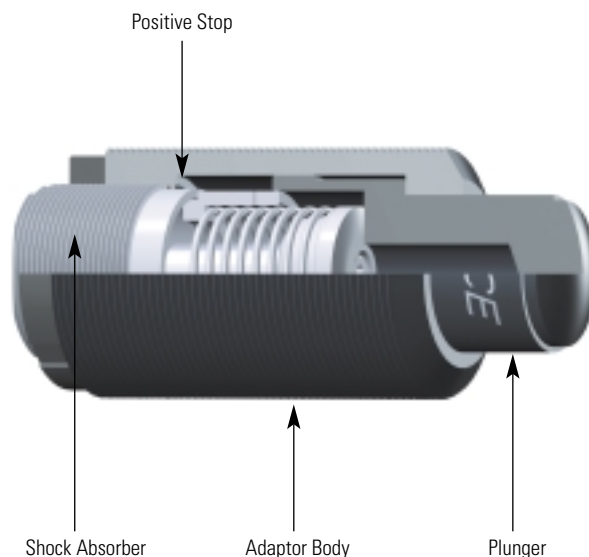
BV 4550 (M64x2) for MC, MA, ML 4550 M (M45x1,5)

BV 6425 (M90x2) for ML 6425 M (M64x2)

BV 6450 (M90x2) for MC, MA, ML 6450 M (M64x2)

Material: Threaded body and plunger hardened high tensile steel.

Mounting: Directly mount the shock absorber on the outside thread of the side load adaptor or by using the QF flange. You can not use a foot mounting.



PB... Steel Shroud

For thread sizes M33x1.5, M45x1.5 and M64x2 with 25 mm or 50 mm stroke.

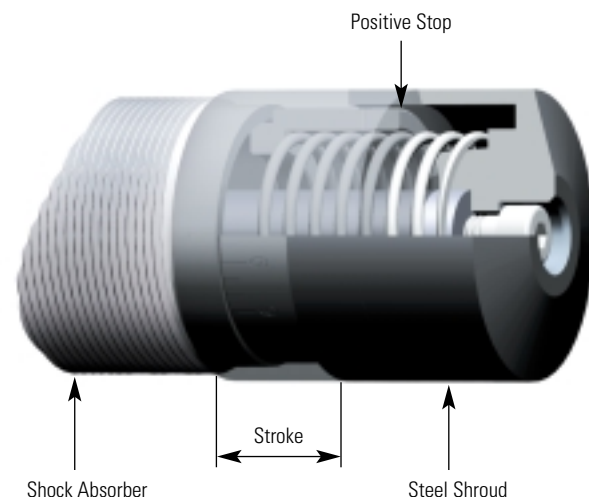
Grinding beads, sand, welding splatter, paints and adhesives etc. can adhere to the piston rod. They then damage the rod seals and the shock absorber quickly fails. In many cases the installation of the optional Steel Shroud can provide worthwhile protection and increase lifetime.

Material: Hardened high tensile steel.

Mounting: To mount the PB steel shroud it is necessary to remove the rod end button of the shock absorber.

Note!

When installing don't forget to allow operating space for the shroud to move as the shock absorber is cycled.



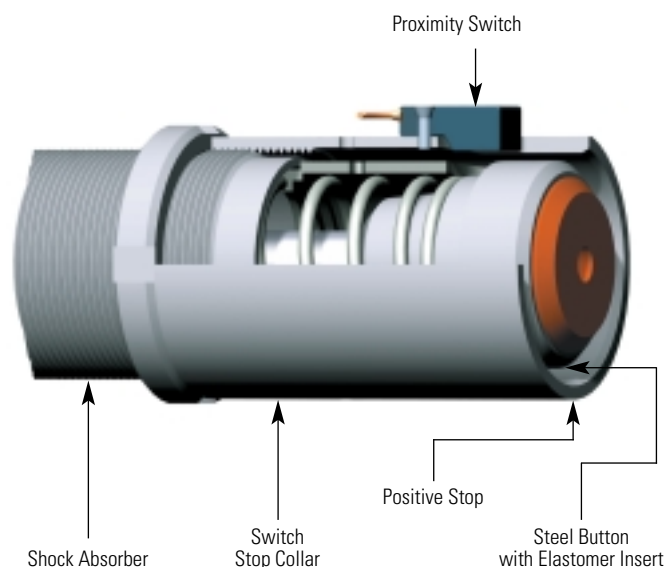
AS... Switch Stop Collar

For thread sizes M33x1.5 and M45x1.5

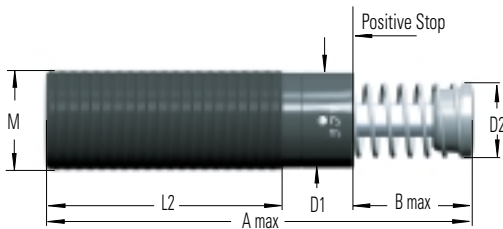
The new ACE StopLight Switch Stop Collar combination serves as a safety element to provide stroke position information for automatically sequenced machines. The compact construction allows its use in nearly any application. The standard rod button is detected by the proximity switch at the end of its stroke to provide switch actuation. The switch is normally open when the shock absorber is extended and only closes when it has completed its operating stroke.

The AS Switch Stop Collar combination is only delivered ready mounted onto the shock absorber c/w the switch.

Material: Hardened high tensile steel.



For circuit diagram of proximity switch see page 32.



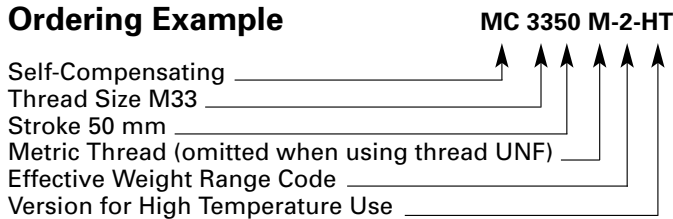
Dimensions and Capacity Chart

Model Part Number	*Stroke mm	A max	B	D1	D2	L2	M	Max. Energy Capacity			Max. Side Load Angle °	Weight kg	
								Nm per cycle		Nm per hour			
								W ₃ max. Nm	W ₄ max. Nm	at 20°C W ₄ max. Nm			at 100°C W ₄ max. Nm
MC 3325 M	25	138	23	30	25	83	M33x1.5	155	215 000	82 000	4	0.45	
MC 3350 M	50	189	48.5	30	25	108	M33x1.5	310	244 000	93 000	3	0.54	
MC 4525 M	25	145	23	42	35	95	M45x1.5	340	307 000	117 000	4	1.13	
MC 4550 M	50	195	48.5	42	35	120	M45x1.5	680	321 000	122 000	3	1.36	
MC 6450 M	50	225	48.5	60	48	140	M64x2	1 700	419 000	159 000	4	2.90	
MC 64100 M	100	326	99.5	60	48	191	M64x2	3 400	550 000	200 000	3	3.70	

* nominal stroke length (without stop collar fitted)

The Calculation and Selection of the most suitable shock absorber (effective weight range) for your application should be carried out or checked by ACE Controls. Adjustable models are also available on request.

Ordering Example



Details Required when Ordering:

- Load to be Decelerated m (kg)
- Impact Velocity v (m/s)
- Propelling Force F (N)
- Operating Cycles per Hour x (/hr)
- Number of Absorbers in Parallel n
- Ambient Temperature °C

Technical Data

Impact velocity range: 0.15 to 5 m/s, up to 20 m/s on request.

Oil filling: special temperature stable synthetic oil.

Material: Shock absorber body and accessories: 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.

Mounting: in any position.

Operating temperature range: -20°C to 150°C

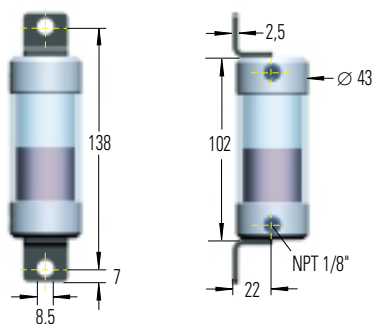
Capacity rating: For **Emergency Use only** applications it is sometimes possible to exceed above max. capacity ratings (please consult ACE for details). The above W₄ ratings (max. energy Nm per hour) can sometimes be increased by using an external Air/Oil Tank (see page 51) and Model version prefix **MCA** (please consult ACE for further details).

On request: Plated finishes for additional corrosion protection.



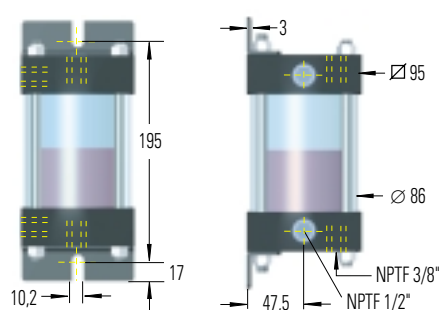
Issue 9.2004 Specifications subject to change

AO 1



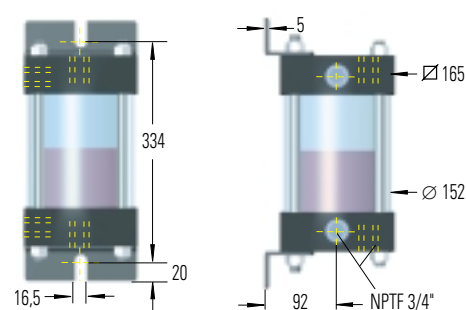
Oil capacity 20 cm³
Material: Alu. caps and polycarbonate body.

AO 3



Oil capacity 330 cm³
Material: Alu. caps and steel body polycarbonate sight gauge.

AO 691



Oil capacity 2600 cm³
Material: Alu. caps and steel body polycarbonate sight gauge.

Max. pressure 8 bar. Max. temperature 80°C.

Oil filling: ATF-Oil 42 cSt at 40°C for all shock absorbers in Magnum Series. Mount air/oil tank higher than shock absorber. Bleed all air from system before operating.

Attention: Exhaust tank before carrying out service. Check valve holds pressure!

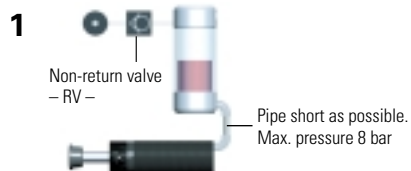
Part Numbers

Type	with tank examples 1-4 Tank	with tank examples 1-4 non-return valve	with circ. circuits Ex. 5-6 Tank	with circ. circuits Ex. 5-6 non-return valve	Conn. pipe. Ø min.
MCA, MAA, MLA 33...	AO 1	CV 1/8	AO 3	CV 1/4	4
MCA, MAA, MLA 45...	AO 1	CV 1/8	AO 3	CV 3/8	6
MCA, MAA, MLA 64...	AO 3	CV 1/4	AO 691	CV 1/2	8
CAA, AA 2...	AO 691	CV 1/2	AO 82	CV 3/4	15
CAA, AA 3...	AO 691	CV 1/2	AO 82	CV 3/4	19
CAA 4...	AO 82	CV 3/4	AO 82	CV 3/4	38

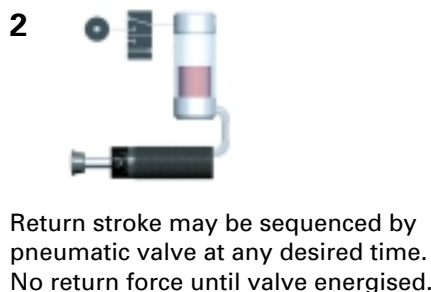
AO 82 details on request.

Suggested Air/Oil tanks in accordance with W₄ ratings

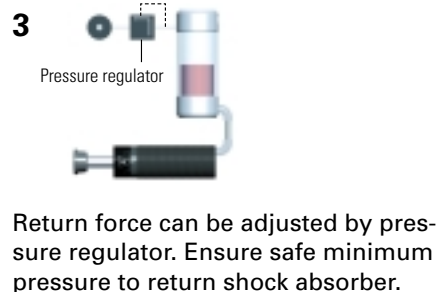
Connection Examples Air/Oil Tanks



Piston rod returns immediately to extended position when load moves away. Operation without main air supply possible for short periods.



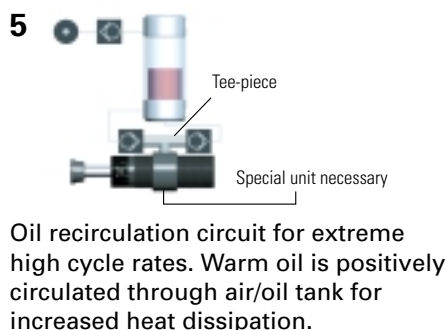
Return stroke may be sequenced by pneumatic valve at any desired time. No return force until valve energised.



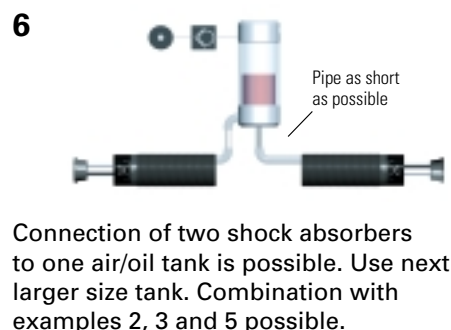
Return force can be adjusted by pressure regulator. Ensure safe minimum pressure to return shock absorber.



Spring return with Air/Oil Tank. No air supply connected. Note: Will extend return time.



Oil recirculation circuit for extreme high cycle rates. Warm oil is positively circulated through air/oil tank for increased heat dissipation.



Connection of two shock absorbers to one air/oil tank is possible. Use next larger size tank. Combination with examples 2, 3 and 5 possible.

Thread Sizes for connection to air/oil tank

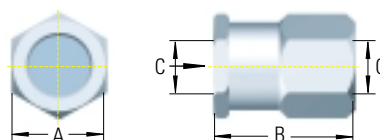
Type	Thread bottom	Thread side**
MCA, MAA, MLA 33	G 1/8 outside*	G 1/8 inside
MCA, MAA, MLA 45	G 1/8 inside	G 1/8 inside
MCA, MAA, MLA 64	G 1/4 inside	G 1/4 inside

* adapted

** on request (add suffix -PG/-P)

Part Numbers CV...

max. pressure 20 bar
max. temperature 95°C
Suitable for: Oil, Air, Water.
Material: Aluminium



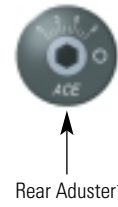
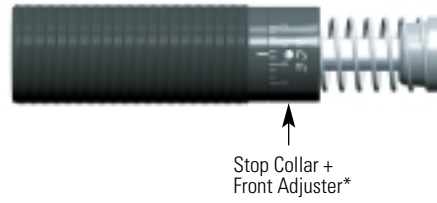
Model

Part No.	A	B	C
CV 1/8	19	24	1/8
CV 1/4	29	33	1/4
CV 3/8	29	33	3/8
CV 1/2	41	40	1/2
CV 3/4	48	59	3/4

Mechanical Stop

The MAGNUM Series units have a built in stop collar (mechanical stop) which also serves as the front adjuster.

If using a shock absorber without a stop collar it is important to install a mechanical stop 0.5 to 1 mm before the end of the stroke.



*MA and ML only

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General

For optimum heat dissipation do not paint the shock absorber. For applications in environments with acids, dusts or powders, abrasives, steam or water please protect the shock absorber and/or consider the special accessories on page 43. The shock absorber should be securely mounted onto a flat and smooth surface of adequate strength.

Self Compensating Models

The MC family of shock absorbers are self compensating. Providing the effective weight on the application remains within the band given in the capacity charts then no adjustment is necessary for changes in weights, speeds or propelling force. These units are available with five standard operating bands (me min. – me max.) and are identified by the suffix number after the model which goes from -0 (very soft) up to -4 (very hard).

The optimum deceleration is achieved when there is no abrupt change in the load velocity at the beginning or the end of the shock absorber stroke.

If there is a hard impact at the start of stroke → use the next softer version (i.e. lower suffix number).

If there is a hard setdown at the end of stroke → use the next harder version, or mount two units in parallel.

Alternatively change to a larger bore size unit. Contact ACE for further advice.

Adjustable Models

The adjustment has a graduated scale from 0 to 9. The adjuster in the body of MA/ML 64 has a side mounted locking screw which should be loosened (1/2 turn max.) with a hex. key before commencing adjustment. The MAGNUM Series units can be adjusted by the hex. socket at the rear of the body – or by rotating the front stop collar. Both adjusters are internally connected and will show the same adjustment value on the scales as they are turned. After installation cycle the equipment a few times and turn the adjustment until optimum deceleration is achieved (i.e. no abrupt change in the load velocity observed at the beginning or at the end of shock absorber stroke). The shock absorber is delivered set at 5.

If there is a hard impact at start of stroke → adjust the unit softer i.e. towards 9 on the scale.

If there is a hard setdown at end of stroke → adjust the unit harder i.e. towards 0.

Adjustment approaching "0" means: a) Impact velocity is too low: consider changing to Model type ML or:

b) Shock absorber selected is too small: use next larger size or mount 2 units in parallel.

Mounting Options

Basic Model



Flange Mounting



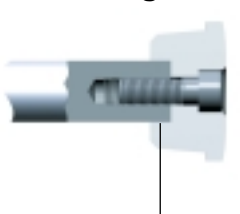
Side Foot Mounting



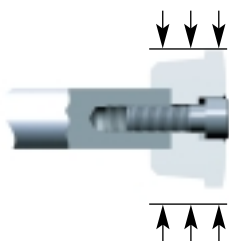
Clevis Mounting



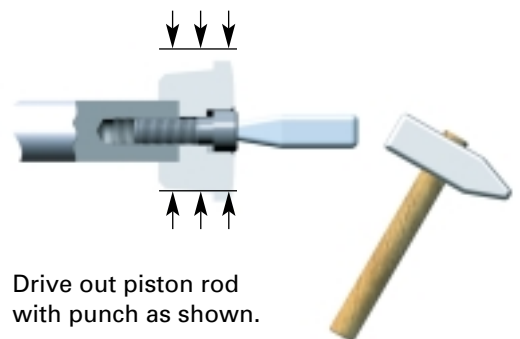
Removing Rod End Button



Press fit (screw loctited for security).



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



Drive out piston rod with punch as shown.

Repairs

It is possible to overhaul ACE shock absorbers in M 33 sizes and larger. We would recommend that damaged or worn shock absorbers are returned to ACE for repair. You will find that this is more economic than the comparative cost of repairing yourself. Spare parts and seal kits etc. are available however if required.

ACE can also offer more than its already extensive range of standard products covering body sizes from M6 up to M130. For over 40 years we have designed and developed many customer specific "specials". These include units with special damping characteristics for unusual applications or non-standard materials or operating fluids. Special seals and mounting accessories for customers specific applications are also available.

Below are a few examples of the thousands of special options that we have provided in the past.



Special shock absorbers with damping in the pull direction. Available in medium bore sizes from M33x1.5 to M64x2.

Ask for details.



Special shock absorbers with non-standard spring for higher return force. For sizes from M14x1.5 upwards.

Ask for details.



Special shock absorbers with lengthened piston rods and clevis mounts for extended mounting points. Available in all sizes from M33x1.5 upwards.

Ask for details.



Special shock absorbers with guided anti-rotation head with built in roller for damping and then allowing the sideways transfer of heavy loads. Available on heavy duty units from M100x2 upwards.

Ask for details.



Shock absorbers with special anti-corrosion finishes. Options include plated or painted finishes, Weartec finish for saltwater protection and units with all exposed parts manufactured from **V4A Stainless Steel**.

Model*

Part No.

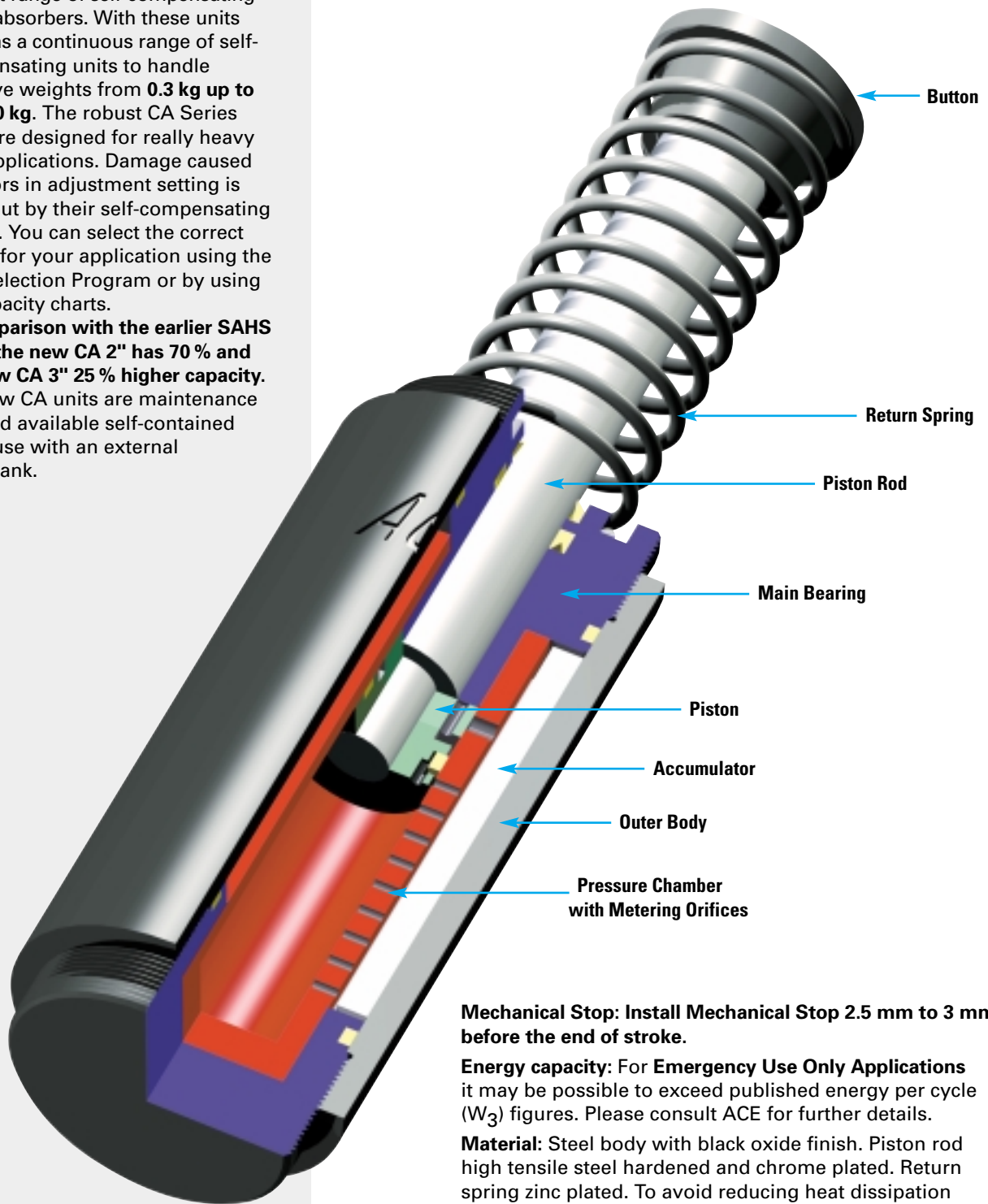
MC 150 M-V4A
MC 150 MH-V4A
MC 150 MH2-V4A
MC 225 M-V4A
MC 225 MH-V4A
MC 225 MH2-V4A
MC 600 M-V4A
MC 600 MH-V4A
MC 600 MH2-V4A

* For Technical details see page 21.

Middle bore sizes M33x1,5 and M45x1,5 by quotation.

The CA 2 to CA 4 complete the ACE product range of self-compensating shock absorbers. With these units ACE has a continuous range of self-compensating units to handle effective weights from **0.3 kg up to 326 000 kg**. The robust CA Series units are designed for really heavy duty applications. Damage caused by errors in adjustment setting is ruled out by their self-compensating design. You can select the correct model for your application using the ACE Selection Program or by using the capacity charts.

In comparison with the earlier SAHS range the new CA 2" has 70 % and the new CA 3" 25 % higher capacity. The new CA units are maintenance free and available self-contained or for use with an external air/oil tank.



Mechanical Stop: Install Mechanical Stop 2.5 mm to 3 mm before the end of stroke.

Energy capacity: For **Emergency Use Only Applications** it may be possible to exceed published energy per cycle (W_3) figures. Please consult ACE for further details.

Material: 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 outer body.

Impact velocity range: 0.3 m/s up to 5 m/s.

Oil filling: Automatic
Transmission Fluid viscosity 42 cSt. at 40°C.

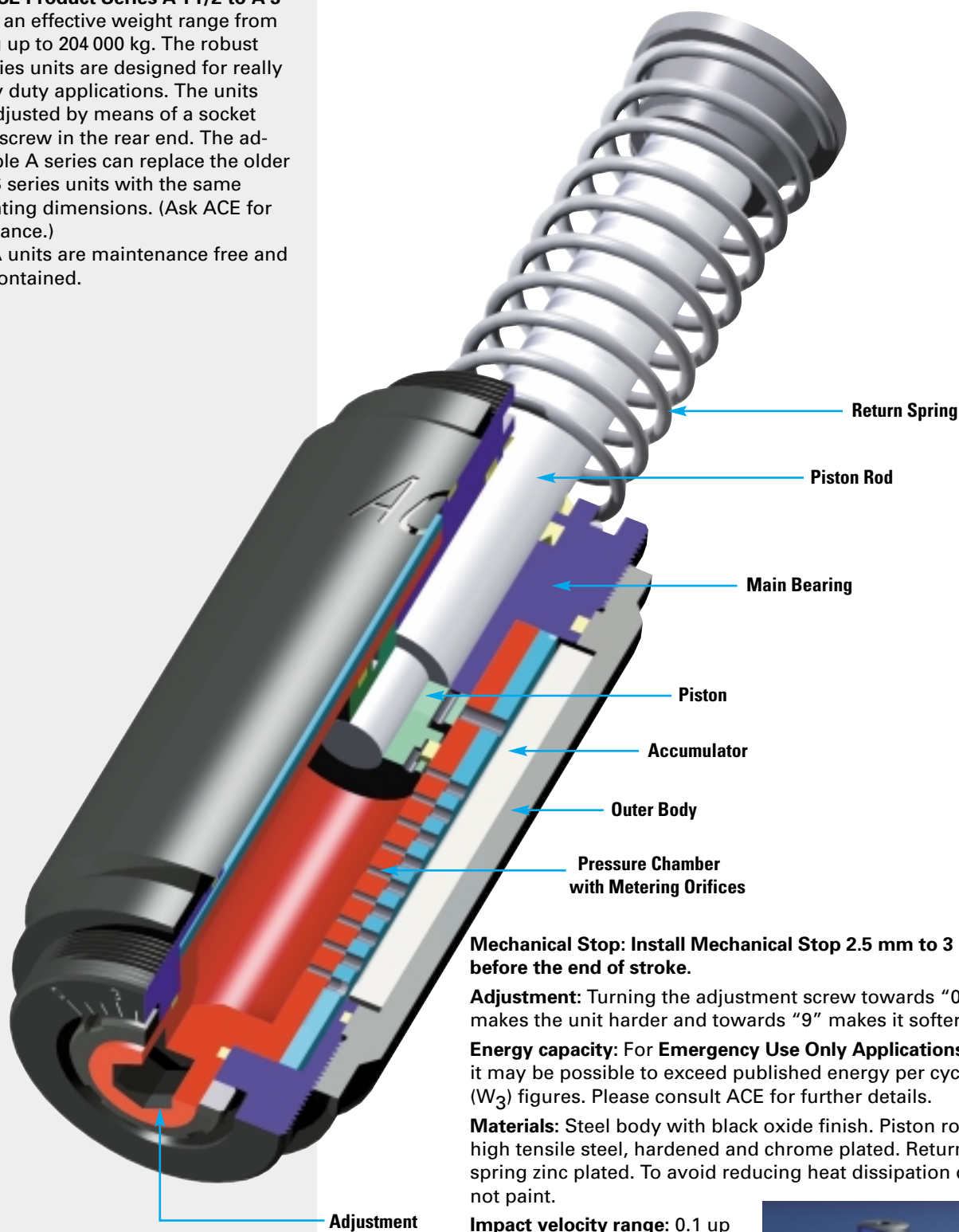
Mounting: In any position.

Operating temperature range: -12°C to +90°C.

On request: Special oils, or for higher or lower impact velocities outside range shown above, or other options please consult ACE.



The adjustable shock absorbers of the **ACE Product Series A 1 1/2 to A 3** cover an effective weight range from 0.3 kg up to 204 000 kg. The robust A Series units are designed for really heavy duty applications. The units are adjusted by means of a socket head screw in the rear end. The adjustable A series can replace the older SAHS series units with the same mounting dimensions. (Ask ACE for assistance.) The A units are maintenance free and self-contained.



Mechanical Stop: Install Mechanical Stop 2.5 mm to 3 mm before the end of stroke.

Adjustment: Turning the adjustment screw towards "0" makes the unit harder and towards "9" makes it softer.

Energy capacity: For **Emergency Use Only Applications** it may be possible to exceed published energy per cycle (W_3) figures. Please consult ACE for further details.

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.

Impact velocity range: 0.1 up to 5 m/s.

Oil filling: Automatic Transmission Fluid viscosity 42cSt. at 40°C.

Mounting: In any position.

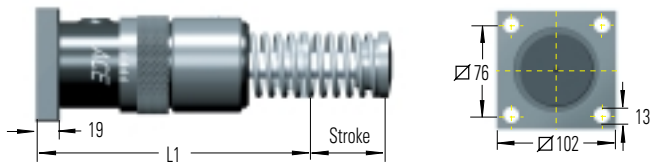
Operating temperature range: -12°C to +90°C.

On request: Special oils, or for higher or lower impact velocities outside range shown above, or other options please consult ACE.

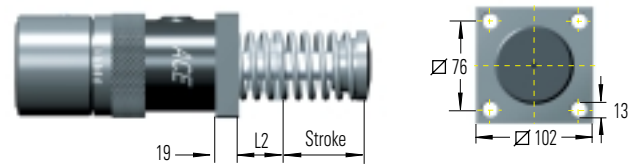


Mounting Options A 1 1/2 . . .

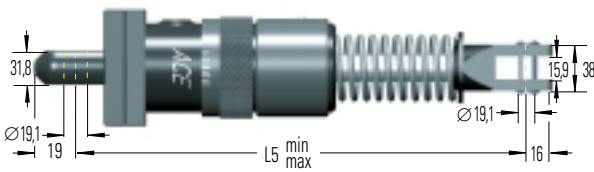
Rear Flange -R



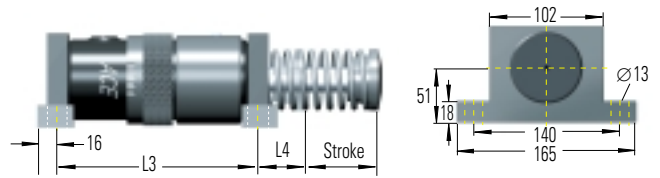
Front Flange -F



Clevis Mounting -C



Foot Mounting -S



Foot Mounting not available on 2" stroke models.

Mechanical Stop: Install Mechanical Stop 2.5 mm to 3 mm before the end of stroke.

Dimensions A 1 1/2

Type	L1	L2	L3	L4	L5
A 1 1/2 x 2	195.2	54.2	-	-	277.8 - 328.6
A 1 1/2 x 3 1/2	233	54.2	170	58.6	316.6 - 405.6
A 1 1/2 x 5	271.5	54.2	208	58.6	354.8 - 481.8
A 1 1/2 x 6 1/2	329	73	246	78	412 - 577

Ordering Example

A 1 1/2 x 2 R

Adjustable _____
 Bore Size \varnothing 1 1/2" _____
 Stroke Length 2" = 50.8 mm _____
 Rear Flange Mounting _____

Model Type Prefix:

- A = self-contained with return spring
(This is standard model)
- AA = air/oil return without return spring
Use only with external air/oil tank
- NA = self-contained without return spring
- SA = air/oil return with return spring
Use only with external air/oil tank

Capacity Chart

Type	Stroke mm	**per Cycle W ₃	Max. Energy Capacity Nm		*Effective Weight me	Return Force N min max	Spring Return Time s	Max. Side-Load Angle °	Weight kg
			Self-Contained	W ₄ per Hour*** with Oil Tank					
A 1 1/2 x 2	50	1800	362 000	452 000	195 - 32 000	160 - 210	0.1	5	7.5
A 1 1/2 x 3 1/2	89	3200	633 000	791 000	218 - 36 000	110 - 210	0.25	4	8.9
A 1 1/2 x 5	127	4 500	904 000	1 130 000	227 - 41 000	90 - 230	0.4	3	10.3
A 1 1/2 x 6 1/2	165	5900	1 180 000	1 469 000	308 - 45 000	90 - 430	0.4	2	12

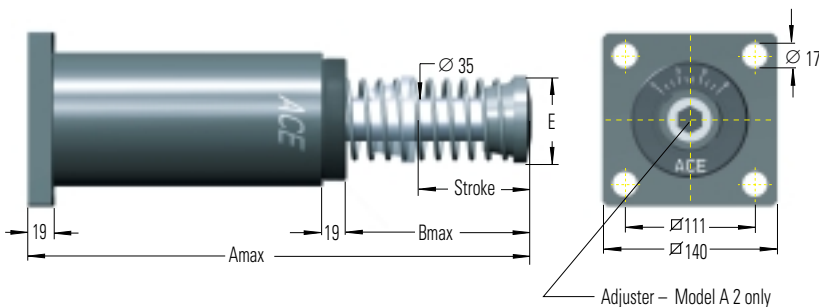
* Standard effective weight ranges only shown. Please consult ACE if your application falls outside these for alternative range unit.

** For **Emergency Use Only** applications it may be possible to exceed these max. capacity ratings. Please consult ACE for further details.

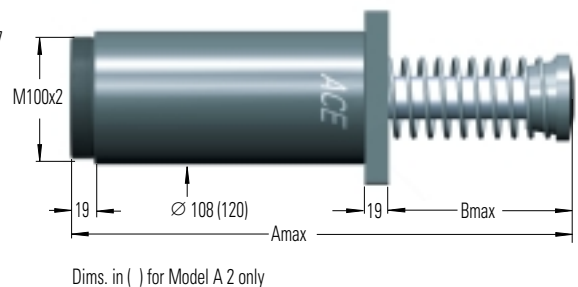
*** Figures for oil recirculation systems on request

Mounting Options CA, A . . .

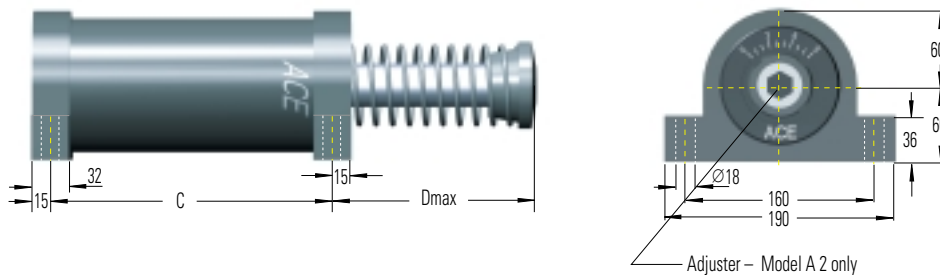
Rear Flange -R



Front Flange -F



Foot Mounting -SM



Dimensions of Clevis Mountings available on request.

NOTE! For replacement of existing SAHS 2" foot mounted units order the old type foot mounting -S.

Dimensions

Type	A max	B max	C	D max	E
2 x 2	313	110	173	125	70
2 x 4	414	160	224	175	70
2 x 6	516	211	275	226	70
2 x 8	643	287	326	302	92
2 x 10	745	338	377	353	108

Ordering Example

CA 2 x 4-3 F
 Self-Compensating _____
 Bore Size 2" _____
 Stroke Length 4" = 102 mm _____
 Effective Weight Range Version _____
 Front Flange Mounting _____

Model Type Prefix:

- A, CA = self-contained with return spring
- AA, CAA = air/oil return without return spring
Use only with external air/oil tank
- NA, CNA = self-contained without return spring
- SA, CSA = air/oil return with return spring
Use only with external air/oil tank

Capacity Chart

Type	Stroke mm	**per Cycle W ₃	Max. Energy Capacity Nm		*Effective Weight me				Return Force N	Spring Return Time s	Max. Side-Load Angle °	Weight kg
			W ₄ per Hour*** Self-Contained	Air/Oil Tank	Soft	-1	-2	-3				
CA 2 x 2	50	3 600	1 100 000	1 350 000	700 - 2 200	1 800 - 5 400	4 500 - 13 600	11 300 - 34 000	210 - 285	0.25	3	12.8
CA 2 x 4	102	7 200	1 350 000	1 700 000	1 400 - 4 400	3 600 - 11 000	9 100 - 27 200	22 600 - 68 000	150 - 285	0.50	3	14.8
CA 2 x 6	152	10 800	1 600 000	2 000 000	2 200 - 6 500	5 400 - 16 300	13 600 - 40 800	34 000 - 102 000	150 - 400	0.60	3	16.9
CA 2 x 8	203	14 500	1 900 000	2 400 000	2 900 - 8 700	7 200 - 21 700	18 100 - 54 400	45 300 - 136 000	230 - 650	0.70	3	19.3
CA 2 x 10	254	18 000	2 200 000	2 700 000	3 600 - 11 000	9 100 - 27 200	22 600 - 68 000	56 600 - 170 000	160 - 460	0.80	3	22.8
A 2 x 2	50	3 600	1 100 000	1 350 000		250 - 77 000			210 - 285	0.25	3	14.3
A 2 x 4	102	9 000	1 350 000	1 700 000		230 - 72 500			150 - 285	0.50	3	16.7
A 2 x 6	152	13 500	1 600 000	2 000 000		260 - 86 000			150 - 400	0.60	3	19.3
A 2 x 8	203	19 200	1 900 000	2 400 000		260 - 90 000			230 - 650	0.70	3	22.3
A 2 x 10	254	23 700	2 200 000	2 700 000		320 - 113 000			160 - 460	0.80	3	26.3

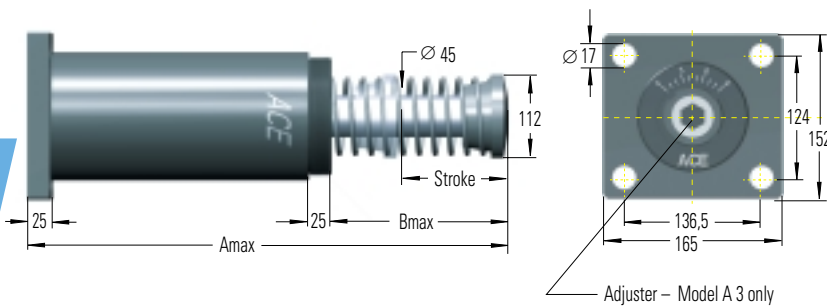
* Standard effective weight ranges only shown. Please consult ACE if your application falls outside these for alternative range unit.

** For **Emergency Use Only** applications it may be possible to exceed these max. capacity ratings. Please consult ACE for further details.

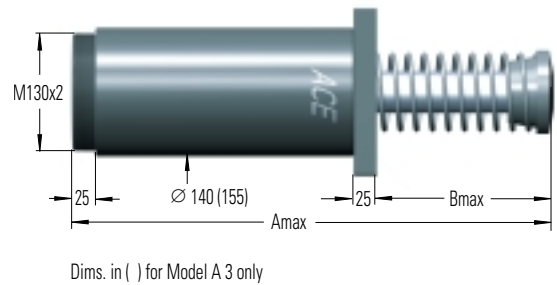
*** Figures for oil recirculation systems on request

Mounting Options CA, A . . .

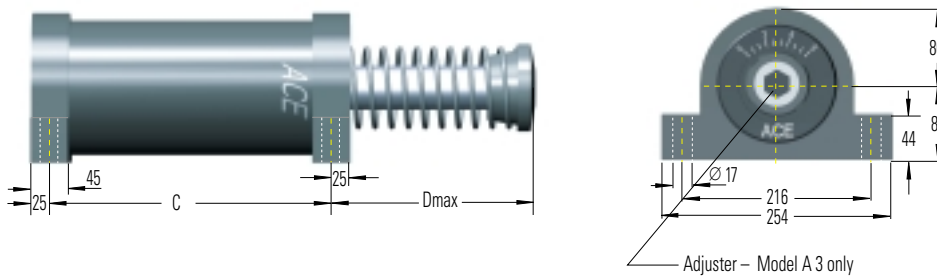
Rear Flange -R



Front Flange -F



Foot Mounting -SM



Dimensions of Clevis Mountings available on request.

NOTE! For replacement of existing SAHS 3" foot mounted units please consult ACE.

SAHS 3" and AHS 3" Interchange dimensions to order

Dimensions

Type	A max	B max	C	D max
3 x 5	502	210	260	216
3 x 8	641	286	337	292
3 x 12	890	433	438	439

Ordering Example

Adjustable _____
 Bore Size 3" _____
 Stroke Length 8" = 203 mm _____
 Rear Flange Mounting _____

A 3 x 8 R

Model Type Prefix:

- A, CA = self-contained with return spring
- AA, CAA = air/oil return without return spring
Use only with external air/oil tank
- NA, CNA = self-contained without return spring
- SA, CSA = air/oil return with return spring
Use only with external air/oil tank

Capacity Chart

Type	Stroke mm	**per Cycle W ₃	Max. Energy Capacity Nm		*Effective Weight me				Return Force N	Spring Return Time s	Max. Side-Load Angle °	Weight kg
			W ₄ Self-Contained	W ₃ with Air/Oil Tank	Soft		Hard					
					-1 min kg max	-2 min kg max	-3 min kg max	-4 min kg max				
CA 3 x 5	127	14 125	2 260 000	2 800 000	2 900 - 8 700	7 250 - 21 700	18 100 - 54 350	45 300 - 135 900	270 - 710	0.60	3	28.9
CA 3 x 8	203	22 600	3 600 000	4 520 000	4 650 - 13 900	11 600 - 34 800	29 000 - 87 000	72 500 - 217 000	280 - 740	0.80	3	33.4
CA 3 x 12	305	33 900	5 400 000	6 780 000	6 950 - 20 900	17 400 - 52 200	43 500 - 130 450	108 700 - 326 000	270 - 730	1.20	3	40.6
A 3 x 5	127	15 800	2 260 000	2 800 000	480 - 154 000				270 - 710	0.60	3	32.7
A 3 x 8	203	28 200	3 600 000	4 520 000	540 - 181 500				280 - 740	0.80	3	38.5
A 3 x 12	305	44 000	5 400 000	6 780 000	610 - 204 000				270 - 730	1.20	3	47.6

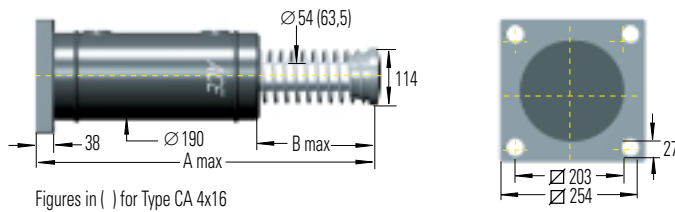
* Standard effective weight ranges only shown. Please consult ACE if your application falls outside these for alternative range unit.

** For **Emergency Use Only** applications it may be possible to exceed these max. capacity ratings. Please consult ACE for further details.

*** Figures for oil recirculation systems on request

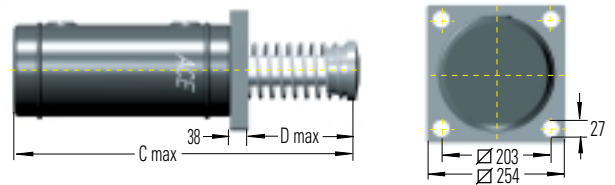
Part Number CA, . . .

Rear Flange -R

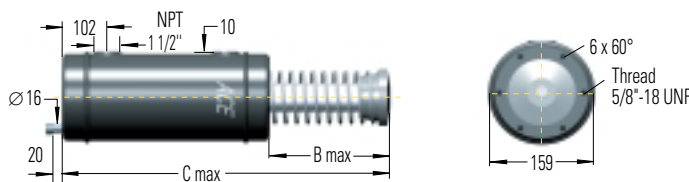


Figures in () for Type CA 4x16

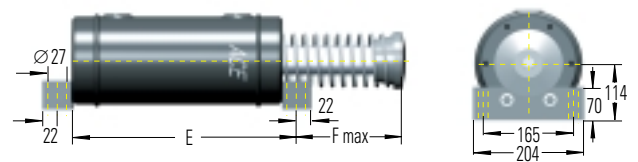
Front Flange -F



6 Tapped Holes (Primary Mounting) -FRP



Side Foot Mounting -S



Dimensions of Clevis Mountings available on request.

Dimensions CA and CSA

Type	A	B	C	D	E	F
4 x 6	716	278	678	240	444	256
4 x 8	818	329	780	291	495	307
4 x 16	1300	607	1261	569	698	585

Dimensions CAA

Type	A	B	C	D	E	F
4 x 6	666	228	628	190	444	206
4 x 8	767	278	729	240	495	256
4 x 16	1174	482	1136	444	698	460

Ordering Example

CA 4 x 8-5 R
 Self-Compensating _____
 Bore Size Ø 4" _____
 Stroke Length 8" = 203 mm _____
 Medium Effective Weight Version _____
 Rear Flange Mounting _____

Model Type Prefix:

- CA = self-contained with return spring
(This is standard model)
- CAA = air/oil return without return spring
Use only with air/oil tank for high energy
capacity per hour figures
- CNA = self-contained without return spring
- CSA = air/oil return with return spring
Use only with air/oil tank

Capacity Chart

Type	Stroke **per Cycle		Max. Energy Capacity Nm		*Effective Weight me			Return Force N		Rod Reset Time s	Weight kg FRP
	mm	W3	Self-Contained	W4 per Hour with Air/Oil Tank	Medium			min	max		
					Soft -3	Medium -5	Hard -7				
4 x 6	152	47 500	3 000 000	5 100 000	3 500 - 8 600	8 600 - 18 600	18 600 - 42 700	480	1 000	1,8	60
4 x 8	203	63 300	3 400 000	5 600 000	5 000 - 11 400	11 400 - 25 000	25 000 - 57 000	310	1 000	2,3	68
4 x 16	406	126 500	5 600 000	9 600 000	10 000 - 23 000	23 000 - 50 000	50 000 - 115 000	310	1 000	a. A.	170

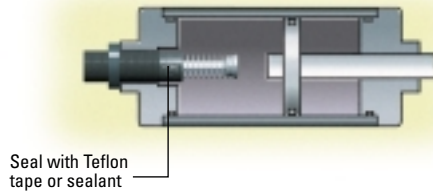
* The effective weight range limits can be raised or lowered to special order.

** For **Emergency Use Only** applications it is sometimes possible to exceed the above ratings. Please consult ACE for further details.

1 ACE Shock absorbers for pneumatic cylinders

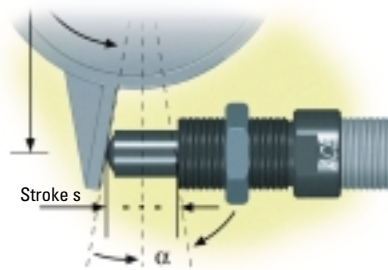
- For:
- optimum deceleration
 - higher speeds
 - smaller cylinders
 - reduced air consumption
 - smaller valves and pipework

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



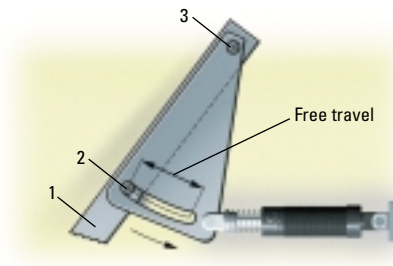
With heavy loads or high velocities normal cylinder cushions are often overloaded. This causes shock loading leading to premature cylinder failure or excessive maintenance. Using oversized cylinders to withstand this shock loading is not the best solution since this considerably increases air consumption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

2 Side load adapter for high side load angles



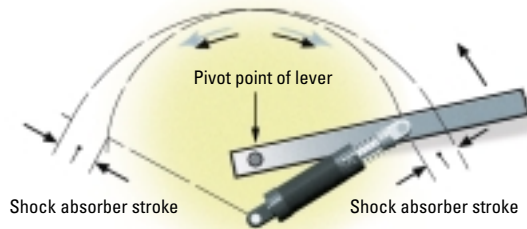
The side loading is removed from the shock absorber piston rod leading to considerably longer life. Wherever possible mount shock absorber so that impacting face is perpendicular to shock absorber axis half way through stroke. See pages 31 and 33 for more details.

3 Undamped free travel with damped end position



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.

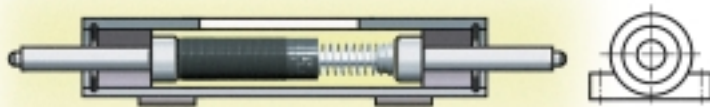
4 One shock absorber for both ends of travel



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

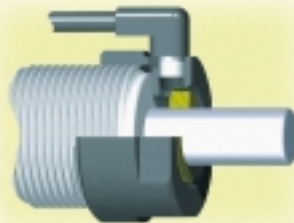
Tip: Leave approx. 1.5 mm of shock absorber stroke free at each end of travel.

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.

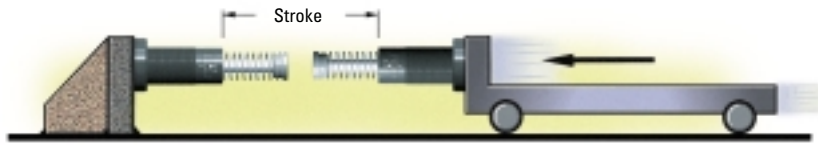
6 Air bleed collar



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

For more details see page 32.

7 Double stroke length



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

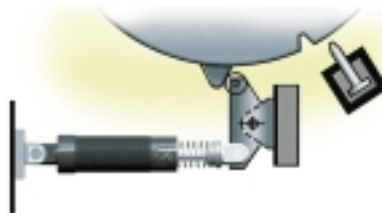
By driving 2 shock absorbers against one another 'nose-to-nose', the effective stroke length can be doubled.

8 Ride over latch

8.1



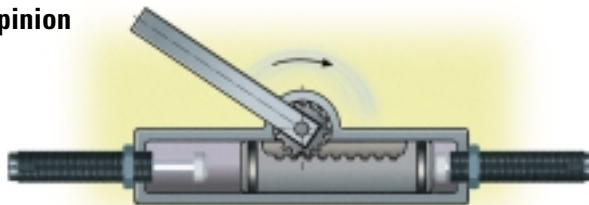
8.2



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

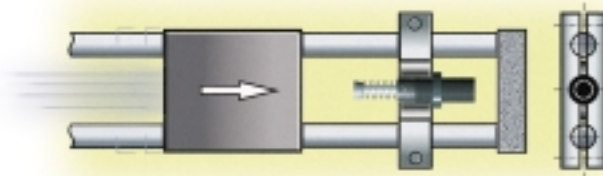
8.2 The latch absorbs the rotational energy of the turntable etc. The turntable can then be held in the datum position with a lock bolt or similar.

9 Rotary actuator or rack and pinion drive



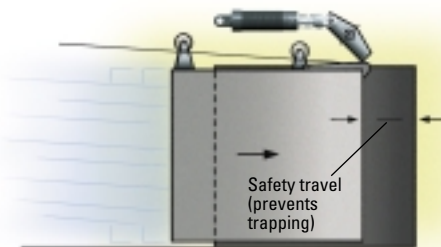
The use of ACE shock absorbers allows higher operating speeds and weights as well as protecting the drive mechanism and housing from shock loads.

10 Adjustable stop clamp e.g. for handling equipment



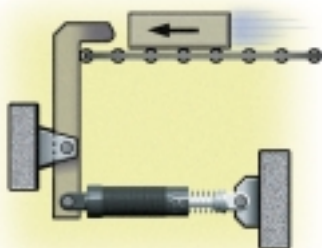
The gentle deceleration of ACE shock absorbers makes the use of adjustable stop clamps possible and removes any chance of the clamp slipping. The kinetic energy is completely removed before the mechanical stop is reached thus making high index speeds possible.

11 Ride-over latch e.g. fire door



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

12 Increasing stroke length mechanically

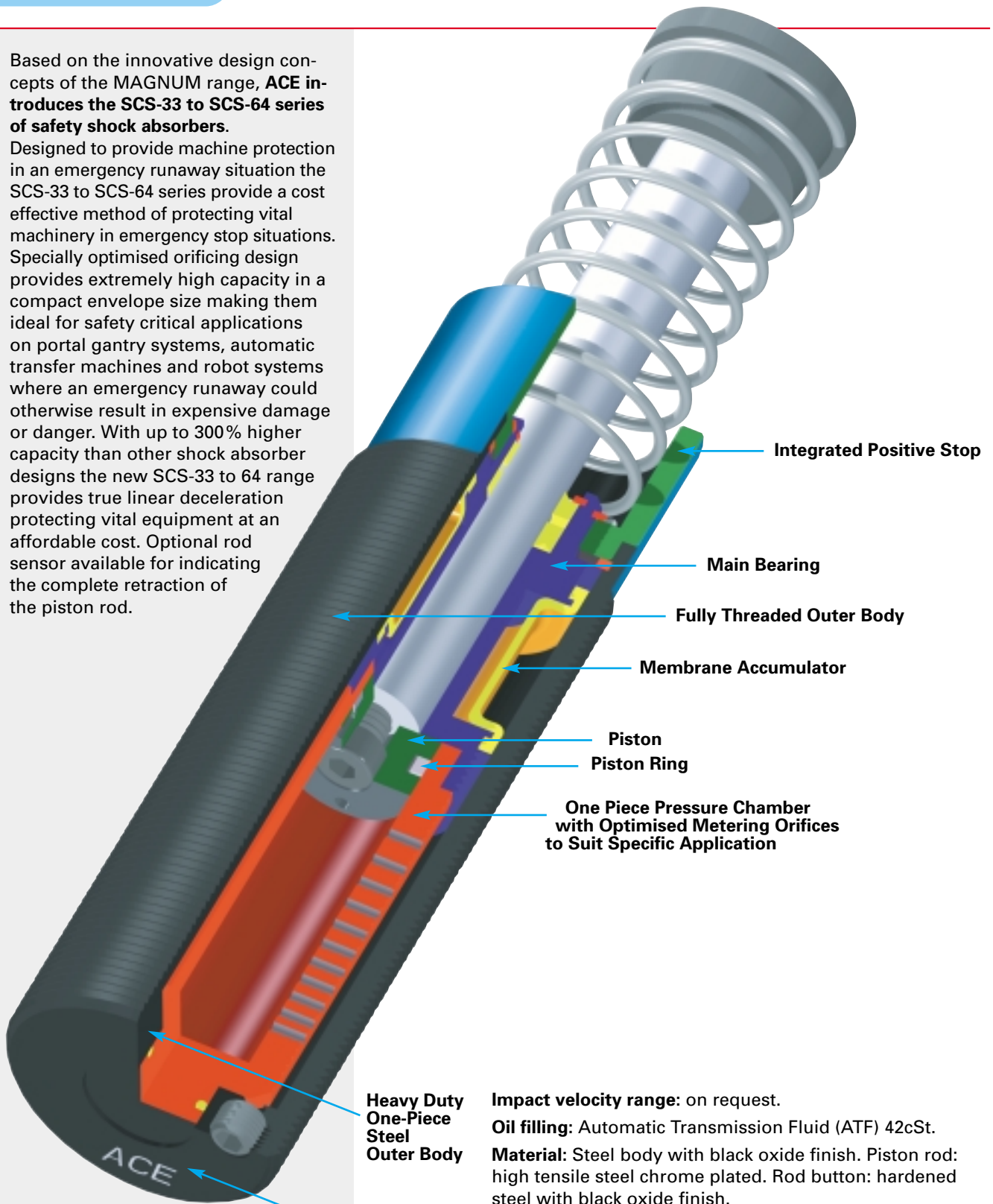


By means of a lever the effective stroke length can be increased and mounting space to the left reduced.

Based on the innovative design concepts of the MAGNUM range, **ACE introduces the SCS-33 to SCS-64 series of safety shock absorbers.**

Designed to provide machine protection in an emergency runaway situation the SCS-33 to SCS-64 series provide a cost effective method of protecting vital machinery in emergency stop situations. Specially optimised orificing design provides extremely high capacity in a compact envelope size making them ideal for safety critical applications on portal gantry systems, automatic transfer machines and robot systems where an emergency runaway could otherwise result in expensive damage or danger. With up to 300% higher capacity than other shock absorber designs the new SCS-33 to 64 range provides true linear deceleration protecting vital equipment at an affordable cost. Optional rod sensor available for indicating the complete retraction of the piston rod.

56



Integrated Positive Stop

Main Bearing

Fully Threaded Outer Body

Membrane Accumulator

Piston

Piston Ring

One Piece Pressure Chamber with Optimised Metering Orifices to Suit Specific Application

Heavy Duty One-Piece Steel Outer Body

Unique Identification Code Number

Impact velocity range: on request.

Oil filling: Automatic Transmission Fluid (ATF) 42cSt.

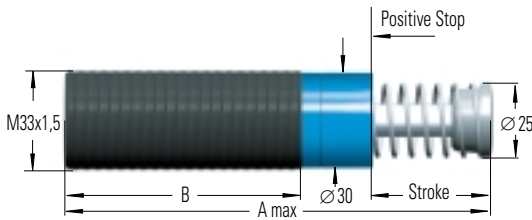
Material: Steel body with black oxide finish. Piston rod: high tensile steel chrome plated. Rod button: hardened steel with black oxide finish. Return spring: zinc plated.

Mounting: in any position.

Temperature range: -12°C to 70°C. Higher temperatures on request.

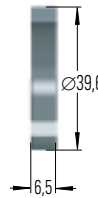


Part Number SCS-33 . . .



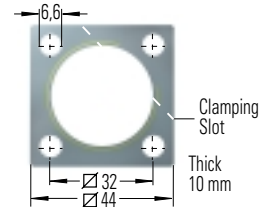
Basic Unit

NM 33



Locking Ring

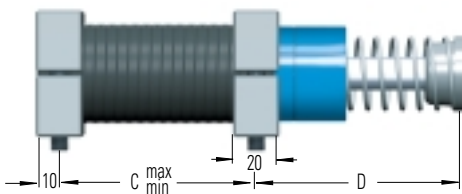
QF 33



Square Flange

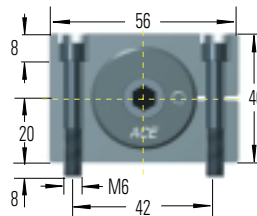
Install with 4 machine screws with
Tightening torque: 11 Nm
Clamping torque: > 90 Nm

S 33



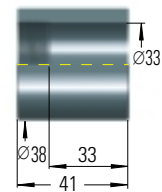
Side Foot Mounting Kit

S 33 = 2 Flanges + 4 Screws M6x40, DIN 912



Tightening torque 11 Nm (Screws)
Clamping torque > 90 Nm

AH 33



Stop Collar

for propelling forces
higher than 55 kN

Ordering Example

SCS-33-50-S-Dxxxx

Safety Shock Absorber _____
Thread Size M33 _____
Max. Stroke without Positive Stop 50 mm _____
Mounting Style: Foot _____
Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load	m (kg)
Emergency Impact Speed	v (m/s) max.
Normal Speed	vs (m/s) min.
Motor Power	P (kW)
Stall Torque Factor	HM (normal 2.5)
Number of Absorbers in Parallel	n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Energy capacity W_3 : At max. side load angle do not exceed 80% of rated max. energy capacity below.

Return spring force: 45 to 135 N.

Operating temperature range: -12°C to 70°C.

Impact cycles per hour: Emergency use only.

In creep speed the shock absorber can be pushed through its stroke.

In creep speed conditions the shock absorber provides minimal resistance and there is no braking effect.

Calculation: For further details of calculation and selection please consult ACE.

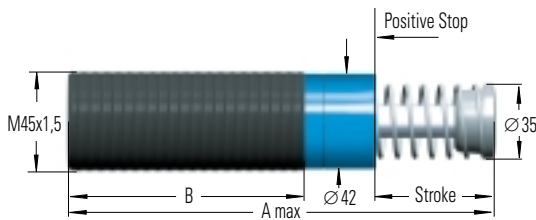
The calculation and selection of the correct ACE Safety Shock Absorber for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

Model Part Number	Stroke mm	A max	B	C min	C max	D	Max. Energy Capacity per Cycle		Max. Side Load Angle	Weight kg
							Standard W_3 max Nm	Optimised Version W_3 max Nm		
SCS-33-25	23	138	83	25	60	68	310	500	3	0.45
SCS-33-50	48.5	189	108	32	86	93	620	950	2	0.54

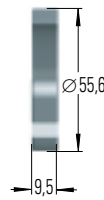
NOTE: Hydros shock super high capacity version available at additional cost.

Part Number SCS-45 . . .



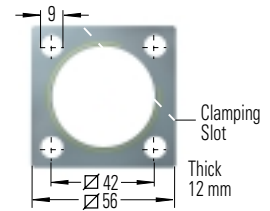
Basic Unit

NM 45



Locking Ring

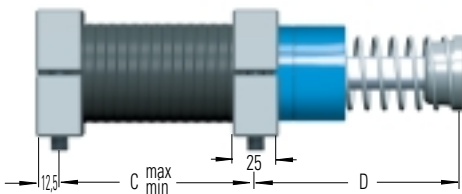
QF 45



Square Flange

Install with 4 machine screws with
Tightening torque: 27 Nm
Clamping torque: > 200 Nm

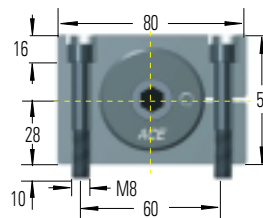
S 45



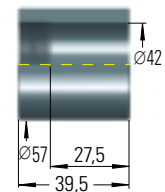
Side Foot Mounting Kit

S 45 = 2 Flanges + 4 Screws M8x50, DIN 912

AH 45



Tightening torque 27 Nm (Screws)
Clamping torque > 350 Nm



Stop Collar

for propelling forces
higher than 90 kN

Ordering Example

SCS-45-75-S-Dxxxx

Safety Shock Absorber _____
Thread Size M45 _____
Max. Stroke without Positive Stop 75 mm _____
Mounting Style: Foot _____
Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
Emergency Impact Speed v (m/s) max.
Normal Speed vs (m/s) min.
Motor Power P (kW)
Stall Torque Factor HM (normal 2.5)
Number of Absorbers in Parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Energy capacity W_3 : At max. side load angle do not exceed 80% of rated max. energy capacity below.

Return spring force: 50 to 180 N.

Operating temperature range: -12°C to 70°C.

Impact cycles per hour: Emergency use only.

In creep speed the shock absorber can be pushed through its stroke.

In creep speed conditions the shock absorber provides minimal resistance and there is no braking effect.

Calculation: For further details of calculation and selection please consult ACE.

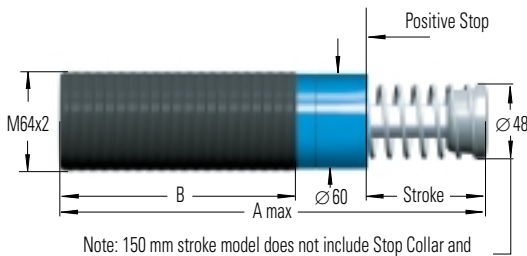
The calculation and selection of the correct ACE Safety Shock Absorber for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

Model Part Number	Stroke mm	A max	B	C min	C max	D	Max. Energy Capacity per Cycle		Max. Side Load Angle °	Weight kg
							Standard W_3 max. Nm	Optimised Version W_3 max. Nm		
SCS-45-25	23	145	95	32	66	66	680	1 200	3	1.13
SCS-45-50	48.5	195	120	40	92	91	1 360	2 350	2	1.36
SCS-45-75	74	246	145	50	118	116	2 040	3 500	1	1.59

NOTE: Hydros shock super high capacity version available at additional cost.

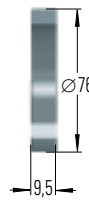
Part Number SCS-64 . . .



Note: 150 mm stroke model does not include Stop Collar and positive stop is provided by the rod button which is 60 mm dia.

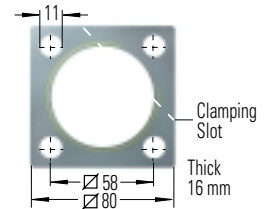
Basic Unit

NM 64



Locking Ring

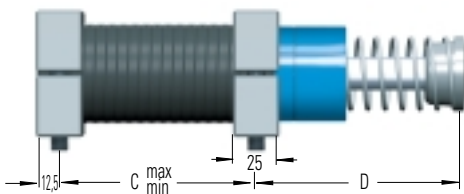
QF 64



Square Flange

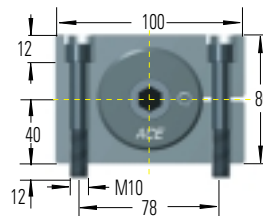
Install with 4 machine screws with
Tightening torque: 50 Nm
Clamping torque: > 210 Nm

S 64



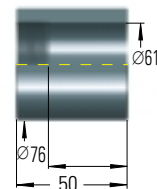
Side Foot Mounting Kit

S 64s = 2 Flanges + 4 Screws M10x80, DIN 912



Tightening torque 50 Nm (Screws)
Clamping torque > 350 Nm

AH 64



Stop Collar

for propelling forces
higher than 140 kN

Ordering Example

SCS-64-50-S-Dxxxx

Safety Shock Absorber _____
Thread Size M64 _____
Max. Stroke without Positive Stop 50 mm _____
Mounting Style: Foot _____
Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
Emergency Impact Speed v (m/s) max.
Normal Speed vs (m/s) min.
Motor Power P (kW)
Stall Torque Factor HM (normal 2.5)
Number of Absorbers in Parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Energy capacity W_3 : At max. side load angle do not exceed 80% of rated max. energy capacity below.

Return spring force: 75 to 365 N.

Operating temperature range: -12°C to 70°C.

Impact cycles per hour: Emergency use only.

In creep speed the shock absorber can be pushed through its stroke.

In creep speed conditions the shock absorber provides minimal resistance and there is no braking effect.

Calculation: For further details of calculation and selection please consult ACE.

The calculation and selection of the correct ACE Safety Shock Absorber for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

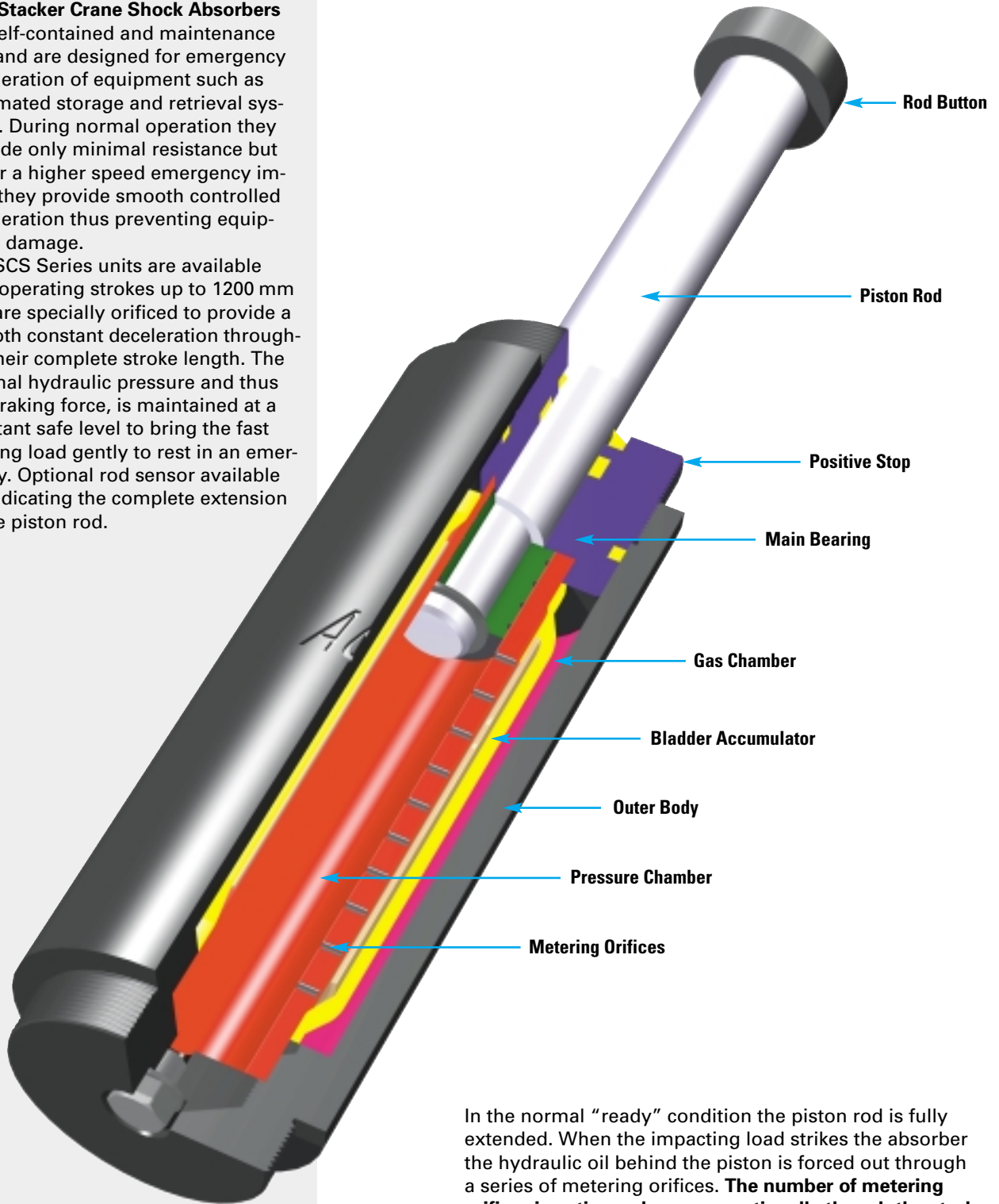
Model Part Number	Stroke mm	A max	B	C min	C max	D	Max. Energy Capacity per Cycle		Max. Side Load Angle °	Weight kg
							Standard W_3 max. Nm	Optimised Version W_3 max. Nm		
SCS-64-50	48.5	225	140	50	112	100	3 400	6 000	3	2.90
SCS-64-100	99.5	326	191	64	162	152	6 800	12 000	2	3.70
SCS-64-150	150	450	241	80	212	226	10 200	18 000	1	5.10

NOTE: Hydros shock super high capacity version available at additional cost.

ACE Stacker Crane Shock Absorbers

are self-contained and maintenance free and are designed for emergency deceleration of equipment such as automated storage and retrieval systems. During normal operation they provide only minimal resistance but under a higher speed emergency impact they provide smooth controlled deceleration thus preventing equipment damage.

The SCS Series units are available with operating strokes up to 1200 mm and are specially orificed to provide a smooth constant deceleration throughout their complete stroke length. The internal hydraulic pressure and thus the braking force, is maintained at a constant safe level to bring the fast moving load gently to rest in an emergency. Optional rod sensor available for indicating the complete extension of the piston rod.

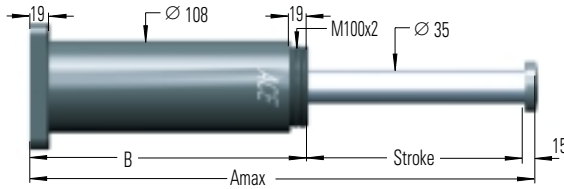


In the normal "ready" condition the piston rod is fully extended. When the impacting load strikes the absorber the hydraulic oil behind the piston is forced out through a series of metering orifices. **The number of metering orifices in action reduces proportionally though the stroke and the load velocity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

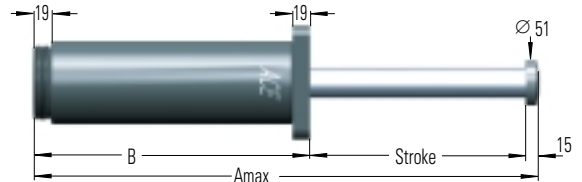


Part Number SCS-38 . . .

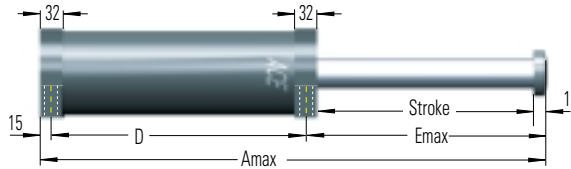
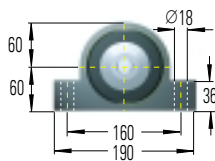
Rear Flange -R



Front Flange -F



Side Foot Mounting -S



Ordering Example

SCS-38-400-F-X

Stacker Crane Shock Absorber _____
 Bore Size \varnothing 38 mm _____
 Stroke 400 mm _____
 Mounting Style: Front Flange _____
 Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
 Full Load Speed v (m/s) min./max.
 Creep Speed vs (m/s) max.
 Motor Power P (kW)
 Stall Torque Factor ST (normal 2.5)
 Number of Absorbers in parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

- Impact velocity range v:** 0.9 to 4.6 m/s.
- Reaction force Q:** at max. capacity rating = 80 kN max.
- Energy capacity W_3 :** At max. side load angle do not exceed 80% of rated max. energy capacity below.
- Return force:** 0.6 to 0.7 kN.
- Filling pressure:** approx. 2 bar.
- Operating temperature range:** -12°C to 66°C (For lower temperatures please consult ACE).

- In Creep Speed:** The shock absorber can be pushed through its stroke.
- In creep speed conditions the shock absorber provides minimal resistance and there is no braking effect.
- Calculation:** For further details of calculation and selection please consult ACE.
- The calculation and selection of the correct ACE Stacker Crane Shock Absorber for your application should be referred to ACE for approval and assignment of unique identification number.**

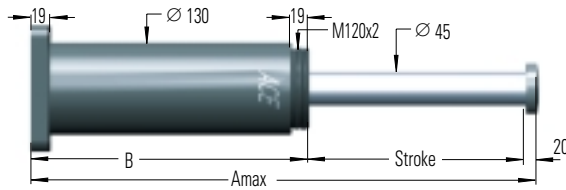
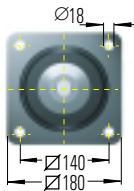
Dimensions and Capacity Chart

Model Part Number	Stroke mm	A	B	D	E	Max. Energy Capacity per Cycle		Max. Side Load Angle		Weight kg	
						W_3	max. kNm	Mounting Style F & S	R	Mounting Style F & R	S
SCS-38-50	50	270	205	175	80	3.6	5	4	12	13	
SCS-38-100	100	370	255	225	132	7.2	5	4	14	15	
SCS-38-150	150	470	305	275	180	10.8	5	4	16	17	
SCS-38-200	200	570	355	325	230	14.4	5	4	18	19	
SCS-38-250	250	670	405	375	280	18	4.7	3.7	20	21	
SCS-38-300	300	785	470	440	330	21.6	3.9	2.9	22	23	
SCS-38-350	350	885	520	490	380	25.2	3.4	2.4	24	25	
SCS-38-400	400	1 000	585	555	430	28.8	3	2	26	27	
SCS-38-500	500	1 215	700	670	530	36	2.4	1.4	30	31	
SCS-38-600	600	1 430	815	785	630	43.2	1.9	0.9	34	35	
SCS-38-700	700	1 645	930	900	730	50.4	1.6	0.6	38	39	
SCS-38-800	800	1 860	1 045	1 015	830	57.6	1.3	0.3	43	44	

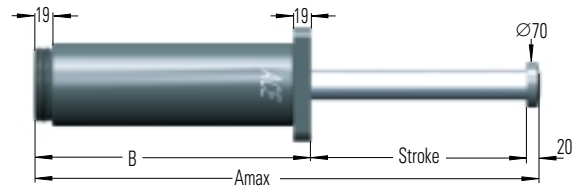
For other stroke lengths, special options (such as higher or lower impact velocity etc.), please consult ACE.

Part Number SCS-50 . . .

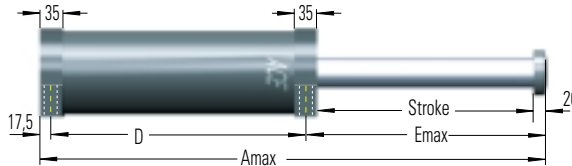
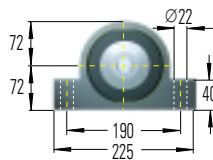
Rear Flange -R



Front Flange -F



Side Foot Mounting -S



62

Ordering Example

SCS-50-400-F-X

Stacker Crane Shock Absorber _____
 Bore Size ϕ 50 mm _____
 Stroke 400 mm _____
 Mounting Style: Front Flange _____
 Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
 Full Load Speed v (m/s) min./max.
 Creep Speed vs (m/s) max.
 Motor Power P (kW)
 Stall Torque Factor ST (normal 2.5)
 Number of Absorbers in Parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Impact velocity range v: 0.6 to 4.6 m/s.

Reaction force Q: At max. capacity rating = **160 kN max.**

Energy capacity W₃: At max side load angle do not exceed 80 % of rated max.energy capacity below.

Return force: 1.0 to 1.2 kN.

Filling pressure: Approx. 2 bar.

Operating temperature range: -12°C to 66°C.
 (For lower temperatures please consult ACE).

In creep speed: The shock absorber can be pushed through its stroke.

In creep speed conditions the shock absorber provides minimal resistance and there is no braking effect.

Calculation: For further details of calculation and selection please consult ACE.

The calculation and selection of the correct ACE Stacker Crane Shock Absorber for your application should be referred to ACE for approval and assignment of unique identification number.

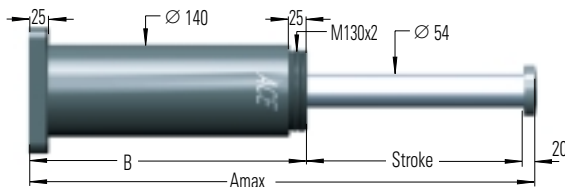
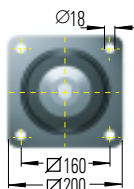
Dimensions and Capacity Chart

Model Part Number	Stroke mm	A	B	D	E	Max. Energy Capacity per Cycle		Max. Side Load Angle		Weight kg	
						W ₃	max. kNm	Mounting Style F & S	Mounting Style R	Mounting Style F & R	Mounting Style S
SCS-50-100	100	390	270	235	138	14		5	4	22	23
SCS-50-150	150	490	320	285	188	21		5	4	25	26
SCS-50-200	200	590	370	335	238	28		5	4	27	28
SCS-50-250	250	690	420	385	288	35		4.5	3.5	30	31
SCS-50-300	300	805	485	450	338	42		3.8	2.8	33	34
SCS-50-350	350	905	535	500	388	49		3.3	2.3	35	37
SCS-50-400	400	1020	600	565	438	56		2.9	1.9	38	40
SCS-50-500	500	1235	715	680	538	70		2.3	1.3	44	45
SCS-50-600	600	1450	830	795	638	84		1.9	0.9	50	51
SCS-50-700	700	1665	945	910	738	98		1.6	0.6	55	57
SCS-50-800	800	1880	1060	1025	838	112		1.3	0.3	61	63
SCS-50-1000	1000	2310	1290	1255	1038	140		1	-	72	74

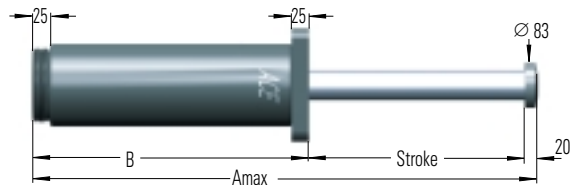
For other stroke lengths, special options (such as higher or lower impact velocity etc.), please consult ACE.

Part Number SCS-63 . . .

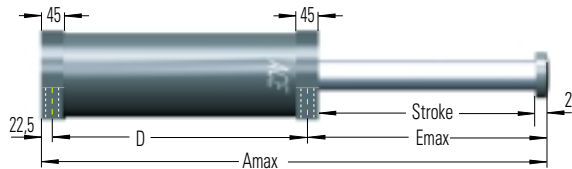
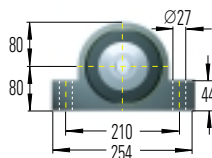
Rear Flange -R



Front Flange -F



Side Foot Mounting -S



Ordering Example

SCS-63-400-F-X

Stacker Crane Shock Absorber _____
 Bore Size \varnothing 63 mm _____
 Stroke 400 mm _____
 Mounting Style: Front Flange _____
 Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
 Full Load Speed v (m/s) min./max.
 Creep Speed vs (m/s) max.
 Motor Power P (kW)
 Stall Torque Factor ST (normal 2.5)
 Number of Absorbers in Parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Impact velocity range v: 0.5 to 4.6 m/s.

Reaction force Q: At max capacity rating = 210 kN max.

Energy capacity W_3 : at max. side load angle do not exceed 80 % of rated max. energy capacity below.

Return force: 1.5 to 2.5 kN.

Filling pressure: Approx. 2 bar.

Operating temperature range: -12°C to +66°C.
 (For lower temperatures please consult ACE).

In creep speed: The shock absorber can be pushed through its stroke.

In creep speed conditions the shock absorber provides minimal resistance and there is no braking effect.

Calculation: For further details of calculation and selection please consult ACE.

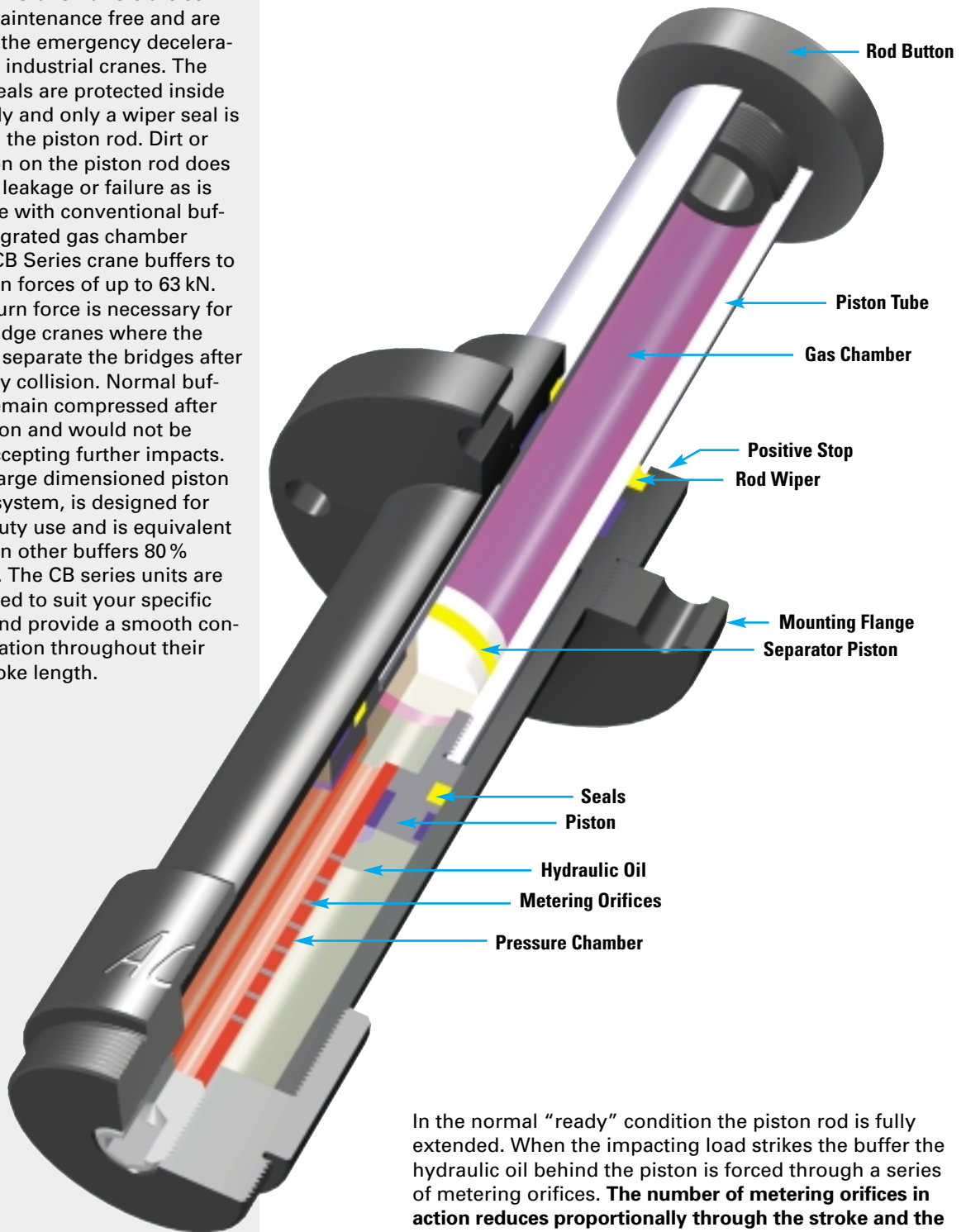
The calculation and selection of the correct ACE Stacker Crane Shock Absorber for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

Model Part Number	Stroke mm	A	B	D	E	Max. Energy Capacity per Cycle		Max. Side Load Angle Mounting Style		Weight kg	
						W_3	max. kNm	F & S	R	F & R	S
SCS-63-100	100	405	285	240	143	18	5	4	29	32	
SCS-63-150	150	505	335	290	193	27	5	4	32	35	
SCS-63-200	200	605	385	340	243	36	5	4	35	38	
SCS-63-250	250	705	435	390	293	45	5	4	38	42	
SCS-63-300	300	805	485	440	343	54	5	4	41	45	
SCS-63-350	350	925	555	510	393	63	5	4	45	49	
SCS-63-400	400	1025	605	560	443	72	5	4	48	52	
SCS-63-500	500	1245	725	680	543	90	4.2	3.2	55	60	
SCS-63-600	600	1445	825	780	643	108	3.4	2.4	62	66	
SCS-63-700	700	1665	945	900	746	126	2.9	1.9	69	73	
SCS-63-800	800	1865	1045	1000	843	144	2.5	1.5	75	79	
SCS-63-1000	1000	2285	1265	1220	1043	180	1.9	0.9	89	93	
SCS-63-1200	1200	2705	1485	1440	1243	216	1.4	0.4	102	106	

For other stroke lengths, special options (such as higher or lower impact velocity etc.), please consult ACE.

ACE Industrial Crane Buffers are self-contained, maintenance free and are designed for the emergency deceleration of heavy industrial cranes. The primary oil seals are protected inside the main body and only a wiper seal is necessary on the piston rod. Dirt or contamination on the piston rod does not cause oil leakage or failure as is often the case with conventional buffers. The integrated gas chamber enables the CB Series crane buffers to provide return forces of up to 63 kN. This high return force is necessary for multiple – bridge cranes where the buffers must separate the bridges after an emergency collision. Normal buffers would remain compressed after such a collision and would not be capable of accepting further impacts. The robust, large dimensioned piston rod bearing system, is designed for very heavy duty use and is equivalent to that used in other buffers 80% larger in size. The CB series units are custom orificed to suit your specific application and provide a smooth constant deceleration throughout their complete stroke length.

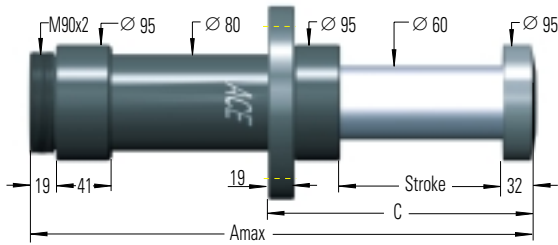


In the normal "ready" condition the piston rod is fully extended. When the impacting load strikes the buffer the hydraulic oil behind the piston is forced through a series of metering orifices. **The number of metering orifices in action reduces proportionally through the stroke and the load velocity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

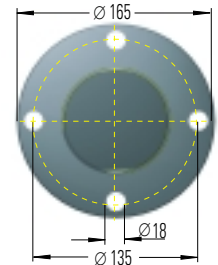
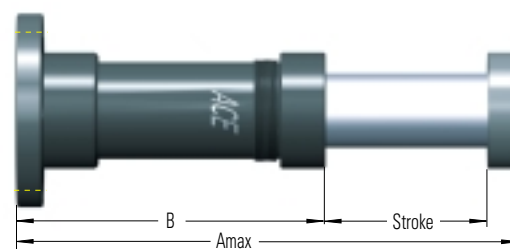


Part Number CB-63 . . .

Front Flange -F



Rear Flange -R



Ordering Example

CB-63-400-F-X

Crane Buffer _____
 Bore Size \varnothing 63 mm _____
 Stroke 400 mm _____
 Mounting Style: Front Flange _____
 Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
 Full Load Speed v (m/s) min./max.
 Creep Speed v_s (m/s) max.
 Motor Power P (kW)
 Stall Torque Factor ST (normal 2.5)
 Number of Buffers in Parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Impact velocity range v : 0.5 to 4.6 m/s.

Reaction force Q : At max. capacity rating = **187 kN. max.**

Operating temperature range: -12°C to $+66^{\circ}\text{C}$.
 (For lower temperatures please consult ACE).

Materials: Steel body with black oxide finish. Piston rod hard chrome plated.

In creep speed: It is possible to use up to approx. 60% of the buffer stroke.

The initial fill pressure governs the rod return force.

The calculation and selection of the correct ACE Crane Buffer for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

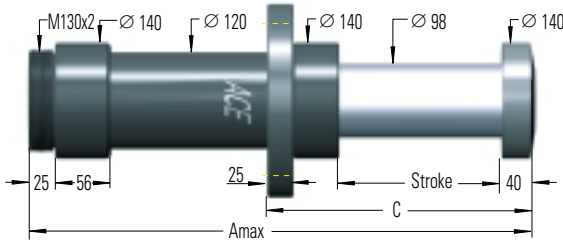
Model	Stroke mm	A	B	C	Piston Rod Return Force		Max. Energy Capacity per Cycle W_3 (kJ)	Effective Weight m_e (kg)*	Max. Side Load Angle ($^{\circ}$)	Weight (kg)
					min. (kN)	max.				
CB-63-100	100	420	288	192	1.5	16	16	900 - 128 000	3.5	12.7
CB-63-200	200	700	468	292	1.5	21	32	1 800 - 256 000	3	16.7
CB-63-300	300	980	648	392	1.5	24	48	2 700 - 384 000	2.5	20.8
CB-63-400	400	1 260	828	492	1.5	25	64	3 700 - 512 000	2	24.8
CB-63-500	500	1 540	1 008	592	1.5	26	80	4 700 - 640 000	1.5	28.8

* The correct effective weight range for your application will be calculated by ACE and should fall within this band.

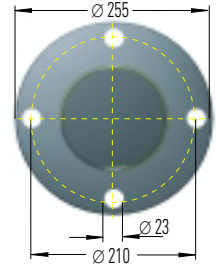
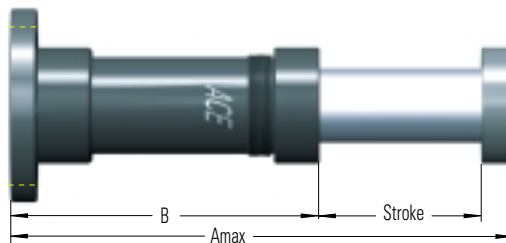
Special options: Special oils, Special flanges, additional corrosion protection etc. available on request.

Part Number CB-100 . . .

Front Flange -F



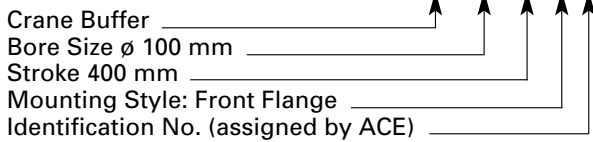
Rear Flange -R



66

Ordering Example

CB-100-400-F-X



Complete Details Required when Ordering:

Moving Load	m	(kg)
Full Load Speed	v	(m/s) min./max.
Creep Speed	vs	(m/s) max.
Motor Power	P	(kW)
Stall Torque Factor	ST	(normal 2.5)
Number of Buffers in Parallel	n	

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Impact velocity range v: 0.5 to 4.6 m/s.

Reaction force Q: At max. capacity rating = **467 kN**.

Operating temperature range: -12°C to +66°C.
(For lower temperatures please consult ACE).

Materials: Steel body with black oxide finish. Piston rod hard chrome plated.

In creep speed: It is possible to use up to approx. 60 % of the buffer stroke.

The initial fill pressure governs the rod return force.

The calculation and selection of the correct ACE Crane Buffer for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

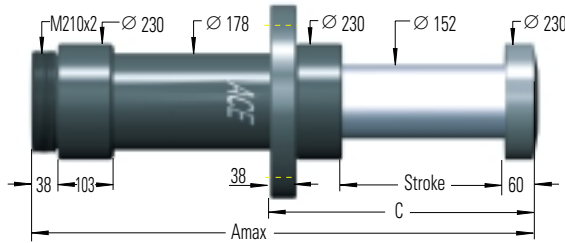
Type	Stroke mm	A	B	C	Piston Rod Return Force		Max. Energy Capacity per Cycle W ₃ (kJ/m)	Effective Weight m _e (kg)*	Max. Side Load Angle (°)	Weight (kg)
					min. (kN)	max.				
CB-100-200	200	735	495	320	3.9	40	80	6 900 - 640 000	4	42.5
CB-100-300	300	1 005	665	420	3.9	50	120	10 300 - 960 000	3.5	50.8
CB-100-400	400	1 275	835	520	3.9	57	160	13 800 - 1 280 000	3	59.1
CB-100-500	500	1 545	1 005	620	3.9	63	200	17 200 - 1 600 000	2.5	67.5
CB-100-600	600	1 815	1 175	720	3.9	68	240	20 700 - 1 920 000	2	75.8

* The correct effective weight range for your application will be calculated by ACE and should fall within this band.

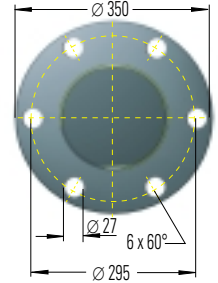
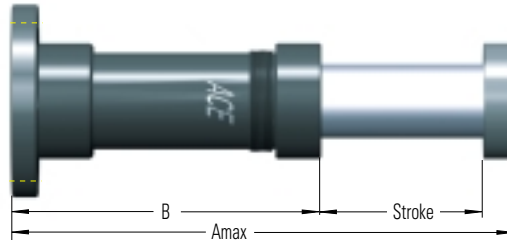
Special options: Special oils, Special flanges, additional corrosion protection etc. available on request.

Part Number CB-160 . . .

Front Flange -F



Rear Flange -R



Ordering Example

CB-160-400-F-X

Crane Buffer _____
 Bore Size ϕ 160 mm _____
 Stroke 400 mm _____
 Mounting Style: Front Flange _____
 Identification No. (assigned by ACE) _____

Complete Details Required when Ordering:

Moving Load m (kg)
 Full Load Speed v (m/s) min./max.
 Creep Speed v_s (m/s) max.
 Motor Power P (kW)
 Stall Torque Factor ST (normal 2.5)
 Number of Buffers in Parallel n

or technical data according to formulae and calculations on page 13 to 15.

Technical Data

Impact velocity range v : 0.5 to 4.6 m/s.

Reaction force Q : At max. capacity rating = 700 kN.

Operating temperature range: -12°C to $+66^{\circ}\text{C}$.
 (For lower temperatures please consult ACE).

Materials: Steel body with black oxide finish. Piston rod hard chrome plated.

In creep speed: It is possible to use up to approx. 60% of the buffer stroke.

The initial fill pressure governs the rod return force.

The calculation and selection of the correct ACE Crane Buffer for your application should be referred to ACE for approval and assignment of unique identification number.

Dimensions and Capacity Chart

Type	Stroke mm	A	B	C	Piston Rod Return Force		Max. Energy Capacity per Cycle W_3 (kJ)	Effective Weight m_e (kg) *	Max. Side Load Angle ($^{\circ}$)	Weight (kg)
					min. (kN)	max.				
CB-160-400	400	1400	940	600	9.6	63	240	22 700 - 1 920 000	4	155
CB-160-600	600	2000	1340	800	9.6	63	360	34 000 - 2 880 000	3	188
CB-160-800	800	2600	1740	1000	9.6	63	480	45 400 - 3 840 000	2	221

* The correct effective weight range for your application will be calculated by ACE and should fall within this band.

Special options: Special oils, Special flanges, additional corrosion protection etc. available on request.

Manual and Maintenance Instructions for Safety Shock Absorbers Type SCS and CB

ACE security shock absorbers are high-quality products. To achieve long-lasting and trouble free operating life please read the following instructions before installation.

Inner Pressure Tube Characteristics

The inner pressure tube is individually designed and manufactured for each specific application. When several safety shock absorbers of the same size but with different metering orifice patterns are used in one system it is important that the mounting positions are not mixed up. Safety shock absorbers have individually designed orifice patterns depending upon application and therefore must only be installed in correct position.

The calculation and selection of the correct safety shock absorbers should be performed or checked by ACE.

Mounting

To mount the shock absorber, we recommend the use of original ACE mounting accessories shown in catalogue. The mounting of each shock absorber must be exactly positioned so that the reaction force (Q) can be adequately transmitted into the mounting structure.

ACE recommends installation via the **front flange – F** mounting style that ensures the maximum protection against buckling.

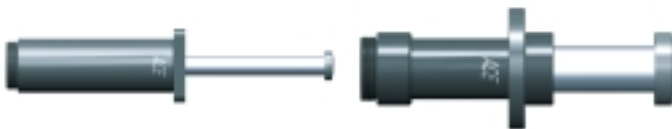
The damper must be mounted so that the moving loads are decelerated with the least possible side loading to the piston rod. The maximum permissible side load angles are detailed in our current catalogue.

The entire stroke length must be used for deceleration because only using part of the stroke can lead to over-stressing and damage to the unit.

Mounting style front flange – F

Safety Shock Absorber SCS

Safety Shock Absorber CB



Environmental Requirements

The permissible temperature range for each shock absorber type can be found in our current catalogue. **CAUTION:** Useage outside the specified temperature range can lead to premature breakdown and damage of of the shock absorbers which can then result in severe system damage or machine failures.

Trouble free operation outdoors or in damp environments is only warranted if the dampers are coated with a specific corrosion protection finish.

Initial Start-Up Checks

First impacts on the shock absorber should only be tried after correctly mounting and with reduced impact speeds and – if possible – with reduced load. Differences between calculated and actual operating data can then be detected early on, and damage to your system can be avoided. If the shock absorbers were selected on calculated data that does not correspond to the maximum possible loading (i.e. selection based on drive power being switched off or at reduced impact speed) then these restricted impact conditions must not be exceeded during initial testing or subsequent use of the system. Otherwise you risk damaging the shock absorbers and/or your machine by over-stressing materials. After the initial trial check that the piston rod fully extends again and that there are no signs of oil leakage. Also check that the mounting hardware is still securely tightened up.

You need to satisfy yourself that no damage has occurred to the piston rod or the body or the mounting hardware.

Fixed Mechanical Stop

Safety shock absorbers do not need an external mechanical stop. The stroke of the safety shock absorber is limited by the contact of the rod end button onto the front body of the shock absorber (with type SCS 33 to SCS 64 by the load contacting the integral or additional stop collar).

What Needs to be Checked after a Full Load Impact?

Safety shock absorbers that were originally checked only at reduced speed or load need to be checked again after a full load impact (i.e. Emergency use) has occurred.

Check that the piston rod fully extends to it's full out position, that there are no signs of oil leakage and that the mounting hardware is still securely fixed.

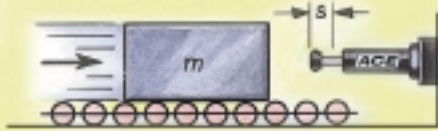
You need to satisfy yourself that no damage has occurred to the piston rod or the body or the mounting hardware. If no damage has occurred, the safety shock absorber can be put back into normal operation (see initial start-up).

Maintenance

Safety shock absorbers are sealed systems and do not need special maintenance. Safety shock absorbers that are not used regularly (i.e. that are intended for Emergency stop systems) should be checked within the normal time frame for safety checks, but **at least once a year**. At this time special attention must be paid to checking that the piston rod resets to its fully extended position, that there is no oil leakage and that the mounting brackets are still secure and undamaged. The piston rod must not show any signs of damage. Safety shock absorbers that are **in use regularly** should be checked every **three months**.

Repair Notice

If any damage to the shock absorber is detected or if there are any doubts as to the proper functioning of the unit please send the unit for service to ACE. Alternatively contact your local ACE office for further advice.



Controlled emergency stop

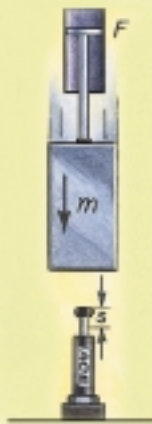
ACE Safety Shock Absorbers protect precision assembly jigs for the aircraft industry.

The basic mount of this coordinate measuring machine for the production of parts in the aircraft industry is made of granite and must not be damaged. To avoid damage from operating errors or mishandling, all movement axes were equipped with safety shock absorbers of the type **SCS-45-50**.

If the turntables malfunction the safety shock absorbers decelerate the loads before expensive damage can occur to the granite measuring tables.



Optimally protected turntable



Secured manufacturing

ACE Safety Shock Absorbers speed up the manufacturing of caravans.

In this production of caravan side panels made of compound materials, two complete production pieces are transported towards two portals with spindle-heads. The installed safety shock absorbers type **SCS-45-75** prevent the 5 500 kg load with speeds of up to 60 m/min nosediving into the valuable machine in case of a crash. In comparison to its predecessor, the safety features of the **SCS-45-75** protect the machine structure more effectively and allow for faster processing times.



Safety shock absorbers attached to the moveable part of the production line

The **Profile Damper Type TA** from the innovative ACE TUBUS series is a maintenance free, self-contained damping element made from a special Co-Polyester Elastomer.

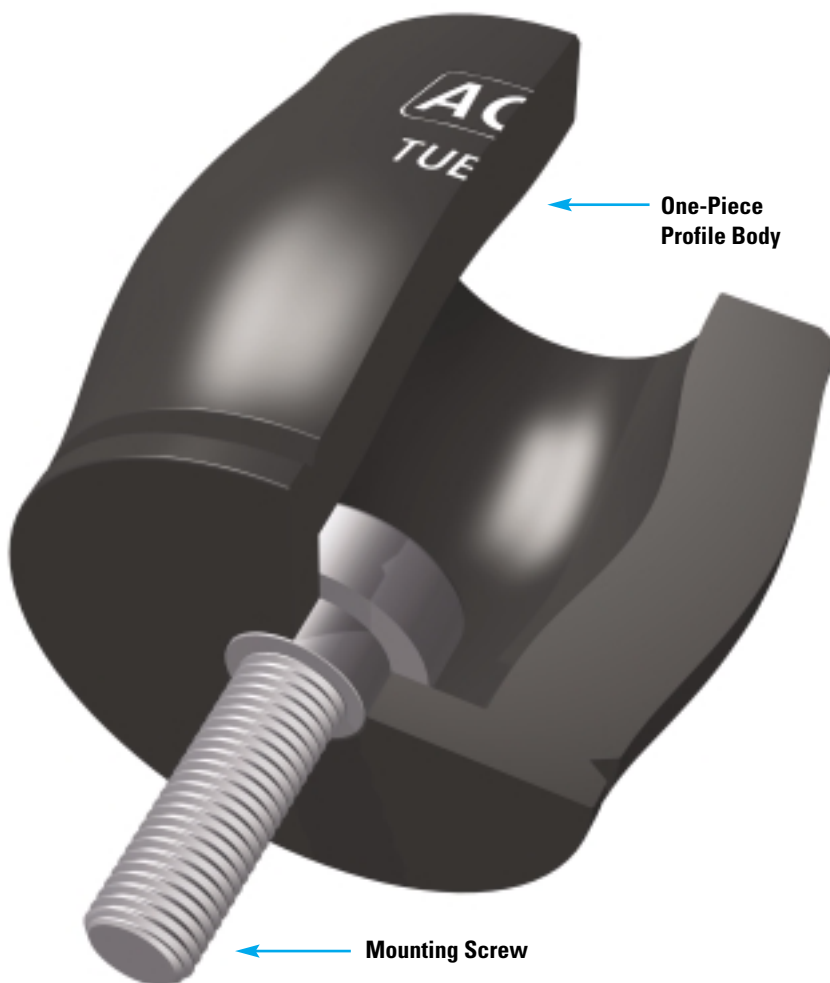
As a result of the degressive damping characteristic it provides a high energy absorption at the beginning of its stroke.

The excellent temperature characteristic of the material provides consistent damping performance over a temperature range of -40°C to 90°C.

The low installed weight, the economic price and the long operating life of up to 1 million cycles make this an attractive alternative to hydraulic end position damping, if the moving mass does not have to stop in an exact datum position and it is not necessary to absorb 100 % of the incoming energy. The **space-saving package size** ranges from \varnothing 12 mm up to \varnothing 116 mm and is very simply and quickly installed with the supplied specially stepped mounting screw.

The TA series have been specially developed to provide **Maximum Energy Capacity** in the **Minimum Mounting Space** in the capacity range from 2 Nm up to 2 000 Nm.

Life expectancy is extremely high; **up to twenty times** longer than for urethane dampers, **up to ten times** longer than rubber bumpers and **up to five times** longer than steel springs.



Overload capacity: For emergency use only (1 cycle) it is possible to exceed the W_3 rating by +40%.

Environment: Resistant to oil, grease, seawater and to microbe or chemical attack. Excellent UV and ozone resistance. Material does not absorb water or swell.

Dynamic force range: 980 N to 82 000 N

Temperature range: -40°C to 90°C

Energy absorption: 40 % to 66 %

Material hardness rating: Shore 55D

Mounting: in any position

Impact velocity range:

up to max. 5 m/s

Mounting screw torque:

M3: 2 Nm

M4: 4 Nm

M5: 6 Nm

M6: 10 Nm

M8: 25 Nm

M12: 85 Nm

M16: 210 Nm

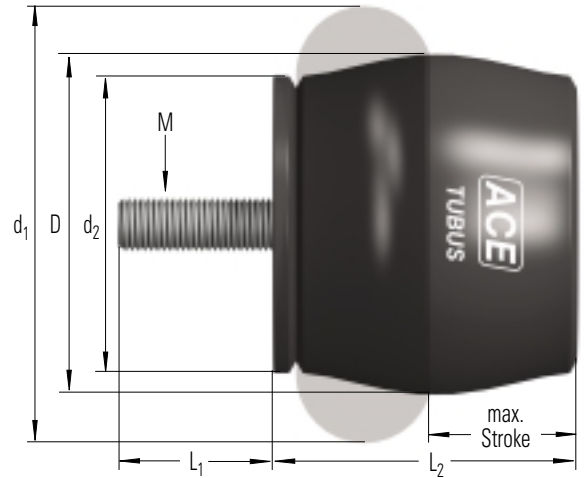
On request: Special strokes, -characteristics, -spring rates, -sizes and materials.

Calculation and selection to be approved by ACE.



Ordering Example TA 37-16

TUBUS axial
Outer- ϕ 37 mm
Stroke 16 mm



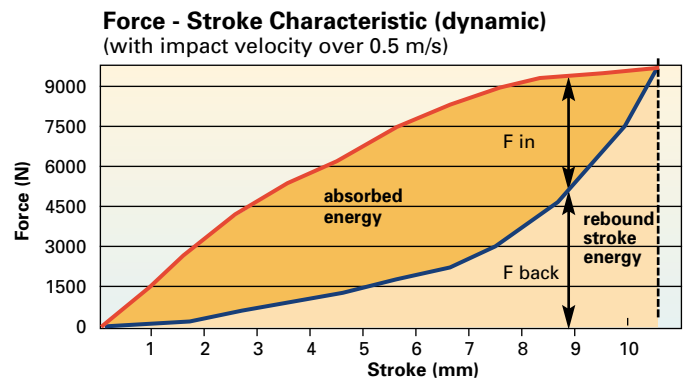
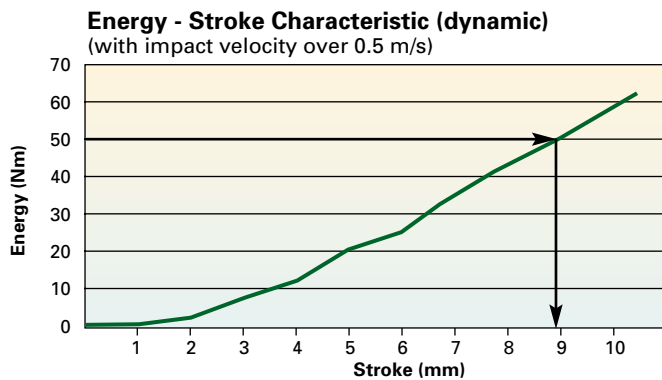
The calculation and selection of the required profile damper should be carried out or be approved by ACE.

Dimensions and Capacity Chart

Type	*W ₃ Nm/cycle	max Stroke mm	D	L ₁	M	L ₂	d ₁	d ₂	Weight in gm
TA 12-5	2	5	12	3	M3	11	15	11	3
TA 17-7	6	7	17	4	M4	16	22	15	4
TA 21-9	10	9	21	5	M5	18	26	18	5
TA 22-10	15	10	22	6	M6	19	27	19	5
TA 28-12	30	12	28	6	M6	26	36	25	10
TA 34-14	50	14	34	6	M6	30	43	30	20
TA 37-16	65	16	37	6	M6	33	48	33	25
TA 40-16	80	16	40	8	M8	35	50	34	30
TA 43-18	100	18	43	8	M8	38	55	38	40
TA 47-20	130	20	47	12	M12	41	60	41	50
TA 50-22	160	22	50	12	M12	45	64	44	60
TA 54-22	190	22	54	12	M12	47	68	47	65
TA 57-24	230	24	57	12	M12	51	73	50	90
TA 62-25	280	25	62	12	M12	54	78	53	105
TA 65-27	350	27	65	12	M12	58	82	57	130
TA 70-29	400	29	70	12	M12	61	86	60	145
TA 72-31	500	31	72	16	M16	65	91	63	175
TA 80-32	600	32	80	16	M16	69	100	69	225
TA 82-35	700	35	82	16	M16	74	105	72	260
TA 85-36	800	36	85	16	M16	76	110	75	300
TA 90-38	900	38	90	16	M16	80	114	78	335
TA 98-40	1200	40	98	16	M16	86	123	85	425
TA 116-48	2000	48	116	16	M16	101	146	98	740

* Max. Energy capacity per cycle for continuous use. For emergency use only (1 cycle) it is possible to exceed this rating by +40%.

Characteristics of Type TA 37-16



With the aid of the characteristic curves above you can estimate the proportion of the total energy that will be absorbed. Example: With impact energy of 50 Nm the Energy-Stroke diagram shows that a stroke of about 8.8 mm is needed. On the Force-Stroke diagram you can estimate the proportion of absorbed energy to rebound energy at this stroke length.

Dynamic ($v > 0.5$ m/s) and static ($v \leq 0.5$ m/s) characteristics of all types are available on request.

The **Profile Damper Type TS** from the innovative ACE TUBUS series is a maintenance free, self-contained damping element made from a special Co-Polyester Elastomer. As a result of the almost linear damping characteristic it provides a very smooth energy absorption with minimum reaction loads on the machine. The excellent temperature characteristic of the material provides consistent damping performance over a temperature range of -40°C to 90°C. The low installed weight, the economic price and the long operating life of up to 1 million cycles makes this an attractive alternative to hydraulic end position damping, if the moving mass does not have to stop in an exact datum position and it is not necessary to absorb 100% of the incoming energy.

The **space-saving** package size ranges from \varnothing 14 mm up to 107 mm and is very simply and quickly installed with the supplied specially stepped mounting screw.

The TS series have been specially developed to provide **Maximum Energy Capacity** in the **Minimum Mounting Space** in the capacity range from 2 Nm up to 910 Nm.

Life expectancy is extremely high; **up to twenty times** longer than for urethane dampers, **up to ten times** longer than rubber buffers and **up to five times** longer than steel springs.



Overload capacity: For emergency use only (1 cycle) it is possible to exceed the W_3 rating by +40%.

Environment: Resistant to oil, grease, seawater and to microbe or chemical attack. Excellent UV and ozone resistance. Material does not absorb water or swell.

Dynamic force range: 1300 N to 24 000 N

Temperature range: -40°C to 90°C

Energy absorption: 26% to 56%

Material hardness rating: Shore 40D

Mounting: in any position

Impact velocity range:
up to max. 5 m/s

Mounting screw torque:

M4: 4 Nm

M5: 6 Nm

M6: 10 Nm

M12: 85 Nm

M16: 210 Nm

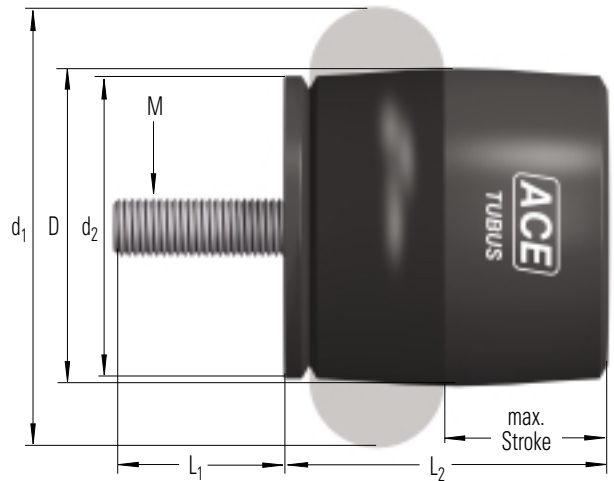
On request: special strokes, -characteristics, -spring rates, -sizes and materials.

Calculation and selection to be approved by ACE.



Ordering Example TS 44-23

TUBUS axial soft _____
 Outer- ϕ 44 mm _____
 Stroke 23 mm _____



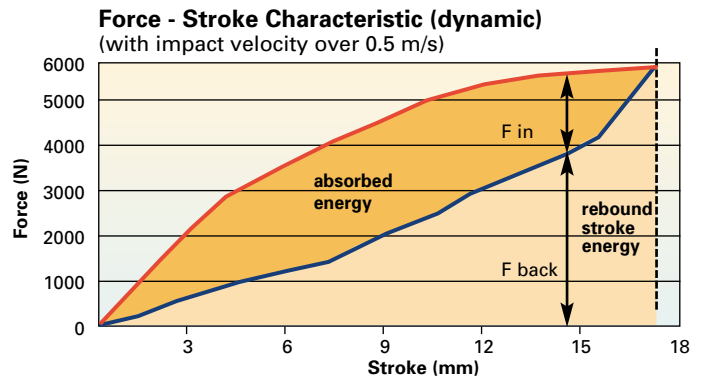
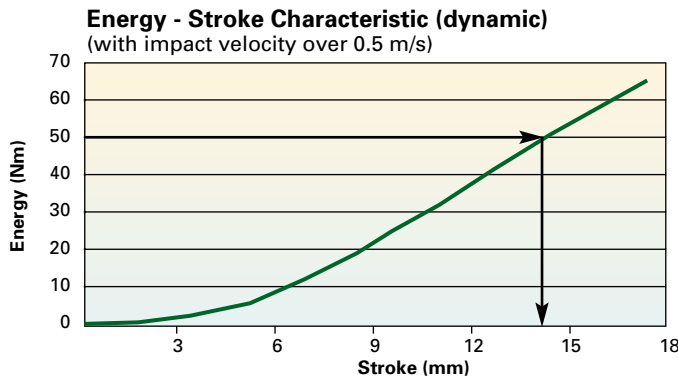
The calculation and selection of the required profile damper should be carried out or be approved by ACE.

Dimensions and Capacity Chart

Type	*W ₃ Nm/cycle	max Stroke mm	D	L ₁	M	L ₂	d ₁	d ₂	Weight in gm
TS 14-7	2	7	14	4	M4	15	19	13	3
TS 18-9	4	9	18	5	M5	18	24	16	4
TS 20-10	6	10	20	6	M6	21	27	19	5
TS 26-15	15	15	26	6	M6	28	37	25	10
TS 32-16	25	16	32	6	M6	32	44	30	15
TS 35-19	30	19	35	6	M6	36	48	33	25
TS 40-19	35	19	40	6	M6	38	51	34	30
TS 41-21	45	21	41	12	M12	41	55	38	40
TS 44-23	65	23	44	12	M12	45	60	40	45
TS 48-25	80	25	48	12	M12	49	64	44	60
TS 51-27	90	27	51	12	M12	52	69	47	70
TS 54-29	115	29	54	12	M12	55	73	50	80
TS 58-30	135	30	58	12	M12	59	78	53	100
TS 61-32	160	32	61	16	M16	62	83	56	120
TS 64-34	195	34	64	16	M16	66	87	60	145
TS 68-36	230	36	68	16	M16	69	92	63	165
TS 75-39	285	39	75	16	M16	75	101	69	210
TS 78-40	340	40	78	16	M16	79	105	72	245
TS 82-44	395	44	82	16	M16	84	110	75	275
TS 84-43	460	43	84	16	M16	85	115	78	300
TS 90-47	565	47	90	16	M16	92	124	84	395
TS 107-56	910	56	107	16	M16	110	147	100	615

* Max. Energy capacity per cycle for continuous use. For emergency use only (1 cycle) it is possible to exceed this rating by +40%.

Characteristics of Type TS 44-23



With the aid of the characteristic curves above you can estimate the proportion of the total energy that will be absorbed. Example: With impact energy of 50 Nm the Energy-Stroke diagram shows that a stroke of about 14 mm is needed. On the Force-stroke diagram you can estimate the proportion of absorbed energy to rebound energy at this stroke length.

Dynamic ($v > 0.5$ m/s) and static ($v \leq 0.5$ m/s) characteristics of all types are available on request.

The **Profile Damper Type TR** from the innovative ACE TUBUS series is a maintenance free, self-contained damping element made from a special Co-Polyester Elastomer. The radial deformation of the TR series provides a very long and soft deceleration with a progressive energy absorption towards the end of stroke. The excellent temperature characteristic of the material provides consistent damping performance over a temperature range of -40°C to 90°C. The low installed weight, the economic price and the long operating life of up to 1 million cycles makes this an attractive alternative to hydraulic end position damping, if the moving mass does not have to stop in an exact datum position and it is not necessary to absorb 100 % of the incoming energy.

The **space saving** package size ranges from \varnothing 29 mm up to \varnothing 100 mm and is very simply and quickly installed with the supplied specially stepped mounting screw.

The TR Series have been specially developed to provide **Maximum Stroke in the Minimum Mounting Space** in the capacity range from 2 Nm up to 115 Nm.

Life expectancy is extremely high; **up to twenty times** longer than for urethane dampers, **up to ten times** longer than rubber buffers and **up to five times** longer than steel springs.



Overload capacity: For emergency use only (1 cycle) it is possible to exceed the W_3 rating by + 40 %.

Environment: Resistant to oil, grease, seawater and to microbe or chemical attack. Excellent UV and ozone resistance. Material does not absorb water or swell.

Dynamic force range: 300 N to 6 200 N

Temperature range: -40°C to 90°C

Energy absorption: 17 % to 35 %

Material hardness rating:

Shore 40D

Mounting: in any position

Impact velocity range:

up to max. 5 m/s

Mounting screw torque:

M5: 6 Nm

M6: 10 Nm

M8: 25 Nm

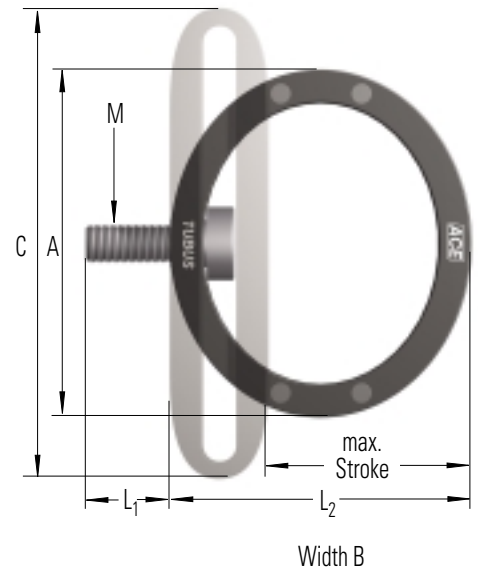
On request: special strokes, -characteristics, - spring rates, -sizes and materials.

Calculation and selection to be approved by ACE.



Ordering Example TR 93-57

TUBUS radial _____
 Outer- \varnothing 93 mm _____
 Stroke 57 mm _____



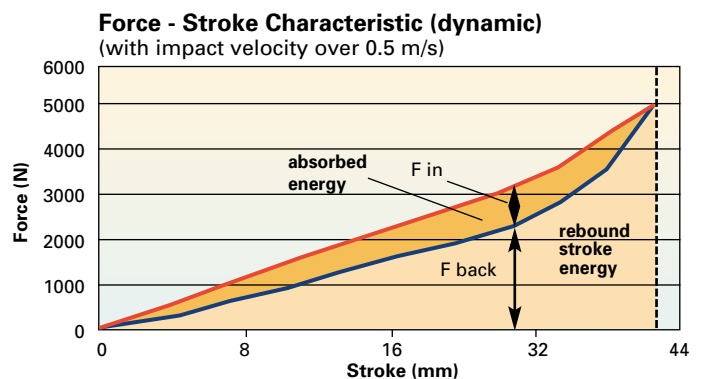
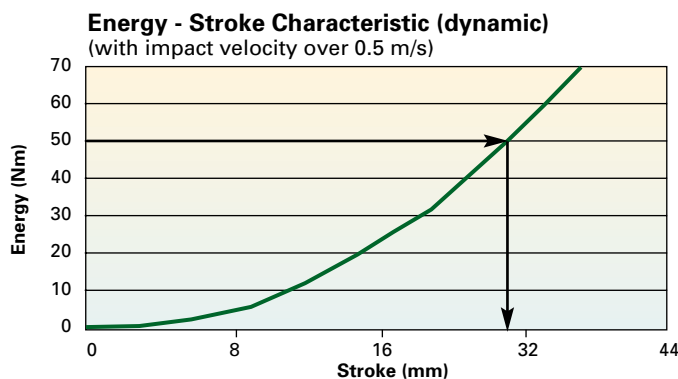
The calculation and selection of the required profile damper should be carried out or be approved by ACE.

Dimensions and Capacity Chart

Type	*W ₃ Nm/cycle	max. Stroke mm	A	L ₁	M	L ₂	B	C	Weight in gm
TR 29-17	2	17	29	5	M5	25	13	38	10
TR 37-22	3	22	37	5	M5	32	19	50	15
TR 43-25	4	25	43	5	M5	37	20	58	20
TR 50-35	6	35	50	5	M5	44	34	68	25
TR 63-43	15	43	63	5	M5	55	43	87	55
TR 67-40	25	40	67	5	M5	59	46	88	80
TR 76-46	40	46	76	6	M6	67	46	102	105
TR 83-50	45	50	83	6	M6	73	51	109	150
TR 85-50	70	50	85	8	M8	73	69	111	195
TR 93-57	90	57	93	8	M8	83	83	124	295
TR 100-60	115	60	100	8	M8	88	82	133	335

* Max. Energy capacity per cycle for continuous use. For emergency use only (1 cycle) it is possible to exceed this rating by +40%.

Characteristics of Type TR 93-57



With the aid of the characteristic curves above you can estimate the proportion of the total energy that will be absorbed. Example: With impact energy of 50 Nm the Energy-Stroke diagram shows that a stroke of about 31 mm is needed. On the Force-stroke diagram you can estimate the proportion of absorbed energy to rebound energy at this stroke length.

Dynamic ($v > 0.5$ m/s) and static ($v \leq 0.5$ m/s) characteristics of all types are available on request.

The **Radial Tube Damper Type TR-L** from the innovative ACE TUBUS series is a maintenance free, self-contained damping element made from a special Co-Polyester Elastomer. The radial deformation of the TR-L series provides a very long and soft deceleration with a progressive energy absorption towards the end of the stroke. The excellent temperature characteristic of the material provides consistent damping performance over a temperature range of -40°C to 90°C. The tube damper has been specially developed for applications that require very low reaction forces. The actual force generated depends upon the length of the tube damper chosen. The TUBUS TR-L type is suitable for a wide range of applications that require protection from shock or impact anywhere along a straight line. Typical applications include mining equipment, dockyard handling equipment and on baggage handling and conveyor systems. The special stepped mounting screws supplied make installation very quick and simple. The TR-L series have been developed to provide **maximum stroke** in the **minimum mounting space**.

Life expectancy is extremely high: up to **twenty times** longer than for urethane dampers, up to **ten times** longer than rubber buffers and up to **five times** longer than steel springs.

There are 3 small new types with mounting screw M5. They provide high energy capacity up to 30 Nm with a maximum height of 59 mm.

NEW



Overload capacity: For emergency use only (1 cycle) it is possible to exceed the W_3 rating by +40%.

Environment: Resistant to oil, grease, seawater and to microbe or chemical attack. Excellent UV and ozone resistance. Outer material does not absorb water or swell.

Dynamic force range: 6 800 N to 286 000 N

Temperature range:
-40°C to 90°C

Material: Shore 40D hardness.

Energy absorption:
14 % to 26 %

Mounting: in any position

Impact velocity range:
up to max. 5 m/s

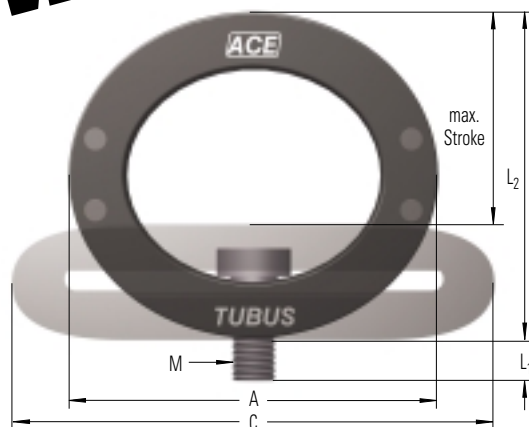
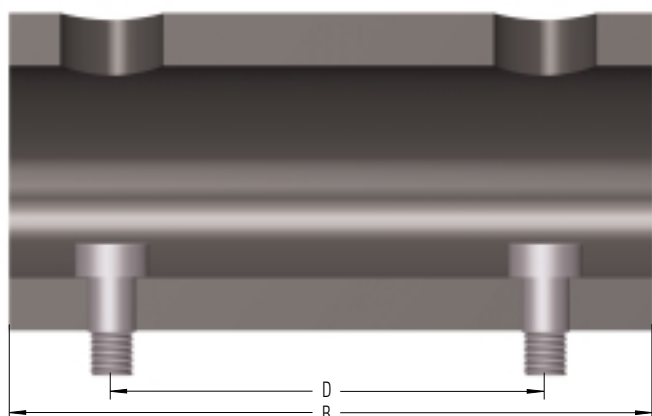
Mounting screw torque:
M5: 6 Nm
M8: 25 Nm
M16: 210 Nm

On request: special strokes, -colours, -sizes and materials.

Calculation and selection to be approved by ACE.



NEW



Ordering Example TR 66-40L-2

TUBUS radial long _____
 Outer-ø 66 mm _____
 Stroke 40 mm _____
 Length 2 = 305 mm _____

The calculation and selection of the required profile damper should be carried out or be approved by ACE.

Dimensions and Capacity Chart

Type	*W ₃ Nm/cycle	Reaction force in N	max. Stroke mm	A	B	C	D	M	L ₁	L ₂	Weight in kg
TR 29-17L	12	1450	17	29	80	38	40	M5	5	25	0.06
TR 43-25L	16	1900	25	43	80	58	40	M5	5	37	0.06
TR 63-43L	30	1950	43	63	80	87	40	M5	5	55	0.10
TR 66-40L-1	100	6800	40	66	152	87	102	M8	8	59	0.25
TR 66-40L-2	200	13600	40	66	305	87	254	M8	8	59	0.55
TR 66-40L-3	300	20400	40	66	457	87	406	M8	8	59	0.80
TR 66-40L-4	400	27200	40	66	610	87	559	M8	8	59	1.10
TR 66-40L-5	500	34000	40	66	762	87	711	M8	8	59	1.30
TR 76-45L-1	135	7200	45	76	152	100	102	M8	8	68	0.35
TR 76-45L-2	270	14500	45	76	305	100	254	M8	8	68	0.70
TR 76-45L-3	400	21700	45	76	457	100	406	M8	8	68	1.10
TR 76-45L-4	535	29000	45	76	610	100	559	M8	8	68	1.40
TR 76-45L-5	670	36300	45	76	762	100	711	M8	8	68	1.70
TR 83-48L-1	155	8100	48	83	152	106	102	M8	8	73	0.45
TR 83-48L-2	315	16300	48	83	305	106	254	M8	8	73	0.90
TR 83-48L-3	470	24500	48	83	457	106	406	M8	8	73	1.35
TR 83-48L-4	625	32600	48	83	610	106	559	M8	8	73	4.80
TR 83-48L-5	780	40800	48	83	762	106	711	M8	8	73	2.25
TR 99-60L-1	205	13600	60	99	152	130	102	M16	16	88	0.60
TR 99-60L-2	410	27200	60	99	305	130	254	M16	16	88	1.10
TR 99-60L-3	615	40800	60	99	457	130	406	M16	16	88	1.75
TR 99-60L-4	820	54400	60	99	610	130	559	M16	16	88	2.35
TR 99-60L-5	1025	68100	60	99	762	130	711	M16	16	88	2.90
TR 99-60L-6	1230	81700	60	99	914	130	864	M16	16	88	3.50
TR 99-60L-7	1435	95300	60	99	1067	130	1016	M16	16	88	4.10
TR 143-86L-1	575	31700	86	143	152	191	76	M16	16	127	1.25
TR 143-86L-2	1155	63500	86	143	305	191	203	M16	16	127	2.50
TR 143-86L-3	1730	95300	86	143	457	191	355	M16	16	127	3.80
TR 143-86L-4	2305	127100	86	143	610	191	508	M16	16	127	5.10
TR 143-86L-5	2880	158900	86	143	762	191	660	M16	16	127	6.40
TR 143-86L-6	3455	190600	86	143	914	191	812	M16	16	127	7.70
TR 143-86L-7	4030	224000	86	143	1067	191	965	M16	16	127	9.00
TR 188-108L-1	1350	40800	108	188	152	245	76	M16	16	165	2.15
TR 188-108L-2	2710	81700	108	188	305	245	203	M16	16	165	4.45
TR 188-108L-3	4060	122500	108	188	457	245	355	M16	16	165	6.70
TR 188-108L-4	5420	163400	108	188	610	245	508	M16	16	165	9.00
TR 188-108L-5	6770	204300	108	188	762	245	660	M16	16	165	11.20
TR 188-108L-6	8120	245100	108	188	914	245	812	M16	16	165	13.45
TR 188-108L-7	9480	286000	108	188	1067	245	965	M16	16	165	15.75

* Max. Energy capacity per cycle for continuous use. For emergency use only (1 cycle) it is possible to exceed this rating by +40%.

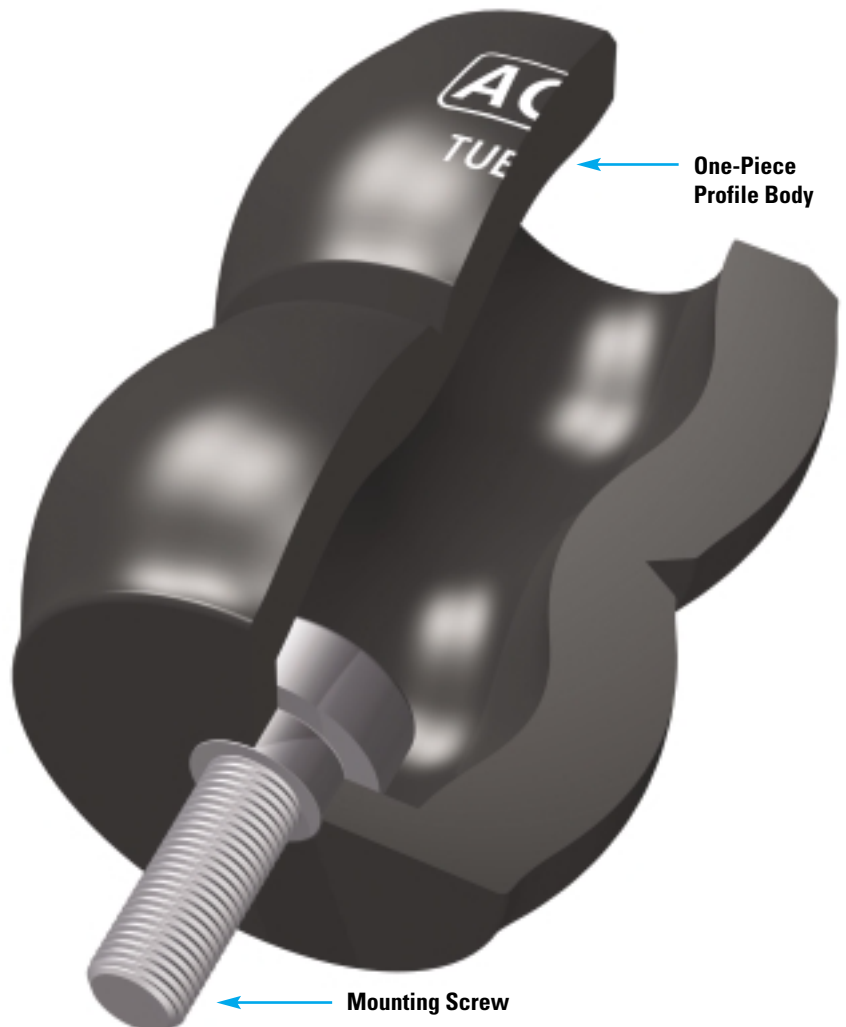
Issue 9.2004 Specifications subject to change

The **Profile Damper Type TC** from the innovative ACE TUBUS Series is a maintenance free, self-contained damping element made from a special Co-Polyester Elastomer. They have been specially developed for Crane equipment applications and fulfill the international Industry standards OSHA and CMAA.

Many crane applications require a spring rate with a high return force. This is achieved with the unique **Dual-Profile Concept** of the TC-S models. For Energy-Management-Systems the TC model types provide a cost efficient solution with a high return force capability.

The very small and light package size from \varnothing 64 mm up to \varnothing 176 mm covers an energy absorption capacity ranging from 450 Nm up to 12720 Nm/cycle. The excellent resistance to UV, sea-water chemical and microbe attack together with the wide operating temperature range from -40°C to 90°C enables a wide range of applications.

Life expectancy is extremely high; **up to twenty times** longer than for urethane dampers, up to **ten times** longer than rubber buffers and up to **five times** longer than steel springs.



Overload capacity: For emergency use only (1 cycle) it is possible to exceed the W_3 rating by +40%.

Environment: Resistant to oil, grease, seawater and to microbe or chemical attack. Excellent UV and ozone resistance. Material does not absorb water or swell.

Dynamic force range: 80 000 N to 978 000 N

Temperature range: -40°C to 90°C

Energy absorption:
31% to 63%

Material hardness rating:
Shore 55D

Mounting: in any position

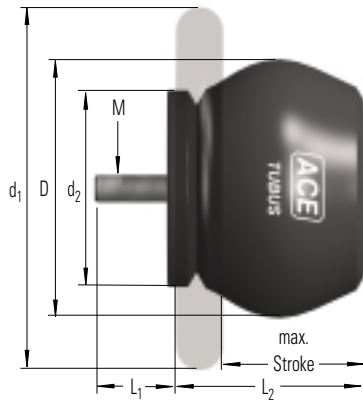
Impact velocity range:
up to max. 5 m/s

Mounting screw torque:
M12: 85 Nm
M16: 210 Nm

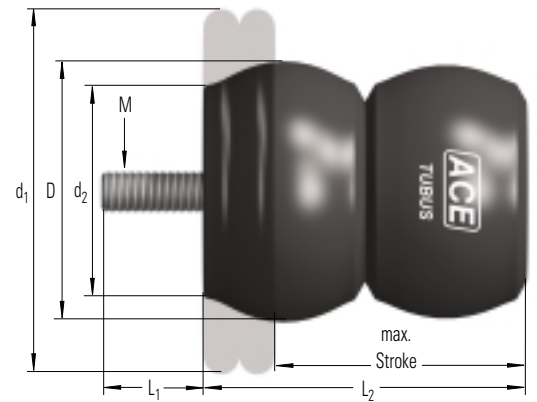
On request: special strokes, -characteristics, -spring rates, -sizes and materials.

Calculation and selection to be approved by ACE.





Model type TC



Model type TC-S

Ordering Example TC 83-73-S

TUBUS Crane Buffer _____
 Outer-ø 83 mm _____
 Stroke 73 mm _____
 Model type soft _____

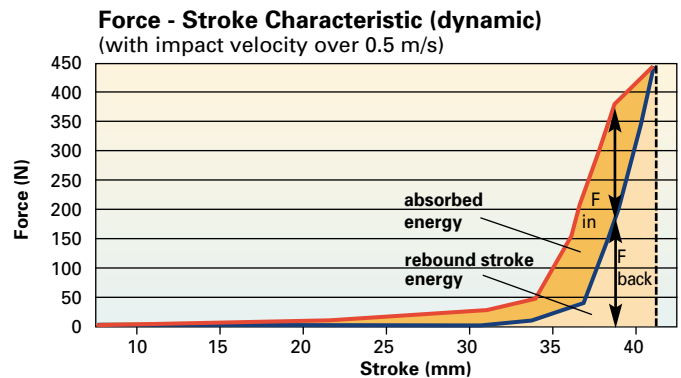
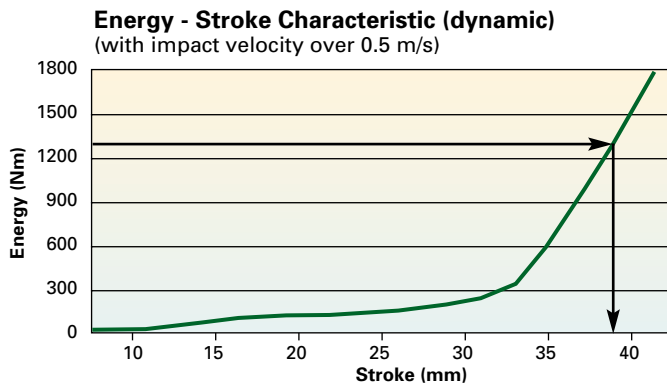
The calculation and selection of the required profile damper should be carried out or be approved by ACE.

Dimensions and Capacity Chart

Type	*W ₃ Nm/cycle	max. Stroke mm	D	L ₁	M	L ₂	d ₁	d ₂	Weight in kg
TC 64-62-S	450	62	64	12	M12	79	89	52	0.2
TC 74-76-S	980	76	74	12	M12	96	114	61	0.25
TC 83-73-S	1900	73	83	12	M12	94	127	69	0.3
TC 86-39	1210	39	86	12	M12	56	133	78	0.25
TC 90-49	1630	49	90	12	M12	68	124	67	0.25
TC 100-59	1770	59	100	12	M12	84	149	91	0.5
TC 102-63	1970	63	102	16	M16	98	140	82	0.5
TC 108-30	1900	30	108	12	M12	53	133	77	0.35
TC 117-97	3710	97	117	16	M16	129	188	100	1.0
TC 134-146-S	7290	146	134	16	M16	188	215	117	1.6
TC 136-65	4250	65	136	16	M16	106	178	106	1.1
TC 137-90	6350	90	137	16	M16	115	216	113	1.1
TC 146-67-S	8330	67	146	16	M16	118	191	99	1.5
TC 150-178-S	8860	178	150	16	M16	241	224	132	2.6
TC 153-178-S	7260	178	153	16	M16	226	241	131	2.3
TC 168-124	10100	124	168	16	M16	166	260	147	2.3
TC 176-198-S	12720	198	176	16	M16	252	279	150	3.6

* Max. Energy capacity per cycle for continuous use. For emergency use only (1 cycle) it is possible to exceed this rating by +40%.

Characteristics of Type TC 90-49

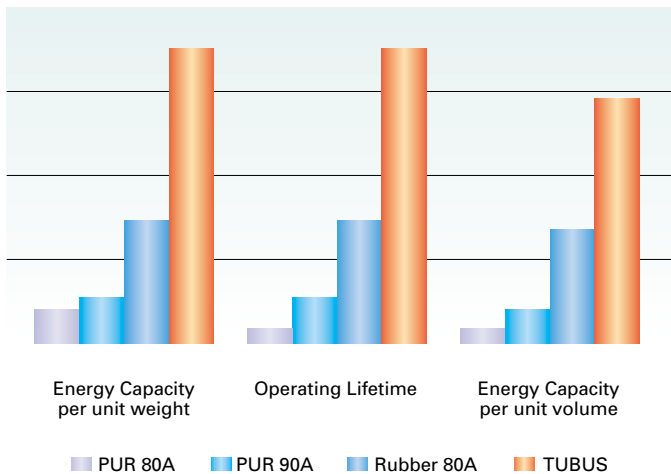


With the aid of the characteristic curves above you can estimate the proportion of the total energy that will be absorbed.
 Example: With impact energy of 1300 Nm the Energy-Stroke diagram shows that a stroke of about 38 mm is needed. On the Force-Stroke diagram you can estimate the proportion of absorbed energy to rebound energy at this stroke length.

Note: with these types the return force towards the end of the stroke is significant and we recommend you try to use a minimum of 90% of the total stroke available.

Dynamic ($v > 0.5$ m/s) and static ($v \leq 0.5$ m/s) characteristics of all types are available on request.

Physical Properties of TUBUS Profile Dampers



ACE TUBUS Profile Dampers are high performance damping elements made from a special Co-Polyester Elastomer. They have a high energy absorbing capacity compared with other materials.

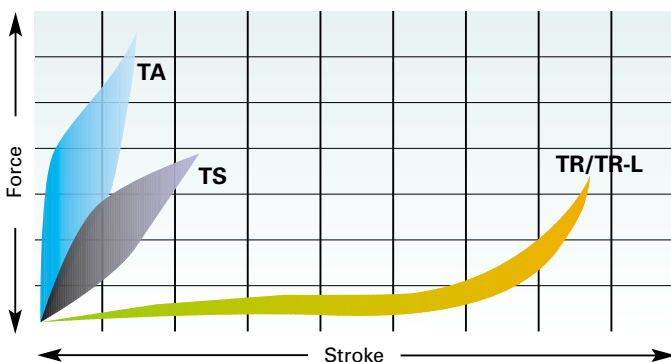
The TUBUS-series comprises 5 main types with over 80 individual models.

The excellent damping characteristics are achieved as a result of the special elastomer material and the worldwide patented construction design. This enables us to change the characteristics of the elastomer material so that individual and distinct damping curves are possible.

TUBUS dampers offer a considerable performance advantage when compared to other materials such as rubber, urethanes and steel springs.

A further advantage compared to other damping elements is the **operating life expectancy** – up to twenty times longer than with urethane dampers, up to ten times longer than with rubber dampers and up to five times longer than with steel spring dampers.

Comparison of Damping Characteristics



Characteristics of dynamic energy absorption for impact velocity over 0.5 m/s. For impact velocities under 0.5 m/s, please request a static characteristic curve.

The innovative TUBUS dampers absorb energy while exhibiting the following damping characteristics:

Model Type TA: Degressive characteristic with max. energy absorption (coloured area) with min. stroke. Energy absorption: 40 % to 66 %.

Model Type TS: Almost linear characteristic with low reaction force over a short operating stroke. Energy absorption: 26 % to 56 %.

Model Type TR/TR-L: Progressive characteristic with gradually increasing reaction force over a long stroke. Energy absorption **TR:** 17 % to 35 %
Energy absorption **TR-L:** 14 % to 26 %

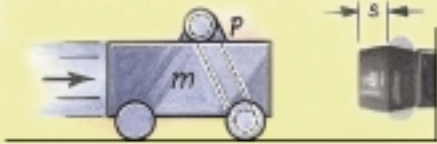
The material does not absorb water or swell and it is highly resistant to abrasion. Products of the TUBUS-series will work at temperatures of -40°C up to 90°C and are resistant to grease, oil, petroleum fluids, microbe and chemical attack and sea water. They also have good UV and ozone resistance. The very long service life of up to one million cycles, the compact size and the low unit weight differentiate the TUBUS profile dampers from all other types of elastomer damping elements.

If you are looking for an economic damping solution where the load does not need to be decelerated to an exact datum position and you do not need 100 % absorption of the impact energy then TUBUS dampers are a real alternative to hydraulic end position damping. They are the preferred solution for end stop dampers in robotic systems, high bay warehouse systems and all similar automated plant and machinery.

For the crane industry we manufacture special high capacity crane buffers that have an ideal deceleration characteristic with high return force for this type of application and energy capacities from 450 to 12 720 Nm. This means you can have a TUBUS crane buffer capable of providing up to 900 kN of braking force in a package only weighing 3 kg and absorbing up to 50 % of the energy.

Special Dampers

Besides the standard product range of the TUBUS-series there are also a large number of special products available upon request for customer-specific applications.



Safe end position damping

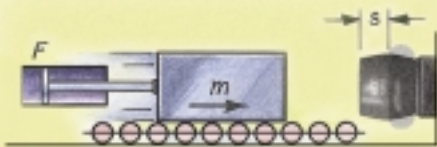
ACE TUBUS Profile Dampers protect the integrated loading station on a new high speed machining centre.

The ACE TUBUS damper is designed to prevent over-run on the high speed loading station of a Camshaft machining centre used in the automobile industry. In the event that the drive train fails during operation or incorrect data is inputted the ACE TUBUS damper absorbs the impact preventing costly damage to the machine. The **TA-98-40 TUBUS damper** impressed engineers with its exceptionally long service life in operation.

When used as an emergency stop the TUBUS damper can absorb up to 63% of the impact energy.



Safety with ultra high speed operation



Safe reliable cycling

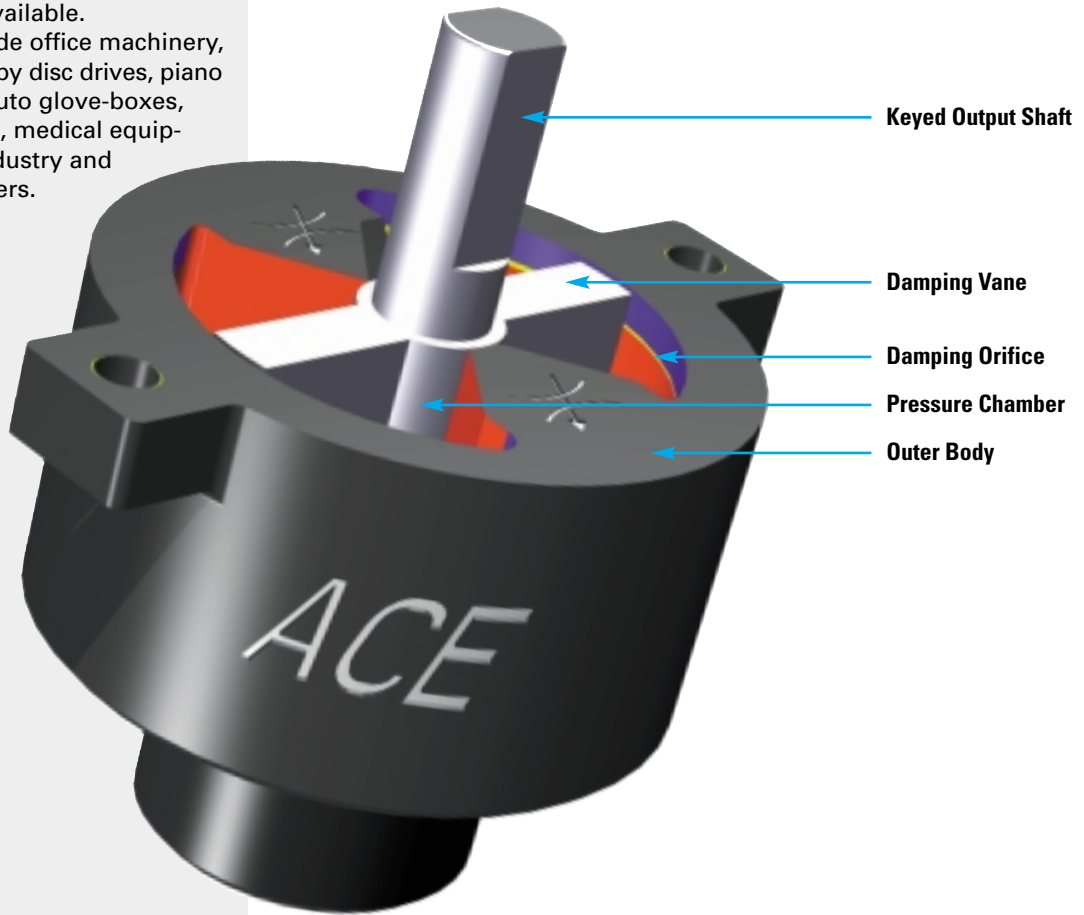
ACE TUBUS Profile Dampers prevent impact problems between the different directions of motion on a weigh feeder.

The illustrated weigh feeder is a critical production component and must always function correctly. A previous history of machine damage caused by the crossing of different motions in operation was eliminated by the use of TUBUS type **TA 22-10** profile dampers. Due to the co-polyester construction of TUBUS dampers a degressive damping curve could be engineered to suit the application. The combination of superior damage protection, small size and economic cost made the TUBUS damper the ideal solution for this critical application.



Consistent, safe operation of a weigh feeder

ACE Rotary Dampers are sealed maintenance free units. They are available with fixed or adjustable damping rates. The damping can be clockwise, anticlockwise or in both directions. The outer body is either plastic or metal depending upon model size. The output connection can be direct onto the keyed output shaft or indirect via a plastic gear (available with 4 standard modules). Plastic rack with modules of 0.5 to 1 are also available. Applications include office machinery, lids and flaps, floppy disc drives, piano lids, CD players, auto glove-boxes, vending machines, medical equipment, furniture industry and a multitude of others.

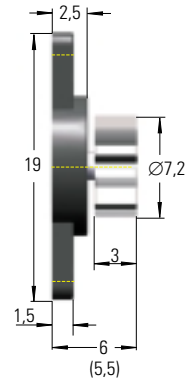
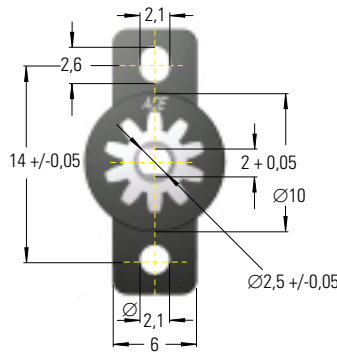


ACE Rotary Dampers guarantee the smooth controlled opening and closing of small lids, covers and flaps. They can be mounted directly on the pivot axis or can be used to provide linear damping by using a plastic gear and rack. They enable mechanisms to operate with a smooth controlled motion giving that "touch of quality" to whatever product they are used on. ACE rotary dampers are filled with a special high viscosity fluid (silicone type) and sealed for life. The fluid is passed through an orifice or groove by a rotating vane to provide damping resistance. The damping torque generated is determined by the fluid viscosity and by the orifice configuration.

Lifetime: With a max. rotational speed of 50 revs/min and a maximum of 10 cycles/min (12 cycles/min with the FDT/FDN types) the rotary dampers still provide more than 80% of their damping torque after a run of 50 000 cycles.



FRT-E2 (Bi-directional)



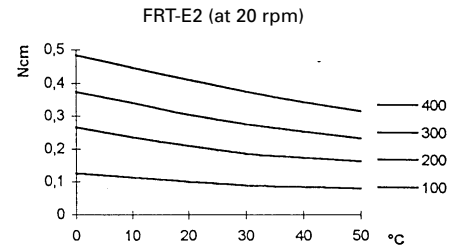
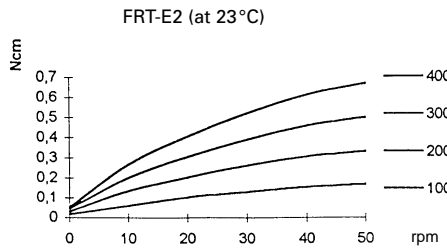
Dims. in () without gear

Models available FRT-E2 . . .

Damping action in both clockwise and anti-clockwise direction		
without gear	with gear	Damping torque Ncm (Nominal 20 rpm, 23°C)
FRT-E2-100	FRT-E2-100-G1	0.1 +/- 0.05
FRT-E2-200	FRT-E2-200-G1	0.2 +/- 0.07
FRT-E2-300	FRT-E2-300-G1	0.3 +/- 0.08
FRT-E2-400	FRT-E2-400-G1	0.4 +/- 0.10

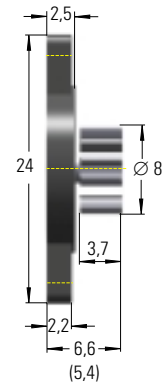
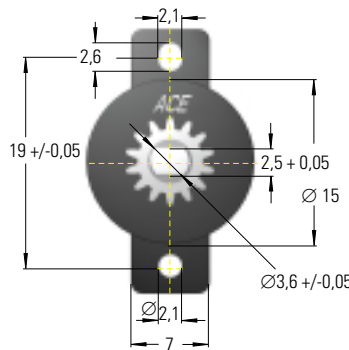
Material: Polycarbonate plastic
Temperature range: 0°C to 50°C

Gear data
 Tooth: Involute
 Module: 0.6*
 Pressure angle: 20°
 No. of teeth: 10
 P.C.D.: 6 mm



* A 250 mm long plastic rack is available for use with this part see page 89.

FRT-G2 (Bi-directional)



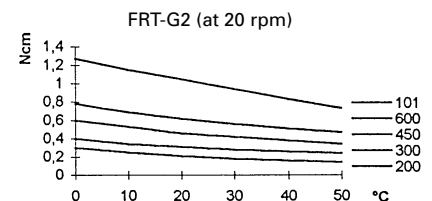
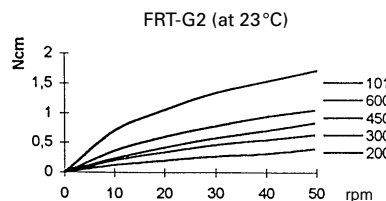
Dims. in () without gear

Models available FRT-G2 . . .

Damping action in both clockwise and anti-clockwise direction		
without gear	with gear	Damping torque Ncm (Nominal 20 rpm, 23°C)
FRT-G2-200	FRT-G2-200-G1	0.20 +/- 0.07
FRT-G2-300	FRT-G2-300-G1	0.30 +/- 0.08
FRT-G2-450	FRT-G2-450-G1	0.45 +/- 0.10
FRT-G2-600	FRT-G2-600-G1	0.60 +/- 0.12
FRT-G2-101	FRT-G2-101-G1	1.00 +/- 0.20

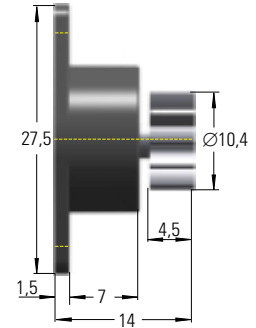
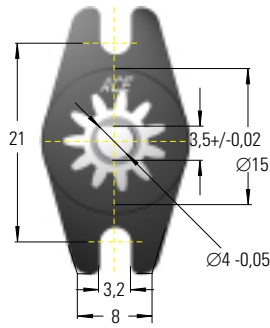
Material: Polycarbonate plastic
Temperature range: 0°C to 50°C

Gear data
 Tooth: Involute
 Module: 0.5*
 Pressure angle: 20°
 No. of teeth: 14
 P.C.D.: 7 mm



* A 250 mm long plastic rack is available for use with this part see page 89.

FRT-C2 and FRN-C2



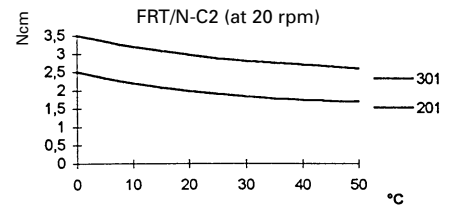
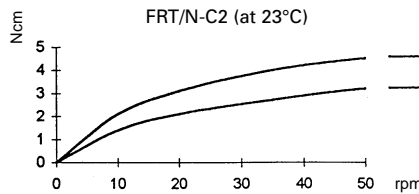
Models available FRT-C2 . . .

Model	Bi-directional damping	Right-hand damping (clockwise)	Left-hand damping (anti-clockwise)	Damping torque Ncm (Nominal 20 rpm. 23°C)
without gear	FRT-C2-201	FRN-C2-R201	FRN-C2-L201	2 +/- 0.6
without gear	FRT-C2-301	FRN-C2-R301	FRN-C2-L301	3 +/- 0.8
with gear	FRT-C2-201-G1	FRN-C2-R201-G1	FRN-C2-L201-G1	2 +/- 0.6
with gear	FRT-C2-301-G1	FRN-C2-R301-G1	FRN-C2-L301-G1	3 +/- 0.8

Material: Polycarbonate plastic
Temperature range: 0°C to 50°C

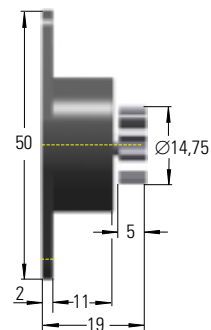
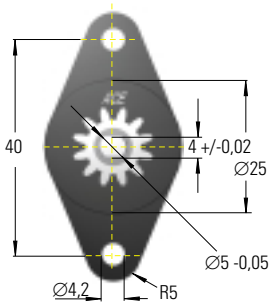
Gear data

Tooth: Involute
 Module: 0.8*
 Pressure angle: 20°
 No. of teeth: 11
 P.C.D.: 8.8 mm



* A 170 mm long flexible plastic rack and a 250 mm long rigid model are available for use with this part see page 89.

FRT-D2 and FRN-D2



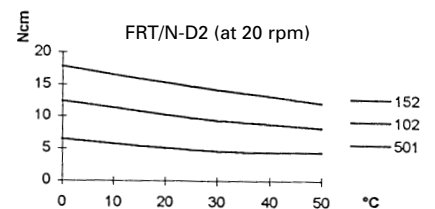
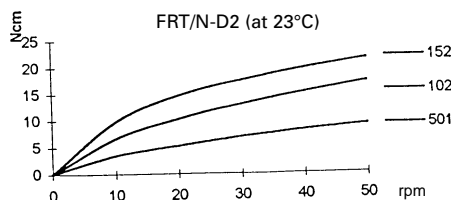
Models available FRT-D2 . . .

Model	Bi-directional damping	Right-hand damping (clockwise)	Left-hand damping (anti-clockwise)	Damping torque Ncm (Nominal 20 rpm. 23°C)
without gear	FRT-D2-501	FRN-D2-R501	FRN-D2-L501	5 +/- 1
without gear	FRT-D2-102	FRN-D2-R102	FRN-D2-L102	10 +/- 2
without gear	FRT-D2-152	FRN-D2-R152	FRN-D2-L152	15 +/- 3
with gear	FRT-D2-501-G1	FRN-D2-R501-G1	FRN-D2-L501-G1	5 +/- 1
with gear	FRT-D2-102-G1	FRN-D2-R102-G1	FRN-D2-L102-G1	10 +/- 2
with gear	FRT-D2-152-G1	FRN-D2-R152-G1	FRN-D2-L152-G1	15 +/- 3

Material: Polycarbonate plastic
Temperature range: 0°C to 50°C

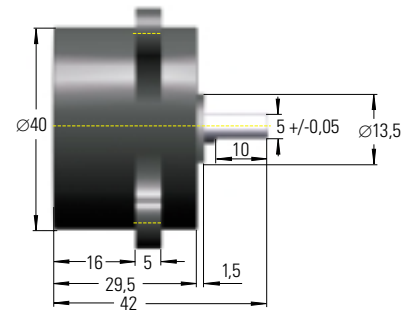
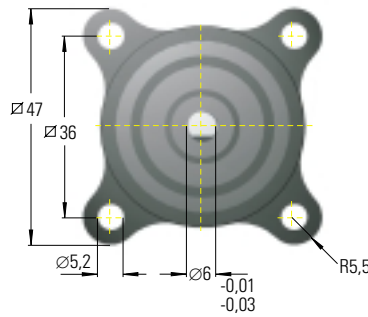
Gear data

Tooth: Involute
 Module: 1.0*
 Pressure angle: 20°
 No. of teeth: 12
 P.C.D.: 12.75 mm



* A 250 mm and 500 mm FRT plastic rack is available for use with this part see page 89.

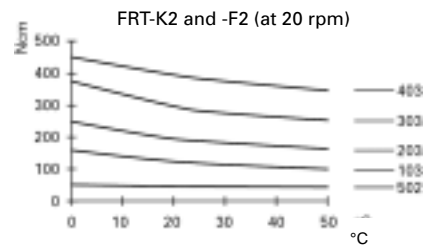
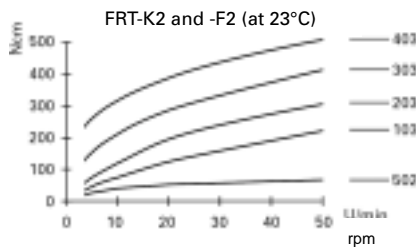
FRT/FRN-K2 and FRT/FRN-F2



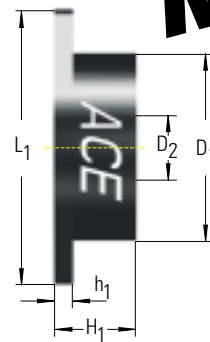
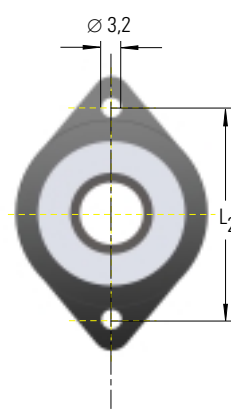
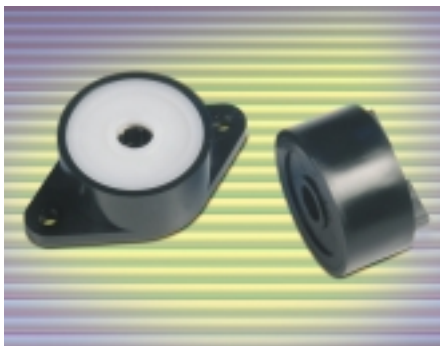
Models available FRT-F2 . . .

Model	Bi-directional damping	Right-hand damping clockwise	Left-hand damping anti-clockwise	Damping torque Ncm (Nominal 20 rpm, 23°C)
FRT-K2-502		FRN-K2-R502	FRN-K2-L502	50 +/- 10
FRT-K2-103		FRN-K2-R103	FRN-K2-L103	100 +/- 20
FRT-F2-203		FRN-F2-R203	FRN-F2-L203	200 +/- 40
FRT-F2-303		-	-	300 +/- 80
FRT-F2-403		-	-	400 +/- 100

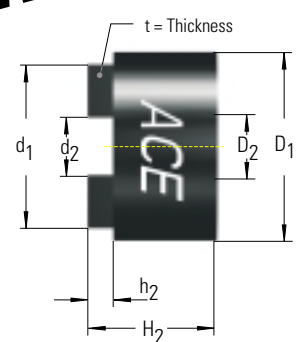
Material: Polycarbonate plastic
Temperature range: 0°C to 50°C
Weight max.: 0.116 kg



FFD



NEW



Models available FFD- . . .

Damping direction	Model	Damping torque in Nm	Dimensions		Flange Type				Standard Type					
			D ₁	D ₂	H ₁	h ₁	L ₁	L ₂	d ₁	d ₂	H ₂	h ₂	t	
unidirectional	FFD-25	0.1 / 0.5 / 1.0	25	6	13	3	42	34	21	6.2	16	4	4	
unidirectional	FFD-28	0.1 / 0.5 / 1.0	28	8	13	3	44	36	24	8.2	16	4	4	
unidirectional	FFD-30	0.1 / 0.5 / 1.0 / 1.5	30	10	13	3	46	38	26	10.2	16	4	4	
bi-directional	FFD-25	1.0 / 1.5 / 2.0	25	6	19	3	42	34	21	6.2	22	4	4	
bi-directional	FFD-28	1.0 / 1.5 / 2.0	28	8	19	3	44	36	24	8.2	22	4	4	
bi-directional	FFD-30	1.5 / 2.0 / 2.5 / 3.0	30	10	19	3	46	38	26	10.2	22	4	4	

Material: Polycarbonate plastic
Temperature range: -10°C to 60°C
Rotational speed max.: 30 rpm
Cycle rate max.: 13 cycles per min.
Recommended Shaft details: Ø⁺⁰/_{-0.03}

Ordering Example

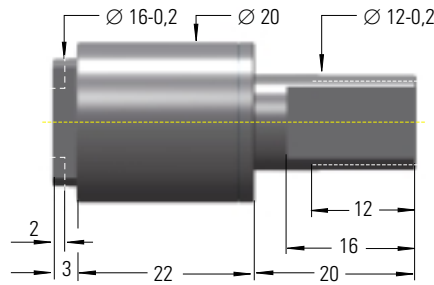
FFD-25-FS-L-102

Friction Damper _____ ↑
 Body Ø _____ ↑
 Mounting Style (Flange = F, Standard = S) _____ ↑
 Damping Option (unidirec. = S, bi-direc. = W) _____ ↑
 Damping Direction (right = R, left = L) _____ ↑
 Damping torque see chart _____ ↑

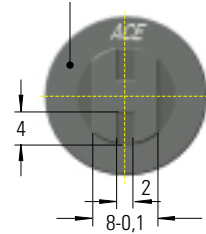
Damping torque

102 = 0.1 Nm
 502 = 0.5 Nm
 103 = 1.0 Nm
 153 = 1.5 Nm
 203 = 2.5 Nm
 303 = 3.0 Nm

FYN-N1



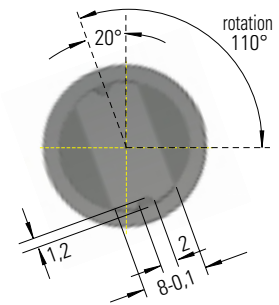
white end cap: left-hand damping
black end cap: right-hand damping



Models available FYN-N1 . . .

Model	Right-hand damping (clockwise)	Left-hand damping (anti-clockwise)	Damping torque Ncm	Return Damping torque Ncm
FYN-N1-R103		FYN-N1-L103	100	20
FYN-N1-R203		FYN-N1-L203	200	40
FYN-N1-R253		FYN-N1-L253	250	40
FYN-N1-R303		FYN-N1-L303	300	80

With \varnothing 18 mm body on request.



Material: Black polycarbonate

Temperature range: -5°C to 50°C

Weight: 0.012 kg

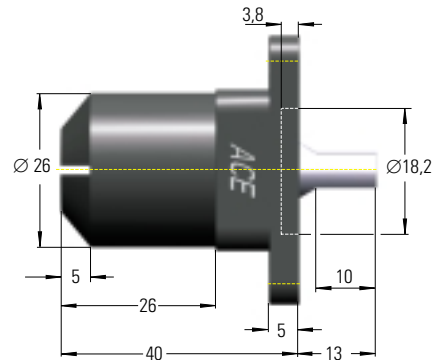
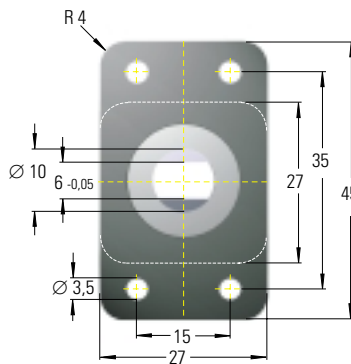
Max. Rotation angle: 110°

Do not use damper as final end stop.
Fit external mechanical stops at each end of travel.

"Coloured end cap for identification of the damping direction.
Also available with a damping torque of 250 Ncm!"



FYN-K1



Models available FYN-K1 . . .

Model	Right-hand damping (clockwise)	Left-hand damping (anti-clockwise)	Damping torque Ncm
FYN-K1-R		FYN-K1-L	400

Material: Black polycarbonate

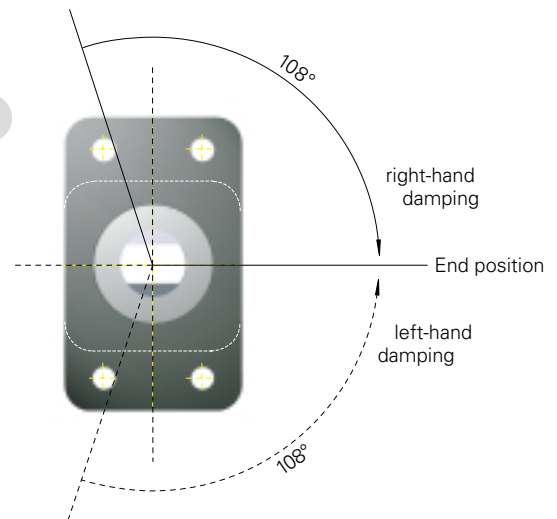
Temperature range: -5°C to 50°C

Max. Rotation angle: 108°

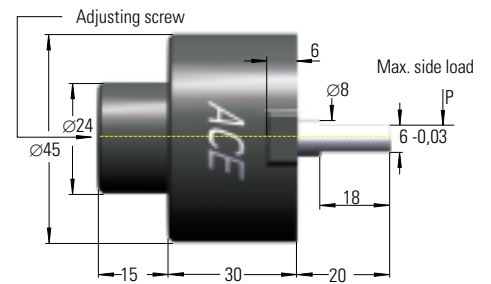
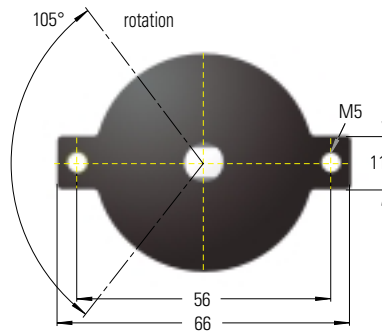
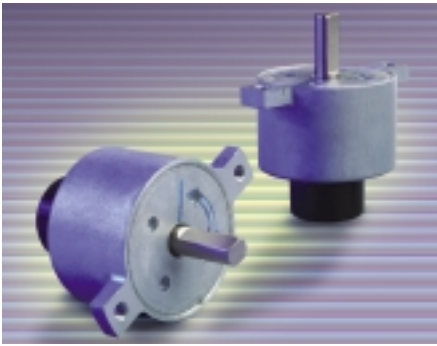
Return travel damping: 100 Ncm

Weight: 0.035 kg

Do not use damper as final end stop.
Fit external mechanical stops at each end of travel.



FYT-H1 and FYN-H1



Keyed output shaft shown in mid-travel position.

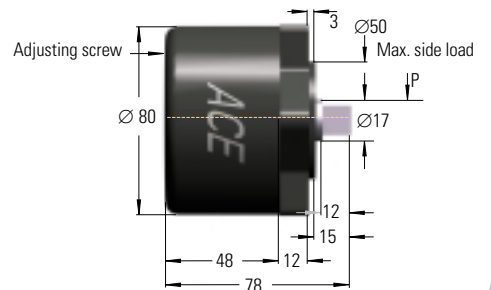
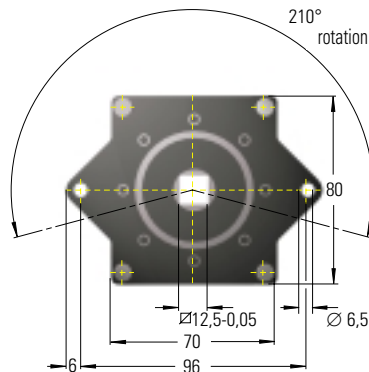
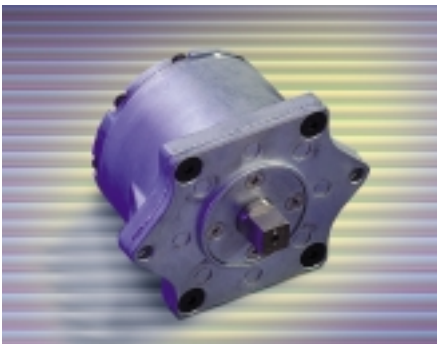
Models available FYT-H1 . . .

Model	Bi-directional damping	Right-hand damping (clockwise)	Left-hand damping (anti-clockwise)	Damping torque Nm (adjustable)
Adjustable	FYT-H1	FYN-H1-R	FYN-H1-L	2...10

Material: Zinc diecast, steel shaft
Temperature range: -5°C to 50°C
 Max. rotation: 105°
 Return travel damping: 0.5 Nm
 Maximum side-load: 50 N
 Weight: 0.24 kg

A play of approx. 5° can occur at the beginning of movement.
 Do not use damper as final end stop.
 Fit external mechanical stops at each end of travel.

FYT-LA3 and FYN-LA3



Keyed output shaft shown in mid-travel position.

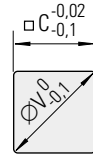
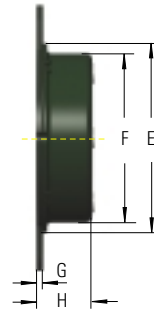
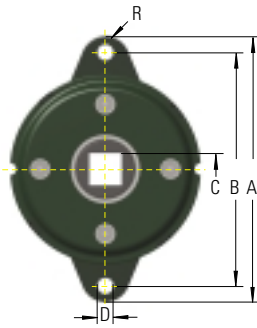
Models available FYT-LA3 . . .

Model	Bi-directional damping	Right-hand damping (clockwise)	Left-hand damping (anti-clockwise)	Damping torque Nm (adjustable)
Adjustable	FYT-LA3	FYN-LA3-R	FYN-LA3-L	4...40

Material: Zinc diecast, steel shaft
Temperature range: -5°C to 50°C
 Max. rotation angle: 210°
 Return travel damping: 4 Nm
 Maximum side-load: 200 N
 Weight: 1.75 kg

A play of approx. 5° can occur at the beginning of movement.
 Do not use damper as final end stop.
 Fit external mechanical stops at each end of travel.

FDT-47 to 70



Recommended Drive Shaft Size

Models available FDT- . . .

Damping in both directions of rotation

	Damping torque Nm (at 20 rpm, 23°C)	Dimensions									
		A	B	C	D	E	F	G	H	R	V
FDT-47	2.0 +/- 0.3	65	56	8	4.5	47	42.8	1.6	10.3	4.5	10
FDT-57	4.7 +/- 0.5	79	68	10	5.5	57	52.4	1.6	11.2	5.5	13
FDT-63	6.7 +/- 0.7	89	76	12.5	6.5	63	58.6	1.6	11.3	6.5	17
FDT-70	8.7 +/- 0.8	95	82	12.5	6.5	70	65.4	1.6	11.3	6.5	17

Body material: Steel. Output shaft sleeve: Nylon (glass reinforced)

Temperature range: -10°C to 50°C

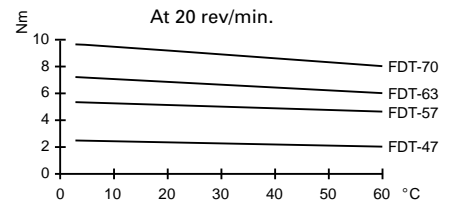
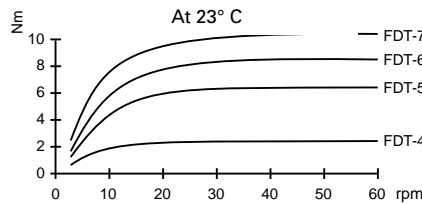
Operating fluid: Silicone Oil

Rotational speed max.: 50 rpm

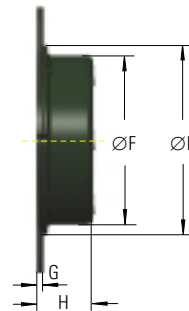
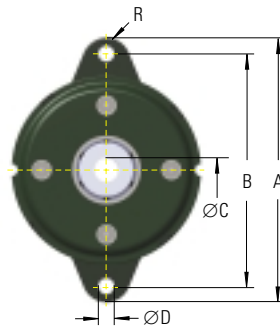
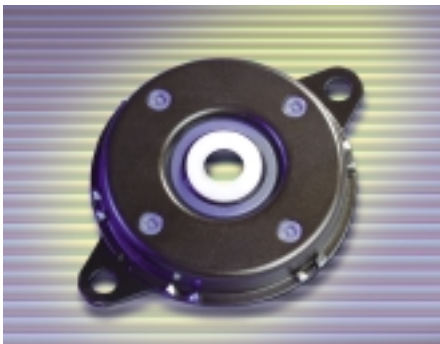
Cycle rate max.: 12 cycles per min.

Weight max.: 0.11 kg

There is no support for the output shaft within the damper structure. External support must be provided for the shaft.



FDN-47 to 70



"You can change the direction of the damping torque, if necessary, by pushing out and turning the bearing bush!"



Models available FDN- . . .

Model

Righthand damping (clockwise)	Lefthand damping (anti-clockwise)	Damping torque Nm	Dimensions									
			A	B	C	D	E	F	G	H	R	
FDN-47-R	FDN-47-L	2.0 +/- 0.3	65	56	6	4.5	47	42.8	1.6	10.3	4.5	
FDN-57-R	FDN-57-L	5.5 +/- 0.6	79	68	10	5.5	57	52.4	1.6	14	5.5	
FDN-63-R	FDN-63-L	8.5 +/- 0.8	89	76	10	6.5	63	58.6	1.6	13.9	6.5	
FDN-70-R	FDN-70-L	10.0 +/- 1.0	95	82	10	6.5	70	65.4	1.6	13	6.5	

Body material: Steel. Output shaft sleeve: Nylon (glass reinforced)

Temperature range: -10°C to 50°C

Operating fluid: Silicone Oil

Rotational speed max.: 50 rpm

Cycle Rate max.: 12 cycles per min.

Weight max.: 0.12 kg

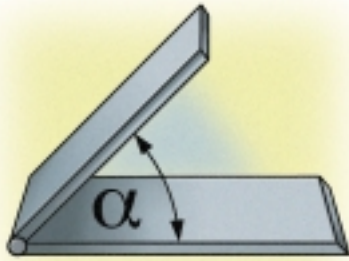
There is no support for the output shaft within the damper structure. External support must be provided for the shaft.

Recommended shaft details:

for FDN-47 $\varnothing 6^{+0}_{-0.03}$

for FDN-57 to FDN-70 $\varnothing 10^{+0}_{-0.03}$

Hardness > HRC55, surface smoothness $R_z < 1 \mu\text{m}$



Closing Torque T

$$T = L / 2 \cdot m \cdot g \cdot \cos \alpha \quad \text{Ncm.}$$

Note: for a uniform lid assume centre of gravity is at distance L/2 from pivot.

Calculation of Rotary Damper for a Lid

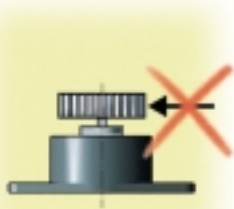
- m = Mass of Lid (kg)
- L = Length of Lid from pivot (cm.)
- n = Rotation speed (r.p.m.)
- g = Acceleration due to gravity (= 9.81)

Calculation Steps

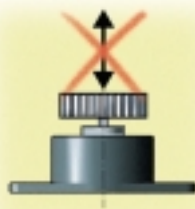
- 1) Calculate max. torque damper will be exposed to. (with example shown max torque is at $\alpha = 0$)
- 2) Decide upon rotation speed desired.
- 3) Choose a rotary damper from catalogue that can handle the torque calculated above.
- 4) With the aid of the damper performance curves, check if the r.p.m. given at your torque corresponds to the desired closing speed of the lid.
- 5) If the r.p.m. is too high – Choose a damper with a higher torque rating.
If the r.p.m. is too low – Choose a damper with a lower torque rating.

Mountings to avoid:

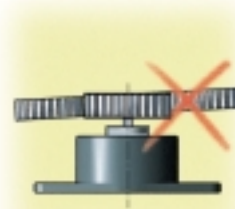
The output shaft should **not** be exposed to side loading.



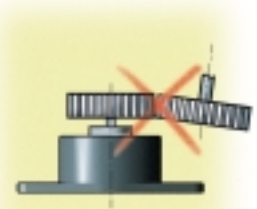
Side loading



End loading

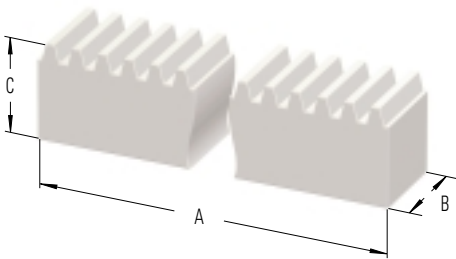


Angular offset

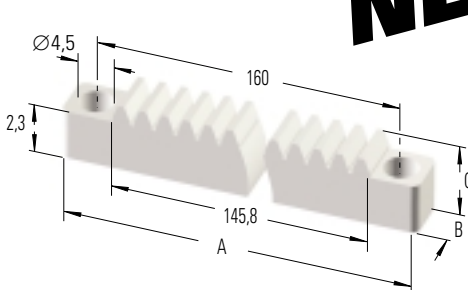


Misalignment

Toothed Rack M 0.5, M 0.6, M 0.8, M 1.0



Toothed Rack M 0.8 P



NEW



Damping Direction

right hand damping = damping action in clockwise direction when looking onto the output shaft.

Accessories

Toothed plastic rack with modules 0.5 to 1 available.

Models available

Toothed Rack	A mm	B mm	C mm	Model
M 0.5	250	4	6	rigid, milled
M 0.6	250	4	6	rigid, milled
M 0.8	250	6	8	rigid, milled
M 0.8 P	170	8	4.1	flexibel, milled
M 1.0	250	10	10	flexibel, milled
M 1.0	500	10	10	flexibel, milled

Metal racks available on request.



Controlling rotary motion

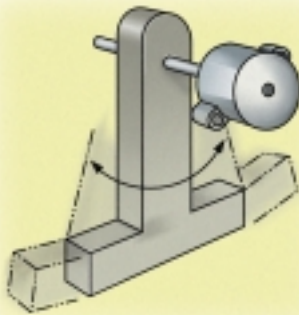
ACE Rotary Dampers installed in VIP lounges in the new Hong Kong Airport Terminal.

This modern information counter consists of a central support console with two fold away counter surfaces. With the counter surfaces folded up the passenger can check flight and baggage details on the built in monitor and keyboard. A PC and printer are housed in the central support console. After use the counter surfaces can be folded down out of the way for easier passenger access.

To provide smooth and safe operation of this sophisticated equipment, model **FYN-H1** ACE rotary dampers were installed at the pivot axis of the counter tops.



Stand console in airport terminal



Controlling pendulum swing

ACE Rotary Dampers take the weight.

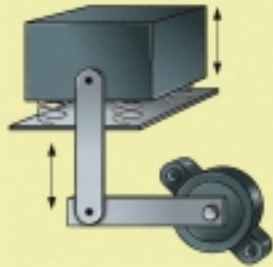
With this agricultural machine the yield of a certain plot is continuously measured to provide optimum packing of the bales according to the prevailing growth conditions.

The crop is collected and weighed on a continuous basis by means of a damped pendulum arm and load cell. The load cell output is electronically processed and controls the packing of individual bales.

The pendulum/load cell system is damped to provide a consistent noise free output signal by means of four ACE rotary dampers type **FRT-F1**.



Compact combine harvester



Vibration damping

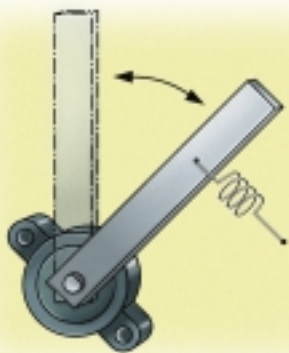
No paper jams with **ACE Rotary Dampers!**

This highly sophisticated sorting machine scans bank documents such as transfer vouchers, remittance and debit notes, cheques and paying in slips etc. before further electronic processing. To ensure that each document is in the correct position for scanning it is pushed against a datum surface with a spring loaded guide.

The guide is so precisely damped by an ACE **FRN-D2** rotary damper that the documents remain undistorted and undamaged and always sit in the exact datum position for error-free scanning.



High speed scanner for bank documents



Damping lever motions

ACE Rotary Dampers protect the keyboard.

To provide long term protection in arduous and often dirty industrial applications (and also to protect against unauthorised access) the machine keyboard is installed in a lockable and pivoted housing cabinet.

ACE rotary dampers type **FRN-F1** were installed on the pivot axis to provide a smooth controlled motion to the keyboard as it is pulled down into its operating position. The damper also prevents overloading the hinge system and prevents damage to the keyboard, the housing cabinet and the hinges.



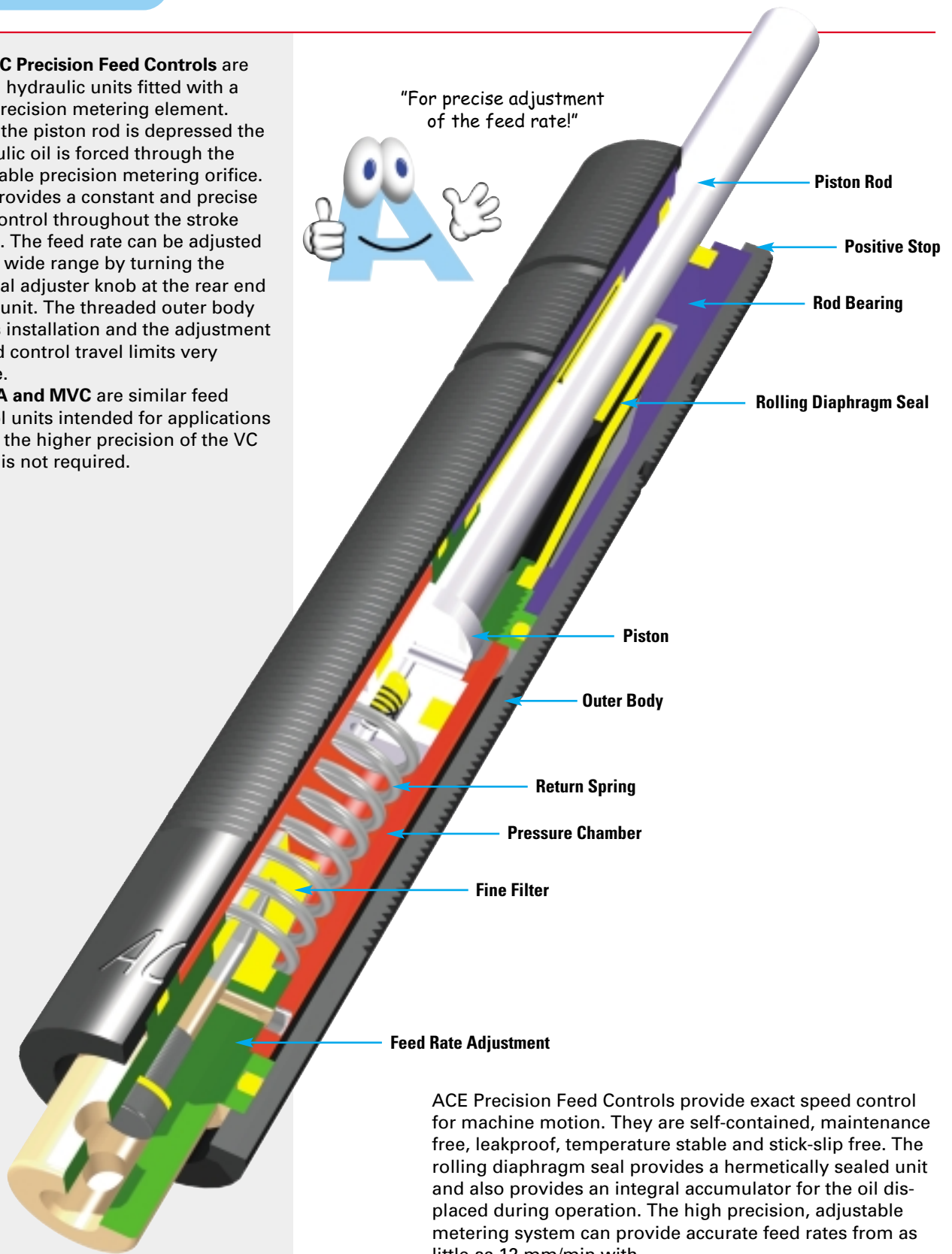
Pivoted machine keyboard

ACE VC Precision Feed Controls are sealed hydraulic units fitted with a high precision metering element. When the piston rod is depressed the hydraulic oil is forced through the adjustable precision metering orifice. This provides a constant and precise feed control throughout the stroke length. The feed rate can be adjusted over a wide range by turning the external adjuster knob at the rear end of the unit. The threaded outer body makes installation and the adjustment of feed control travel limits very simple.

FA, MA and MVC are similar feed control units intended for applications where the higher precision of the VC series is not required.



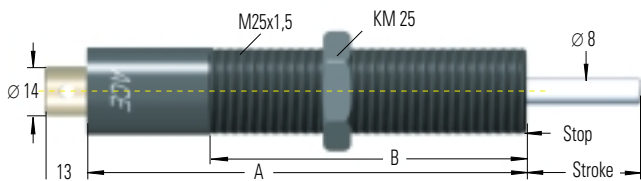
"For precise adjustment of the feed rate!"



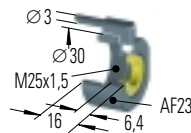
ACE Precision Feed Controls provide exact speed control for machine motion. They are self-contained, maintenance free, leakproof, temperature stable and stick-slip free. The rolling diaphragm seal provides a hermetically sealed unit and also provides an integral accumulator for the oil displaced during operation. The high precision, adjustable metering system can provide accurate feed rates from as little as 12 mm/min with low propelling forces. Applications include saws, cutters, drill feeds, grinding and boring machines in the plastics, metal, wood and glass industries.



Part Number VC 25 FT . . .

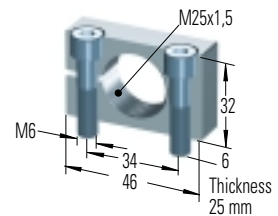


SP 25



Air Bleed Adaptor
for VC 2515 FT to VC 2555 FT

MB 25



Clamp Mount

Accessories, mounting, installation... see pages 30 to 32.

Capacity Chart

Model Part Number	Stroke mm	A	B	Propelling Force N		Return force N min - max	Reset time s	max. Side load angle °	Weight kg
				min	max				
VC 2515FT	15	128	80	30	3500	5 - 10	0.2	3	0.4
VC 2530FT	30	161	110	30	3500	5 - 15	0.4	2	0.5
VC 2555FT	55	209	130	35	3500	5 - 20	1.2	2	0.6
VC 2575FT	75	283	150	50	3500	10 - 30	0.3	2	0.8
VC 25100FT	100	308	150	60	3500	10 - 35	0.5	1	0.9
VC 25125FT	125	333.5	150	70	3500	10 - 40	0.6	1	1.0

Suffix "FT" signifies a M25x1.5 threaded body.

Suffix "F" signifies a plain body 23.8 mm dia. (without thread) also available, with optional clamp type mounting block.
For VC2515,30 and 55 use 250-0220. For VC2575,100 and 125 use 250-0264.

Technical Data

VC precision feed controls

Feed rate range: min. 0.013 m/min with 400 N propelling force. Maximum 38 m/min with 3500 N propelling force.

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

Outer body: Plain body 23.8 mm dia. (without thread) is also available.

Nylon button PP-600 can be fitted onto piston rod. Unit may be mounted in any position.

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

Temperature range: 0°C to 60°C.

Impact velocity: Avoid high impact velocities. At speeds of 0.3 m/s the maximum allowed energy is approx. 1 Nm for units up to 55 mm stroke and approx. 2 Nm for units 75 mm to 125 mm stroke. Where higher energies occur use a shock absorber for the initial impact.

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

In contact with petroleum base oils or cutting fluids specify optional neoprene rolling seal or install air bleed adaptor type SP 25.

Mounting Examples



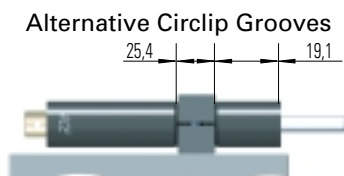
Mounting with clamp mount MB 25



Installed with air bleed collar SP 25



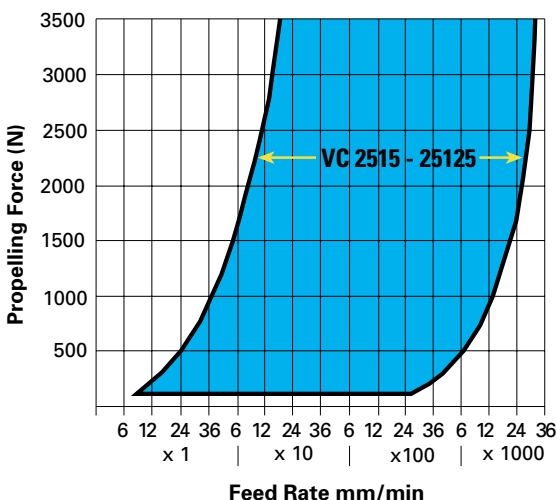
Installed with switch stop collar inc. proximity switch and steel button: AS 25 plus PS 25



Alternative Circlip Grooves

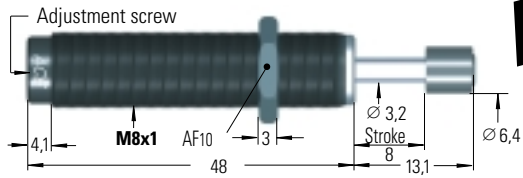
Bulkhead mounting for VC25 ... F with mounting block KB ... (23.8 mm Plain body option)

Operating Range VC



Part Number MA . . .

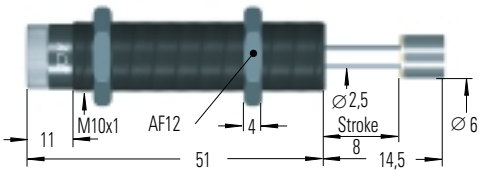
MA 30 M



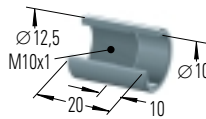
NEW

Accessories, mounting, installation... see pages 28 to 32.

Part Number FA 1008 V-B



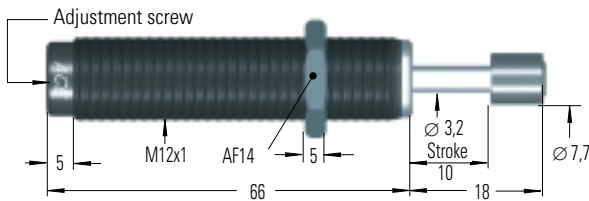
AH 10



Stop Collar

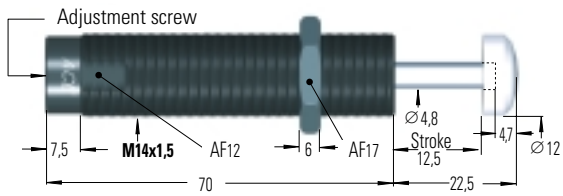
Accessories, mounting, installation... see pages 28 to 32.

MA 35 M



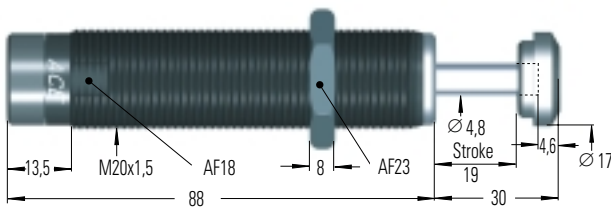
Accessories, mounting, installation... see pages 28 to 32.

MA 150 M



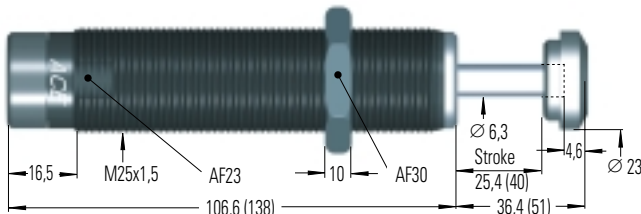
Accessories, mounting, installation... see pages 29 to 32.

MVC 225 M



Accessories, mounting, installation... see pages 29 to 32.

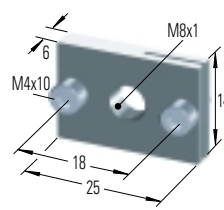
MVC 600 M and MVC 900 M



Dimensions for MVC 900 M in (...)

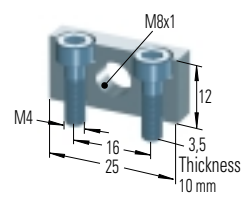
Accessories, mounting, installation... see pages 30 to 32.

RF 8



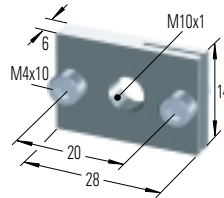
Rectangular Flange

MB 8 SC²



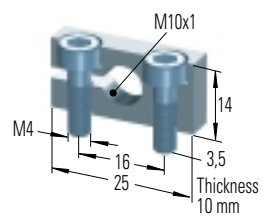
Mounting Block

RF 10



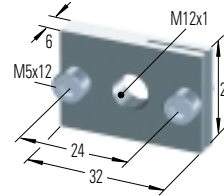
Rectangular Flange

MB 10



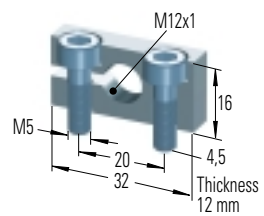
Clamp Mount

RF 12



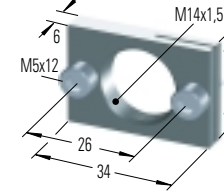
Rectangular Flange

MB 12



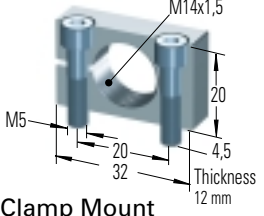
Clamp Mount

RF 14



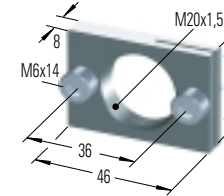
Rectangular Flange

MB 14



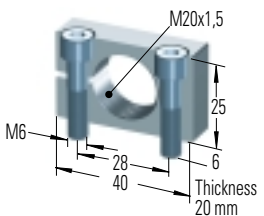
Clamp Mount

RF 20



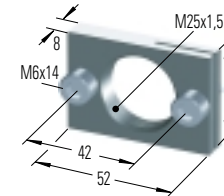
Rectangular Flange

MB 20



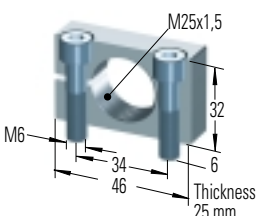
Clamp Mount

RF 25



Rectangular Flange

MB 25



Clamp Mount

Capacity Chart

Model Part Number	Stroke mm	Propelling Force N		Return force N		Reset time s	*max. Side load angle °	Weight kg
		min	max	min	max			
MA 30 M	8	8	- 80	1	- 5	0.3	2	0.025
FA 1008 V-B	8	10	- 180	3	- 6	0.3	2.5	0.026
MA 35 M	10	15	- 200	5	- 11	0.2	2	0.043
MA 150 M-B	12.5	20	- 300	3	- 5	0.4	5	0.06
MVC 225 M	19	25	- 1750	5	- 10	0.65	2	0.13
MVC 600 M	25	65	- 3500	10	- 30	0.85	2	0.31
MVC 900 M	40	70	- 3500	10	- 35	0.95	2	0.4

* For high side-load applications us Side Load Adaptor (BV) pages 28 to 31.

Technical Data

FA 1008 V to MVC 900 M

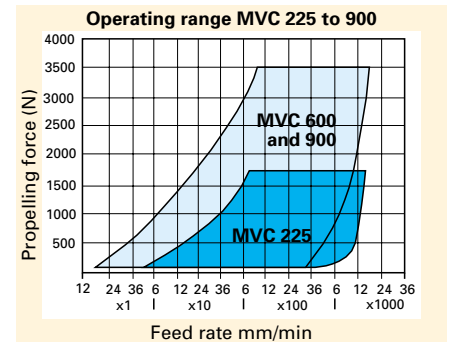
Install mechanical stop 0.5 – 1 mm before end of stroke on model FA 1008 V-B.

Operating temperature range: FA 1008 V-B and MA 35 M: 0°C to 70°C. MVC 225 M and MVC 900 M: -12°C to 90°C.

Self-contained. Can be mounted in any position.

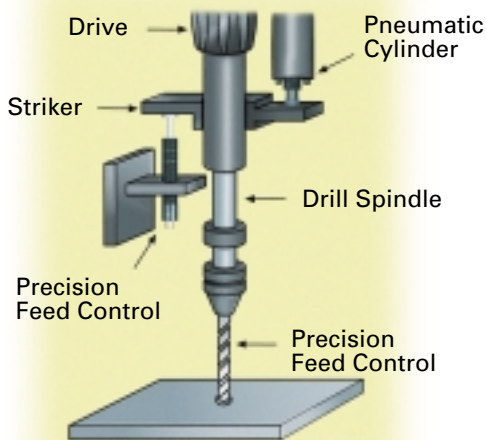
Max. impact velocity: Avoid high impact velocities. At speeds of 0.3 m/s the maximum allowed energy is approx. 2 Nm. Where higher energies occur use a shock absorber for the initial impact.

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



Application Examples

Drilling Sheet Metal

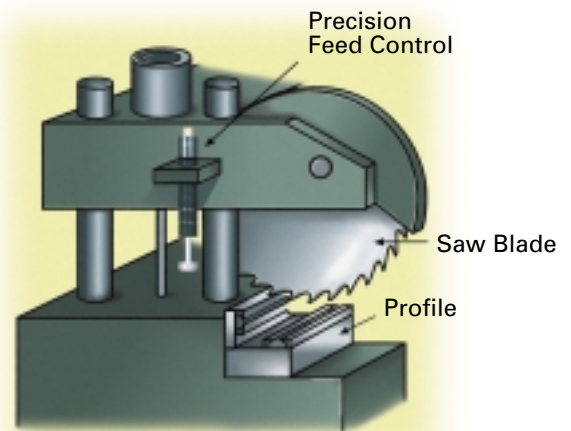


A high force is necessary at the start of drilling when the drill first contacts the sheet.

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

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

Sawing Aluminium and Plastic Profiles



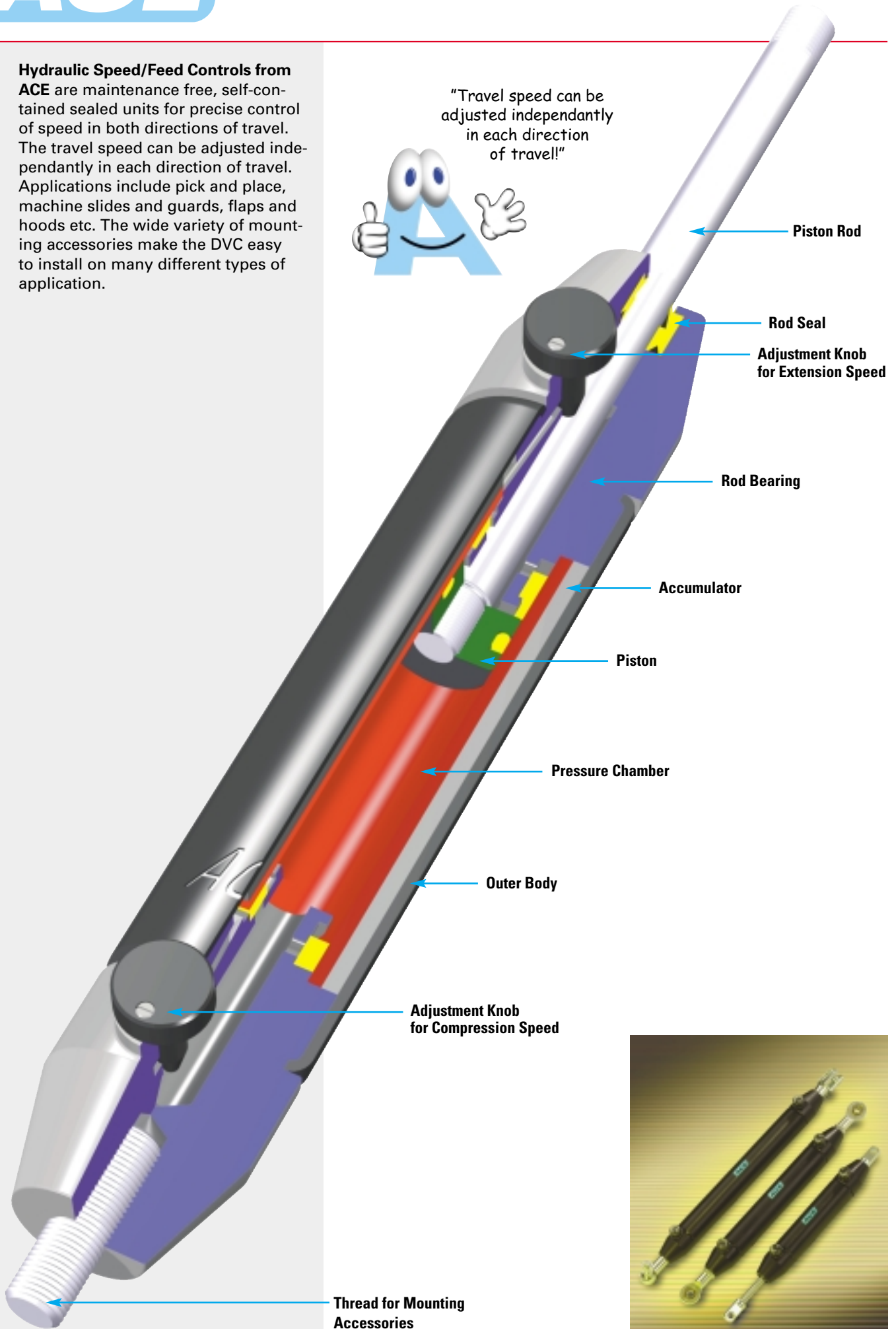
Varying material types, hardness and wear on the saw blade causes the cutting pressure to vary greatly. However the saw advance speed should remain constant as changes cause breakage of the material being cut or of the saw blade.

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

Hydraulic Speed/Feed Controls from ACE are maintenance free, self-contained sealed units for precise control of speed in both directions of travel. The travel speed can be adjusted independantly in each direction of travel. Applications include pick and place, machine slides and guards, flaps and hoods etc. The wide variety of mounting accessories make the DVC easy to install on many different types of application.



"Travel speed can be adjusted independantly in each direction of travel!"

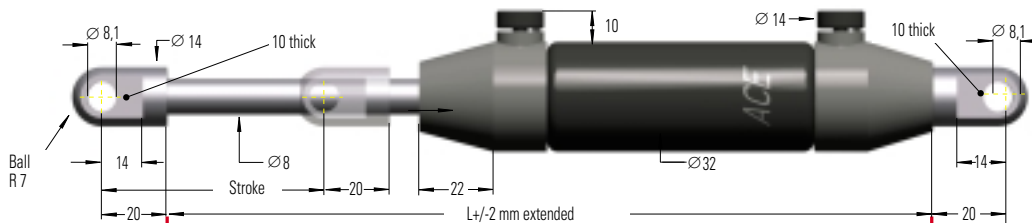


End Fitting

Standard Dimensions

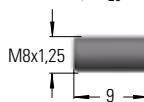
End Fitting

A8



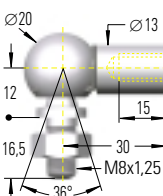
Eye A8

B8



Stud Thread B8

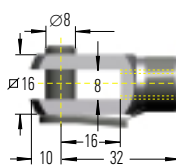
C8



Angle Ball Joint C8

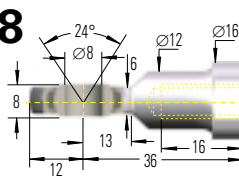
(Max. permitted force 1200 N)

D8



Clevis Fork D8

E8



Swivel Eye E8

Dimensions

Type	Stroke mm	L max.	A max.	B	Propelling Force N	
					(Extension) min.	(Compression) max.
DVC-32-50	50	240			42	2000
DVC-32-50-XX	50		250	75.2	42	2000
DVC-32-100	100	340			42	1670
DVC-32-100-XX	100		350	124.4	42	1670
DVC-32-150	150	440			42	1335
DVC-32-150-XX	150		450	173.6	42	1335

Ordering Example

DVC-32-50-DD-P

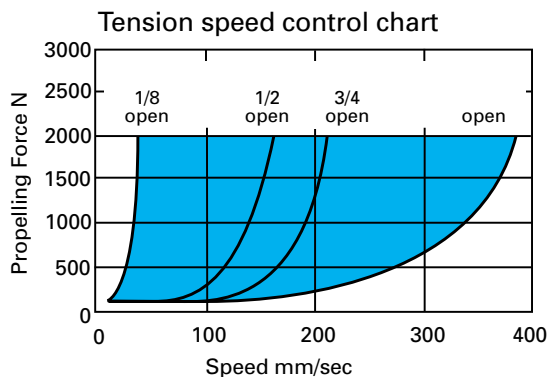
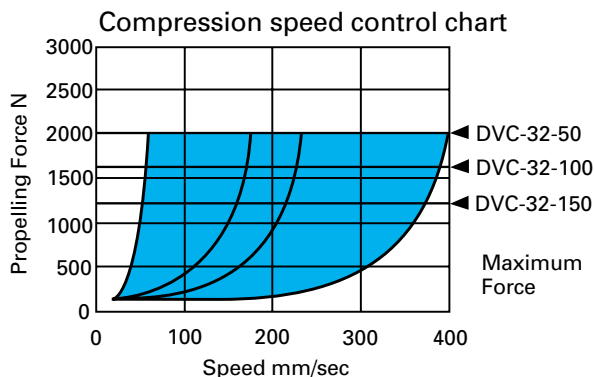
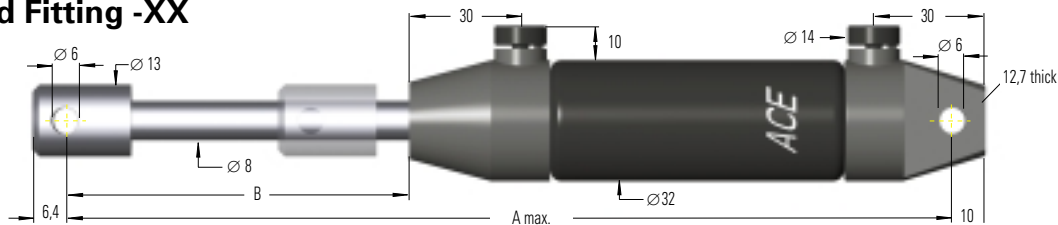
Type (DVC speed/feed controller) _____
 Body ø (32 mm) _____
 Stroke (50 mm) _____
 Piston rod end fitting (D = Clevis fork) _____
 Body end fitting (D = Clevis fork) _____
 Damping direction (P = Both directions) _____

Damping Options

P = Damping in both directions (Standard Model)
 M = Damping on out stroke (Adjustment knob at "rear end" free flow)
 N = Damping on in stroke (Adjustment knob at "piston rod end" free flow)

The end fittings are interchangeable (except the fixed end version, detailed below) and must be positively secured by the customer to prevent unscrewing (i.e. Loctite). For mounting accessories please see page 124.

Fixed End Fitting -XX



Technical Data

ACE speed/feed controls are self-contained and maintenance free.

Mechanical stops: Provide mechanical stop 1 to 1.5 mm before end of each stroke direction.

Mounting position: Can be mounted in any position. The end fittings must be positively secured to prevent unscrewing.

To special order: Special oils and external finishes. Uni-directional

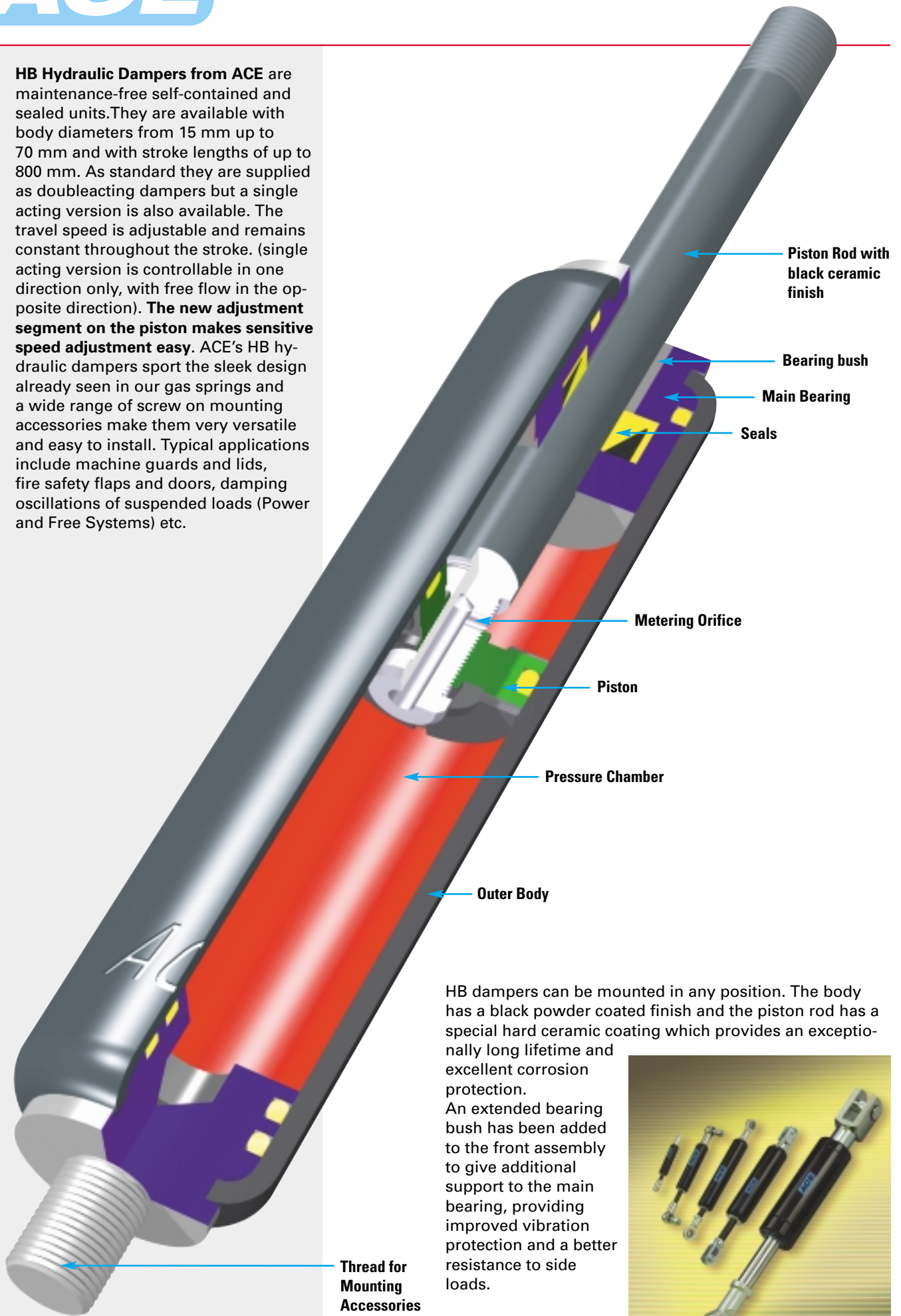
damping (free flow in reverse direction). NOTE: End fittings should be secured with Loctite or similar.

Operating temperature: 0°C to 65°C.

Operating fluid: Automatic Transmission Fluid (ATF) 42cSt. at 40°C

Material: Body: black anodised aluminium. Piston rod: hard chrome plated steel. End fittings: zinc plated steel.

HB Hydraulic Dampers from ACE are maintenance-free self-contained and sealed units. They are available with body diameters from 15 mm up to 70 mm and with stroke lengths of up to 800 mm. As standard they are supplied as doubleacting dampers but a single acting version is also available. The travel speed is adjustable and remains constant throughout the stroke. (single acting version is controllable in one direction only, with free flow in the opposite direction). **The new adjustment segment on the piston makes sensitive speed adjustment easy.** ACE's HB hydraulic dampers sport the sleek design already seen in our gas springs and a wide range of screw on mounting accessories make them very versatile and easy to install. Typical applications include machine guards and lids, fire safety flaps and doors, damping oscillations of suspended loads (Power and Free Systems) etc.



HB dampers can be mounted in any position. The body has a black powder coated finish and the piston rod has a special hard ceramic coating which provides an exceptionally long lifetime and excellent corrosion protection. An extended bearing bush has been added to the front assembly to give additional support to the main bearing, providing improved vibration protection and a better resistance to side loads.

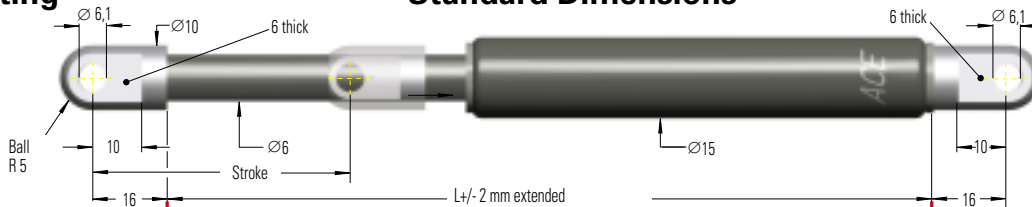


End Fitting

Standard Dimensions

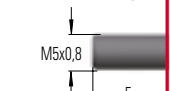
End Fitting

A5



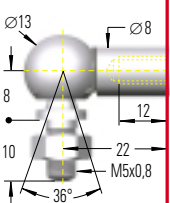
Eye A5

B5



Stud Thread B5

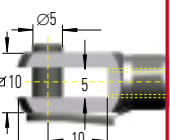
C5



Angle Ball Joint C5

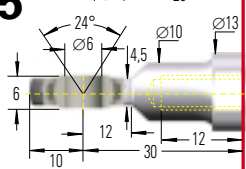
(Max. permitted force 500 N)

D5



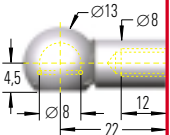
Clevis Fork D5

E5



Swivel Eye E5

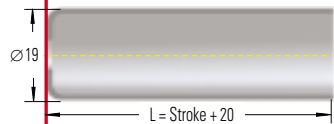
G5



Ball Socket G5

(Max. permitted force 500 N)

W5-15
Rod Shroud



Dimensions

Type	Stroke mm	L Extended	max. Compression Force N
HB-15-25	25	90	800
HB-15-50	50	140	800
HB-15-75	75	190	800
HB-15-100	100	240	350
HB-15-150	150	340	300

Ordering Example

Type (Hydraulic Damper) _____ **HB-15-150-CC-M**
 Body ø (15 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting C5 _____
 Body End Fitting C5 _____
 Damping Direction (M = out stroke only) _____

Damping options

M = Damping on out stroke only P = Damping in both directions
 N = Damping on in stroke only X = Special model suffix

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite). For mounting accessories see page 123.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Adjustment: Adjustment of the damping rate is achieved by pulling (or pushing) the piston rod to its fully extended (or compressed) position. Whilst still pulling the piston rod turn it clockwise to increase damping or anti-clockwise to decrease damping. If the resistance increases noticeably, stop adjusting to avoid damage. The adjustment can add a max. of 6 mm to the L dim. shown.

Free travel: Construction of standard damper results in a free travel of approx 20 % of total stroke when changing travel direction.

Mechanical stops: Provide mechanical stops 1 to 1.5 mm before end of each stroke direction.

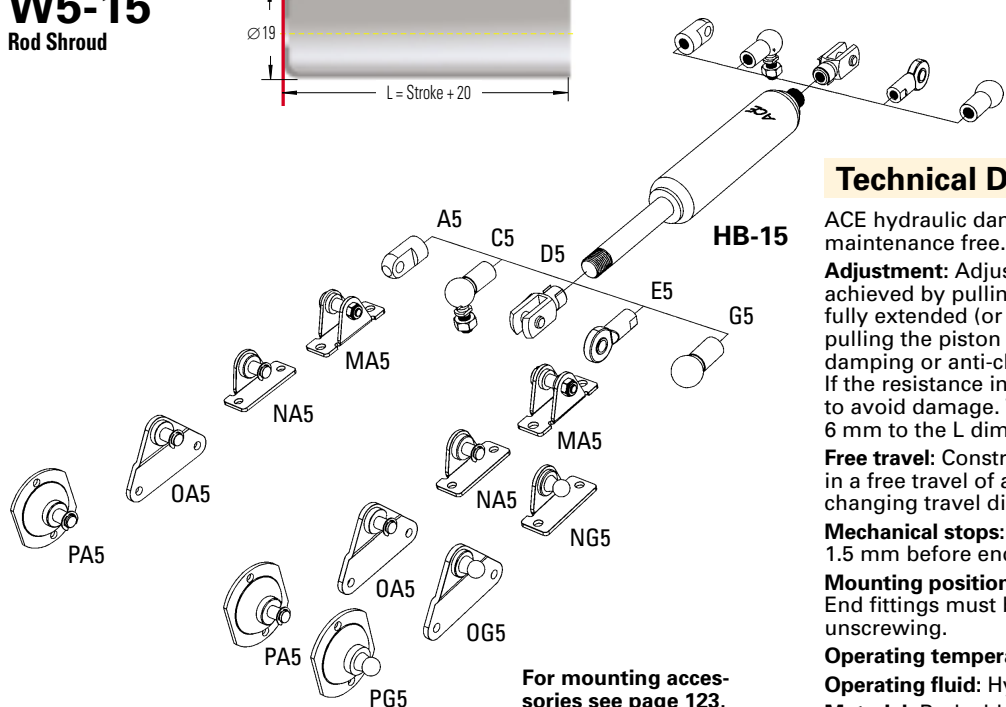
Mounting position: Can be mounted in any position. End fittings must be positively secured to prevent unscrewing.

Operating temperature range: -20°C to +80°C.

Operating fluid: Hydraulic oil.

Material: Body: black powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

Separator piston (-T): Available as a special option to remove free travel. Also provides extension force of max. 50 N. Dimension L = 2.45 x stroke + 47 mm.



For mounting accessories see page 123.

End Fitting

Standard Dimensions

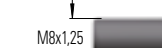
End Fitting

A8



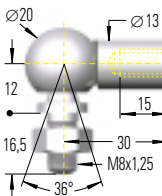
Eye **A8**

B8



Stud Thread **B8**

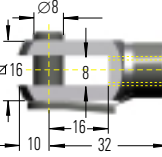
C8



Angle Ball Joint **C8**

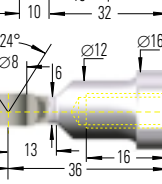
(Max. permitted force 1200 N)

D8



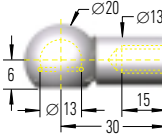
Clevis Fork **D8**

E8



Swivel Eye **E8**

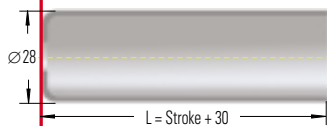
G8



Ball Socket **G8**

(Max. permitted force 1200 N)

W8-22
Rod Shroud



Dimensions

Type	Stroke mm	L Extended	max. Compression Force N
HB-22-50	50	150	1 800
HB-22-100	100	250	1 800
HB-22-150	150	350	1 800
HB-22-200	200	450	1 000
HB-22-250	250	550	1 000

Ordering Example

HB-22-150-DD-M

Type (Hydraulic Damper) _____
 Body ϕ (22 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting D8 _____
 Body End Fitting D8 _____
 Damping Direction (M = out stroke only) _____

Damping Options

M = Damping on out stroke only P = Damping in both directions
 N = Damping on in stroke only X = Special model suffix

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite).
 For mounting accessories see page 124.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Adjustment: Adjustment of the damping rate is achieved by pulling (or pushing) the piston rod to its fully extended (or compressed) position. Whilst still pulling the piston rod turn it clockwise to increase damping and anti-clockwise to decrease damping. If the resistance increases noticeably, stop adjusting to avoid damage. The adjustment can add a max. of 6 mm to the L dim. shown.

Free travel: Construction of standard damper results in a free travel of approx. 20% of stroke.

Mechanical stops: Provide mechanical stops 1 to 1.5 mm before end of each stroke direction.

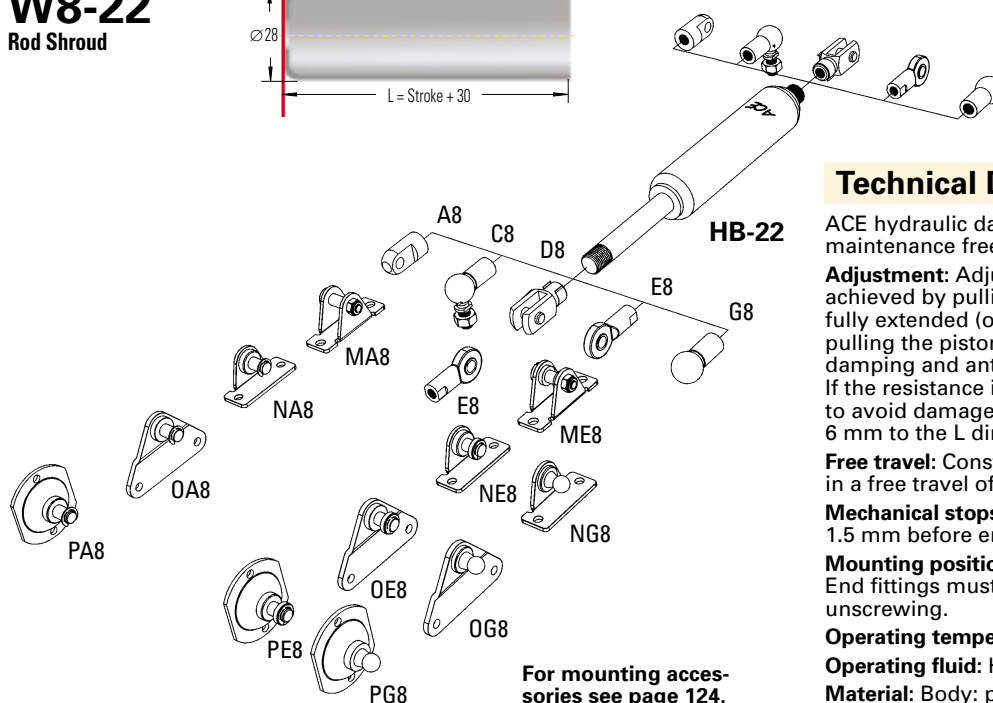
Mounting position: Can be mounted in any position. End fittings must be positively secured to prevent unscrewing.

Operating temperature range: -20°C to +80°C.

Operating fluid: Hydraulic oil.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

Separator piston (-T): Available as a special option to remove free travel. Also provides extension force of max. 100 N. Dimension L = 2.38 x stroke + 55 mm.



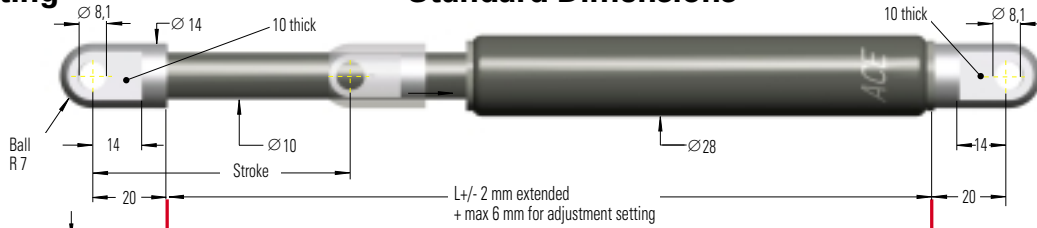
For mounting accessories see page 124.

End Fitting

Standard Dimensions

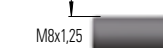
End Fitting

A8



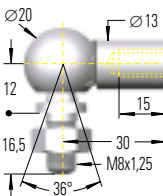
Eye **A8**

B8



Stud Thread **B8**

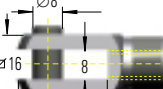
C8



Angle Ball Joint **C8**

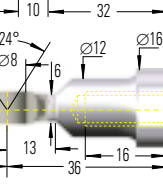
(Max. permitted force 1200 N)

D8



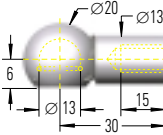
Clevis Fork **D8**

E8



Swivel Eye **E8**

G8

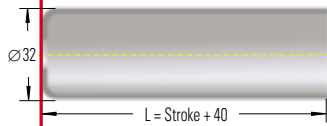


Ball Socket **G8**

(Max. permitted force 1200 N)

W8-28

Rod Shroud



Dimensions

Type	Stroke mm	L Extended	max. Compression Force N
HB-28-100	100	260	3 000
HB-28-150	150	360	3 000
HB-28-200	200	460	3 000
HB-28-250	250	560	3 000
HB-28-300	300	660	2 500
HB-28-350	350	760	2 000
HB-28-400	400	860	1 500
HB-28-500	500	1 060	1 000

Ordering Example

HB-28-150-DD-M

Type (Hydraulic Damper) _____
 Body ϕ (28 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting D8 _____
 Body End Fitting D8 _____
 Damping Direction (M = out stroke only) _____

Damping Options

M = Damping on out stroke only P = Damping in both directions
 N = Damping on in stroke only X = Special model suffix

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite). For mounting accessories see page 124.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Adjustment: Adjustment of the damping rate is achieved by pulling (or pushing) the piston rod to its fully extended (or compressed) position. Whilst still pulling the piston rod turn it clockwise to increase damping and anti-clockwise to decrease damping. If the resistance increases noticeably, stop adjusting to avoid damage. The adjustment can add a max. of 6 mm to the L dim. shown.

Free travel: Construction of the standard damper results in free travel of approx. 20% of stroke.

Mechanical stops: Provide mechanical stops 1 to 1.5 mm before end of each stroke direction.

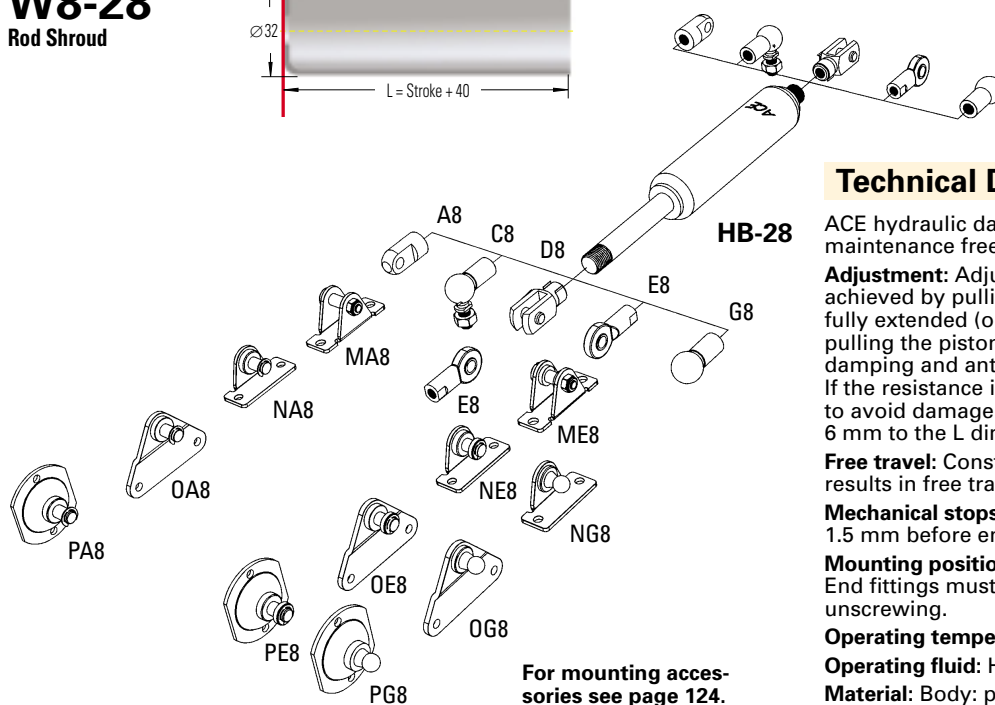
Mounting position: Can be mounted in any position. End fittings must be positively secured to prevent unscrewing.

Operating temperature range: -20°C to +80°C.

Operating fluid: Hydraulic oil.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

Separator piston (-T): Available as a special option to remove free travel. Also provides extension force of max. 100 N. Dimension L = 2.35 x stroke + 60 mm.



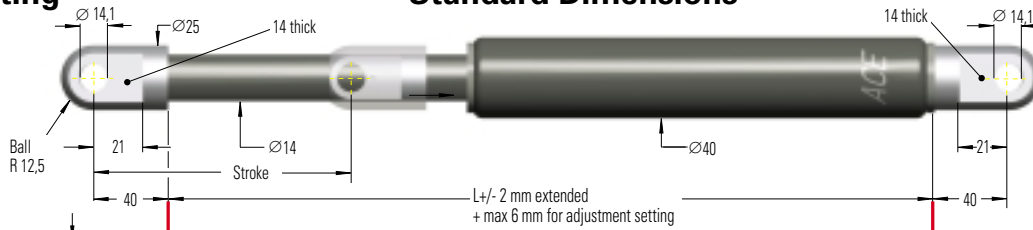
For mounting accessories see page 124.

End Fitting

Standard Dimensions

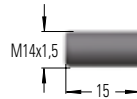
End Fitting

A14



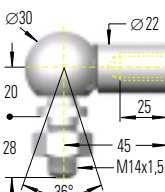
Eye A14

B14



Stud Thread B14

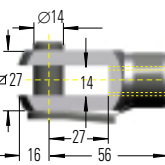
C14



Angle Ball Joint C14

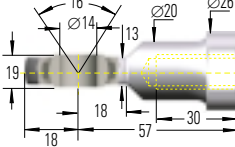
(Max. permitted force 3200 N)

D14



Clevis Fork D14

E14



Swivel Eye E14

Dimensions

Type	Stroke mm	L Extended	max. Compression Force N
HB-40-100	100	275	10 000
HB-40-150	150	375	10 000
HB-40-200	200	475	10 000
HB-40-300	300	675	10 000
HB-40-400	400	875	8 000
HB-40-500	500	1 075	6 000
HB-40-600	600	1 275	4 000
HB-40-700	700	1 475	3 000
HB-40-800	800	1 675	3 000

Ordering Example

HB-40-300-EE-N

Type (Hydraulic Damper) _____
 Body ø (40 mm) _____
 Stroke (300 mm) _____
 Piston Rod End Fitting E14 _____
 Body End Fitting E14 _____
 Damping Direction (N = in stroke only) _____

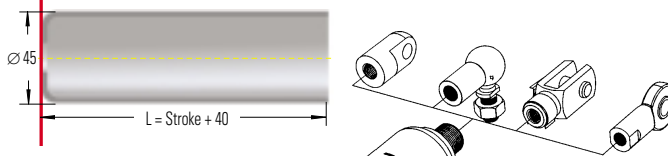
Damping Options

M = Damping on out stroke only P = Damping in both directions
 N = Damping on in stroke only X = Special model suffix

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite). For mounting accessories see page 125.

W14-40

Rod Shroud



Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Adjustment: Adjustment of the damping rate is achieved by pulling (or pushing) the piston rod to its fully extended (or compressed) position. Whilst still pulling the piston rod turn it clockwise to increase or anti-clockwise to decrease damping. If the resistance increases noticeably, stop adjusting to avoid damage. The adjustment can add a max. of 6 mm to the L dim. shown.

Free travel: Construction of standard damper results in a free travel of approx. 20% of stroke when changing directions.

Mechanical stops: Provide mechanical stops 1 to 1.5 mm before end of stroke in each direction.

Mounting position: Can be mounted in any position. End fittings must be positively secured to prevent unscrewing.

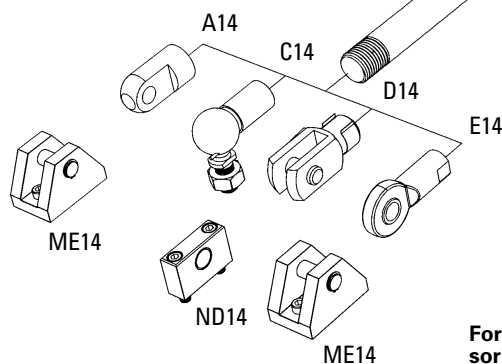
Operating temperature range: -20°C to +80°C (with special seals up to 120°C).

Operating fluid: Hydraulic oil.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

Separator piston (-T): Available as a special option to remove free travel. Also provides extension force of max. 200 N. Dimension L = 2.32 x stroke + 82 mm.

HB-40



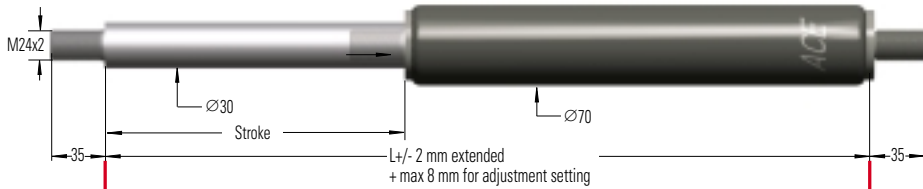
For mounting accessories see page 125.

End Fitting

Standard Dimensions

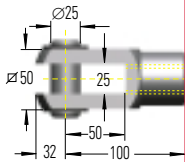
End Fitting

B24



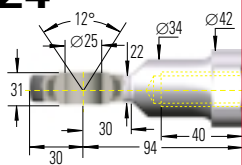
Stud Thread **B24**

D24



Clevis Fork **D24**

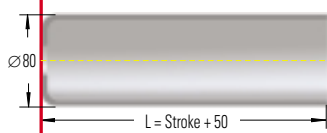
E24



Swivel Eye **E24**

W24-70

Rod Shroud



Dimensions

Type	Stroke mm	L Extended
HB-70-100	100	320
HB-70-200	200	520
HB-70-300	300	720
HB-70-400	400	920
HB-70-500	500	1120
HB-70-600	600	1320
HB-70-700	700	1520
HB-70-800	800	1720

Ordering Example

HB-70-300-EE-N

Type (Hydraulic Damper) _____
 Body ø (70 mm) _____
 Stroke (300 mm) _____
 Piston Rod End Fitting E24 _____
 Body End Fitting E24 _____
 Damping Direction (N = in stroke only) _____

Damping Options

M = Damping on out stroke only P = Damping in both directions
 N = Damping on in stroke only X = Special model suffix

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite). For mounting accessories see page 125.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Adjustment: Adjustment of the damping rate is achieved by pulling (or pushing) the piston rod to its fully extended (or compressed) position. Whilst still pulling the piston rod turn it clockwise to increase or anti-clockwise to decrease the damping. If the resistance increases noticeably, stop adjusting to avoid damage. The adjustment can add a max. of 8 mm to the L dim. shown.

Free travel: Construction of standard damper results in a free travel of approx. 20% of stroke when changing travel direction.

Mechanical stops: Provide mechanical stops 1 to 1.5 mm before end of stroke in each direction.

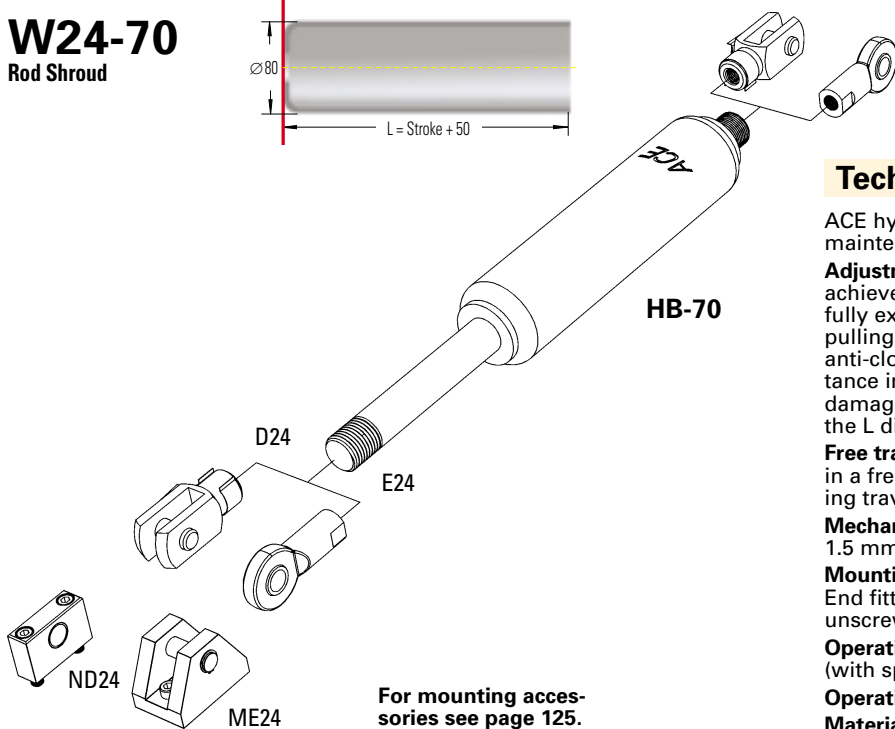
Mounting position: Can be mounted in any position. End fittings must be positively secured to prevent unscrewing.

Operating temperature range: -20°C to +80°C (with special seals up to 120°C).

Operating fluid: Hydraulic oil.

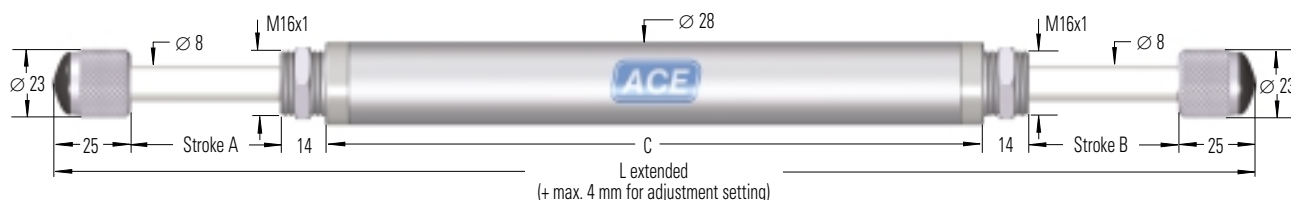
Material: Body: black powder coated steel or zinc plated steel. Piston rod: hard chrome plated. End fittings: zinc plated steel.

Separator piston (-T): Available as a special option to remove free travel. Also provides extension force of max. 250 N. Increases dimension L + 150 mm.



For mounting accessories see page 125.

Standard Dimensions TD-28



Ordering Example

TD-28-50-50-F

Type (Door Damper) _____
 Body ø (28 mm) _____
 Stroke A (50 mm) _____
 Stroke B (50 mm) _____
 Return Type _____
 (F = automatic return with return spring)

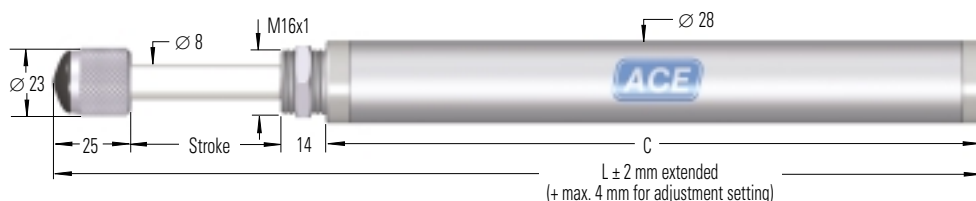
Return Type:

F = automatic return with return spring
 D = without return spring. When one piston rod is pushed in the piston rod at the other end is pushed out (thus the damper must be impacted from alternate ends to sequence correctly).

Dimensions and Capacity Chart

Type	Stroke A	Stroke B	C	L max.	Impact Mass max. kg	Damping Force Q max. N	Energy per Cycle W ₃ max. Nm	Return Force max. N	Return Type	Adjustment
TD-28-50-50	50	50	220	402	150	1550	75	30	F	Tooth Type
TD-28-70-70	70	70	260	482	200	1500	70	30	F	Tooth Type
TD-28-100-100	100	100	220	502	250	1500	80	40	F	Tooth Type
TD-28-120-120	120	120	208	410	250	3800	165	0	D	Tooth Type

Standard Dimensions TDE-28



Ordering Example

TDE-28-50

Type (Door Damper) _____
 Body ø (28 mm) _____
 Stroke (50 mm) _____

Dimensions and Capacity Chart

Type	Stroke	C	L max.	Impact Mass max. kg	Damping Force Q max. N	Energy per Cycle W ₃ max. Nm	Return Force max. N
TDE-28-50	50	130	221	4000	2400	80	30
TDE-28-70	70	158	269	5600	2400	112	30
TDE-28-100	100	193	333	8000	2400	160	30
TDE-28-120	120	214	373	7000	2400	190	40

Technical Data

ACE Door Dampers are single ended or double ended working adjustable hydraulic shock absorbers providing a smooth deceleration characteristic.

Application areas: Cushioning of Elevator doors, automatic and sliding doors and similar applications.

Adjustment: Pull the piston rod fully out and turn the knurled rod end button. This allows the damping to be separately adjusted for each side. As a result of the adjustment mechanism the overall length L can be increased by up to 4 mm.

Operating temperature range: -20°C to 80°C.

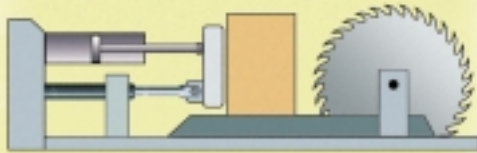
Impact velocity range v: 0.1 to 2 m/s.

Strokes per Minute: max. 10

Material: Piston Rod: hard chrome plated steel. Cylinder body: zinc plated steel.

On request: With different deceleration characteristics, special stroke lengths, special seals etc.

Calculation: The calculation of the Energy capacity (W₃) can be done with the ACE selection software however be careful to observe the max. limits on the impact mass and damping force. For calculation examples see pages 13 to 15.



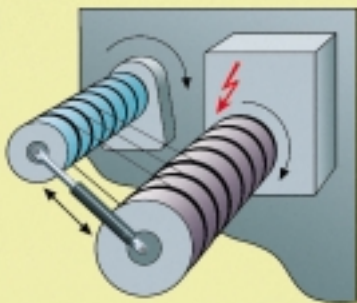
Clean-cut edges

Hydraulic dampers provide a clean cut.

This profile saw was designed to produce cut-outs in aluminium profiles without generating the stick-slip effect that can often be observed when using pneumatic cylinders. This uneven motion can cause imprecise edges due to jammed saw blades or slight movement of the work-piece during cutting. Fitting the hydraulic damper type **HB 28-400-EE** enabled this machine to move smoothly along the cutting line to produce 50 precision cut workpieces per hour.



Profile saw delivers perfectly clean-cut edges

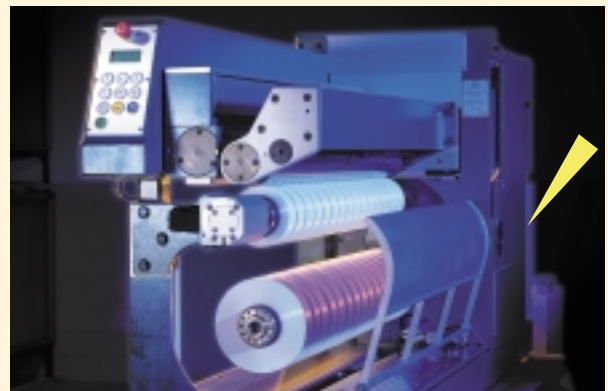


Precise unreeing

Hydraulic dampers bring the sled movement of this textile machine to a gentle stop.

At the turning point of 130 kg reeling spools, a sled should move up and down smoothly without causing a collision at the end of stroke position. The solution was provided by the hydraulic damper **DVC-32-100**. A self-contained sealed unit, ready to install and maintenance free these units are ideal for precise control of speeds in both directions of travel. The travel speed is maintained throughout the entire stroke and can be independently adjusted in each direction of travel.

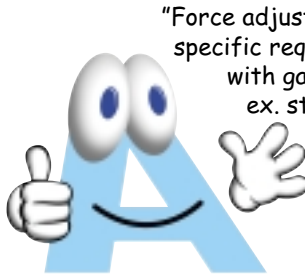
Thanks to their compact design and wide choice of mounting accessories, these dampers could be easily integrated into this machine.



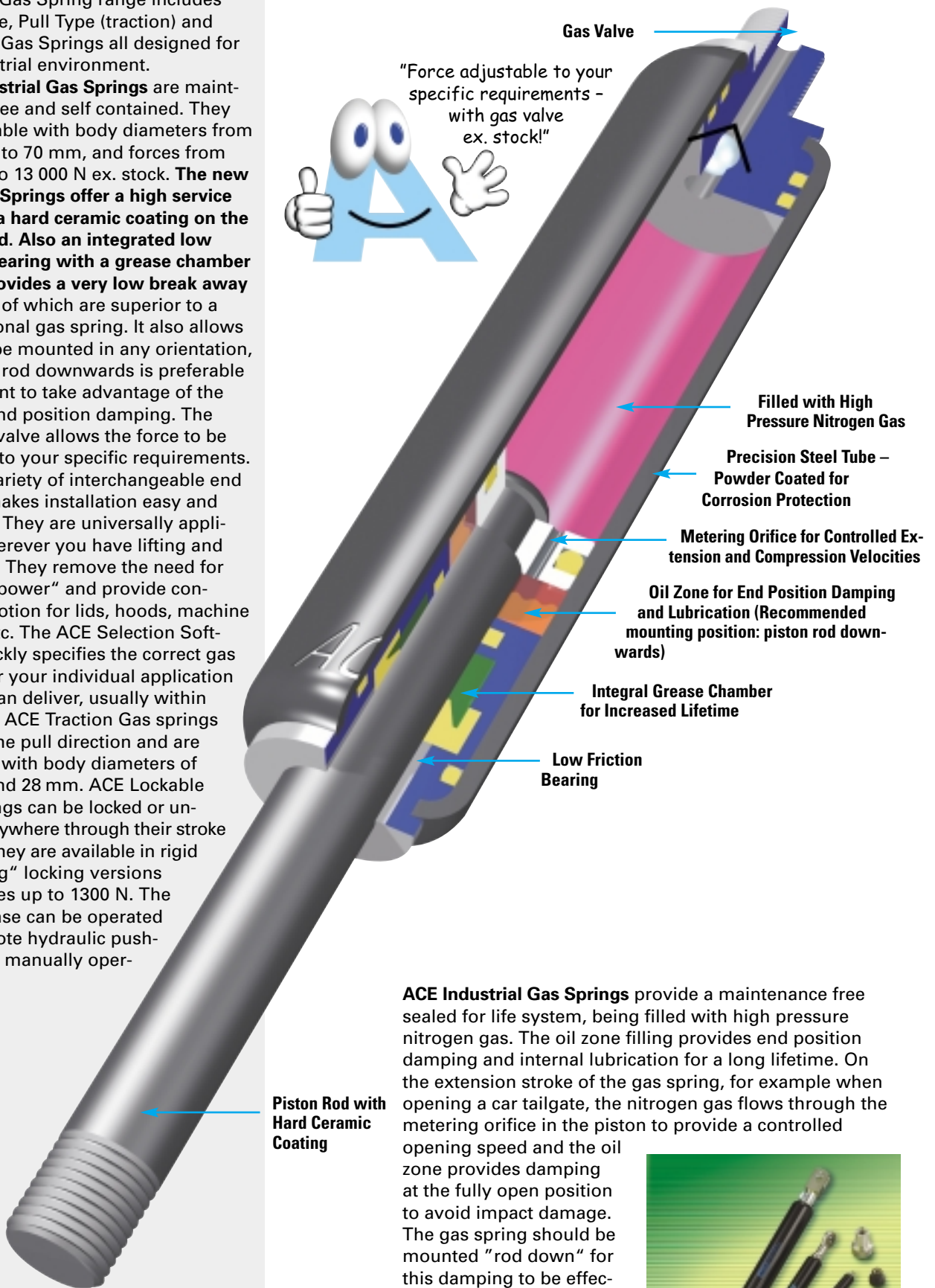
Textile machine unreels threads even better

The ACE Gas Spring range includes Push Type, Pull Type (traction) and Lockable Gas Springs all designed for the industrial environment.

ACE Industrial Gas Springs are maintenance free and self contained. They are available with body diameters from 8 mm up to 70 mm, and forces from 10 N up to 13 000 N ex. stock. **The new ACE Gas Springs offer a high service life with a hard ceramic coating on the piston rod. Also an integrated low friction bearing with a grease chamber which provides a very low break away force.** All of which are superior to a conventional gas spring. It also allows them to be mounted in any orientation, although rod downwards is preferable if you want to take advantage of the built-in end position damping. The optional valve allows the force to be adjusted to your specific requirements. A wide variety of interchangeable end fittings makes installation easy and versatile. They are universally applicable wherever you have lifting and lowering. They remove the need for "muscle power" and provide controlled motion for lids, hoods, machine guards etc. The ACE Selection Software quickly specifies the correct gas spring for your individual application and we can deliver, usually within 24 hours. ACE Traction Gas springs work in the pull direction and are available with body diameters of 19 mm and 28 mm. ACE Lockable Gas springs can be locked or unlocked anywhere through their stroke length. They are available in rigid or "spring" locking versions with forces up to 1300 N. The lock release can be operated by a remote hydraulic push-button or manually operated.



"Force adjustable to your specific requirements - with gas valve ex. stock!"



Piston Rod with Hard Ceramic Coating

ACE Industrial Gas Springs provide a maintenance free sealed for life system, being filled with high pressure nitrogen gas. The oil zone filling provides end position damping and internal lubrication for a long lifetime. On the extension stroke of the gas spring, for example when opening a car tailgate, the nitrogen gas flows through the metering orifice in the piston to provide a controlled opening speed and the oil zone provides damping at the fully open position to avoid impact damage. The gas spring should be mounted "rod down" for this damping to be effective. On closing the tailgate the gas spring helps support the weight. The metering orifice controls the extension and compression velocities of the gas spring.

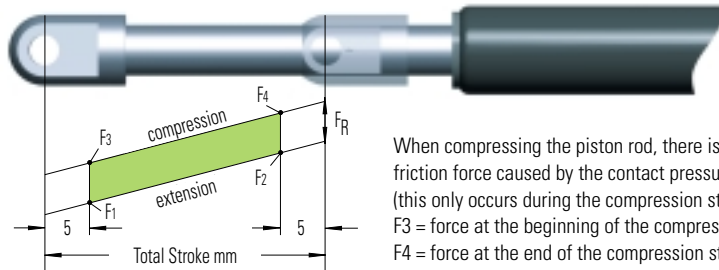


Gas springs are universally accepted, wherever you want to **push, pull, lift, lower, or position** covers, lids or other components by hand without using an external energy source.

ACE gas springs are individually filled to a predetermined pressure to suit a customer's requirement (extension Force F_1). The cross-sectional area of the piston rod and filling pressure determines the extension force $F=p \cdot A$. During the compression of the piston rod, nitrogen flows through an orifice in the piston from the full bore side of the piston to the annulus.

The nitrogen is compressed by the volume of the piston rod. As the piston rod is compressed the pressure increases, so increasing the reaction force (progression). The force depends on the proportional relationship between the piston rod and the inner tube diameter, which is approximately linear.

Gas Spring Force-Stroke Characteristics Standard Gas Spring (Push Type)



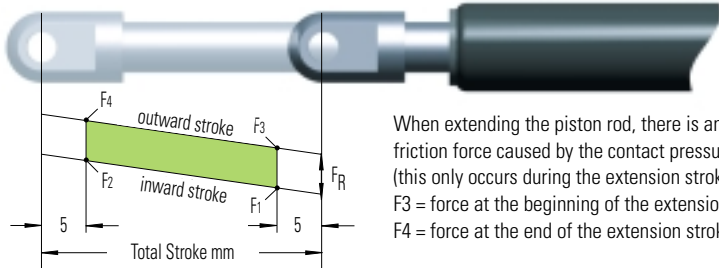
When compressing the piston rod, there is an additional friction force caused by the contact pressure of the seals (this only occurs during the compression stroke) F_R
 F_3 = force at the beginning of the compression stroke
 F_4 = force at the end of the compression stroke

F_1 = nominal force at 20°C (this is the pressure figure normally used when specifying the gas spring)
 F_2 = force in the complete compressed position

Model	Progression* approx. %	Friction F_R ** approx. in N
GS-8	28	10
GS-10	20	10
GS-12	25	20
GS-15	27	20
GS-19	36 - 42***	30
GS-22	39 - 50***	30
GS-28	60 - 95***	40
GS-40	47 - 53***	50
GS-70	25	50
GBF-28	50	60
GBS-28	50	60

** depending on the filling force
 *** depending on the stroke

Traction Gas Spring (Pull Type)



When extending the piston rod, there is an additional friction force caused by the contact pressure of the seals (this only occurs during the extension stroke) F_R
 F_3 = force at the beginning of the extension stroke
 F_4 = force at the end of the extension stroke

F_1 = nominal force at 20°C (this is the pressure figure normally used when specifying the gas spring)
 F_2 = force in the complete extended position

Model	Progression* approx. %	Friction F_R ** approx. in N
GZ-19	10	30
GZ-28	20	40

* **The Progression** (the slope of the force line in the diagrams above) is due to the reduction of the internal gas volume as the piston rod moves from its initial position to its fully stroked position. The approx. progression values given above for standard springs can be altered on request.
Effect of Temperature: The nominal F_1 figure is given at 20°C. An increase of 10°C will increase force by 3.4%.
Filling Tolerance on F_1 Force: -20 N to +40 N or 5% to 7%.

Service Life

Filling tolerance: -20 N to +40 N or 5% to 7%

Effect of temperature: An increase in temperature of each 10°C will increase force by approx. 3.4%.

Temperature range: -20°C to +80°C (special seals from -45°C to 200°C).

Mounting: The gas springs should ideally be installed with the **piston rod pointing downwards** to use the end damping during the extension stroke to smoothly decelerate the motion of the gas spring. Some ACE gas springs have a uniquely designed front bearing with an integrated grease chamber allowing the gas spring to be mounted and operated in any position if required.

When fitting the gas springs ensure that the stroke is fully extended (GZ type fully compressed), this makes assembly and disassembly much easier. Support the moving mass/ flap during assembly or disassembly to prevent accident. To avoid twisting or side loading, it is recommended that ball joints or other pivoted mounting attachments are used. The mounting attachments must always be securely tightened onto the threaded studs of the gas spring.

ACE gas springs are maintenance-free. DO NOT oil or grease the piston rod!

The piston rod must be protected from any hits, scratches or dirt and especially paint. Damage to the surface finish of the piston rod will destroy the sealing system and cause loss of pressure. The outer body must not be deformed or mechanically damaged.

ACE gas springs can be stored in any position. Experience has shown that long storage periods do not result in loss of pressure. However you may experience some "stiction" requiring a higher effort to move the gas spring for the first time after a long storage period.

Generally, ACE gas springs are tested to 70 000 to 100 000 complete strokes (the automobile industry requires 50 000 strokes). During these tests the gas spring must not lose more than 5% of its pressure. Depending upon the application and operating environment, the service life of these gas springs may be much longer. In practise 500 000 strokes or more have been achieved on some applications.

Lifetime traction gas spring see pages 118 and 119.

Calculation

To obtain the ideal selection to give the optimum operation for a gas spring it is important to identify the following points:

- gas spring size
- required gas spring stroke
- mounting points on flap and frame
- extended length of the gas spring
- required extension force
- hand forces throughout the complete movement of the flap

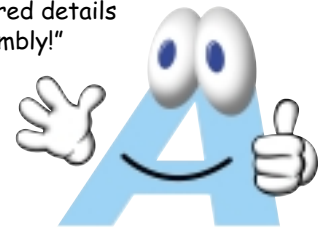
You will receive a quotation showing the opening and closing forces and our recommended mounting points to suit your application.



With our **free calculation service** you can eliminate the time-consuming calculation and fax us your details. Just complete the information shown on the calculation formulae page number 127.

Please attach a sketch of your application (a simple hand sketch is sufficient) in side view. Our application engineers will determine the optimum mounting points and calculate the ideal situation to satisfy your requirements.

"Calculation offer with all required details for assembly!"



Safety Instructions

Gas springs are filled with pure nitrogen gas. Nitrogen is an inert gas that does not burn or explode and is not poisonous. Please note!: the internal pressure of gas springs can be up to 300 Bars. Do not attempt to open or modify them.

Disposal/Recycling: please ask for our disposal recommendations.

All gas springs are marked with a warning sign "Do not open, high pressure", the part number and the production date. We are not responsible for any damages, of whatever kind, that arise due to goods that are not marked accordingly.

ACE gas springs are designed and tested to withstand the highest demands and to provide maximum reliability. Installation recommendations and our expert advisors will assist you in choosing your individual gas spring. **But: the user is ultimately responsible for his own selection!** You should therefore satisfy yourself of the functionality and service life of the product you choose.

Discharging/degassing gas springs: for valve gas springs, see page 121.

The **ACE Gas Spring Refilling Kit** gives the ability to fill, or adjust pressure (or force) of a Gas Spring on site. You gain independence and flexibility. The refilling kit includes all the parts necessary to fill your ACE gas springs on site (models with adjustment valve only). Only the high pressure nitrogen bottle is not included in the kit.

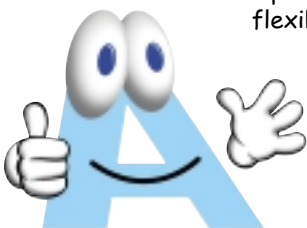
Gas spring refilling kit with one filling bell. Please indicate the thread size.



Available filling bells

- M3.5-8: GS-8
- M3.5-10: GS-10
- M3.5-12: GS-12
- M5: GS-15
- M8: GS-19
- GS-22
- GZ-19
- M10: GS-28
- GZ-28
- M14: GS-40

"Independence and flexibility!"

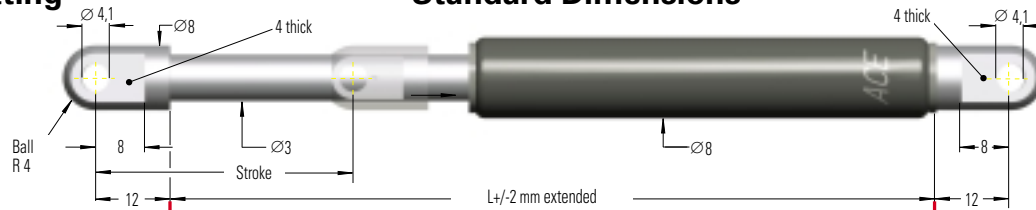


End Fitting

Standard Dimensions

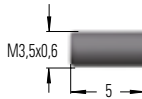
End Fitting

A3.5



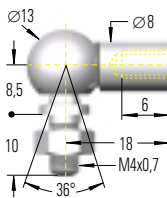
Eye **A3.5**

B3.5



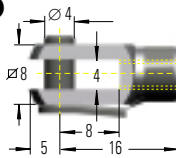
Stud Thread **B3.5**

C3.5



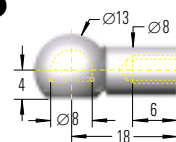
Angle Ball Joint **C3.5**

D3.5



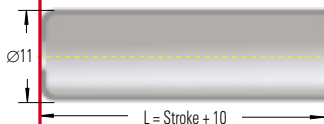
Clevis Fork **D3.5**

G3.5



Ball Socket **G3.5**

W3.5-8
Rod Shroud



Dimensions

Type	Stroke mm	L Extended
GS-8-20	20	72
GS-8-30	30	92
GS-8-40	40	112
GS-8-50	50	132
GS-8-60	60	152
GS-8-80	80	192

Ordering Example

GS-8-30-AC-V-30

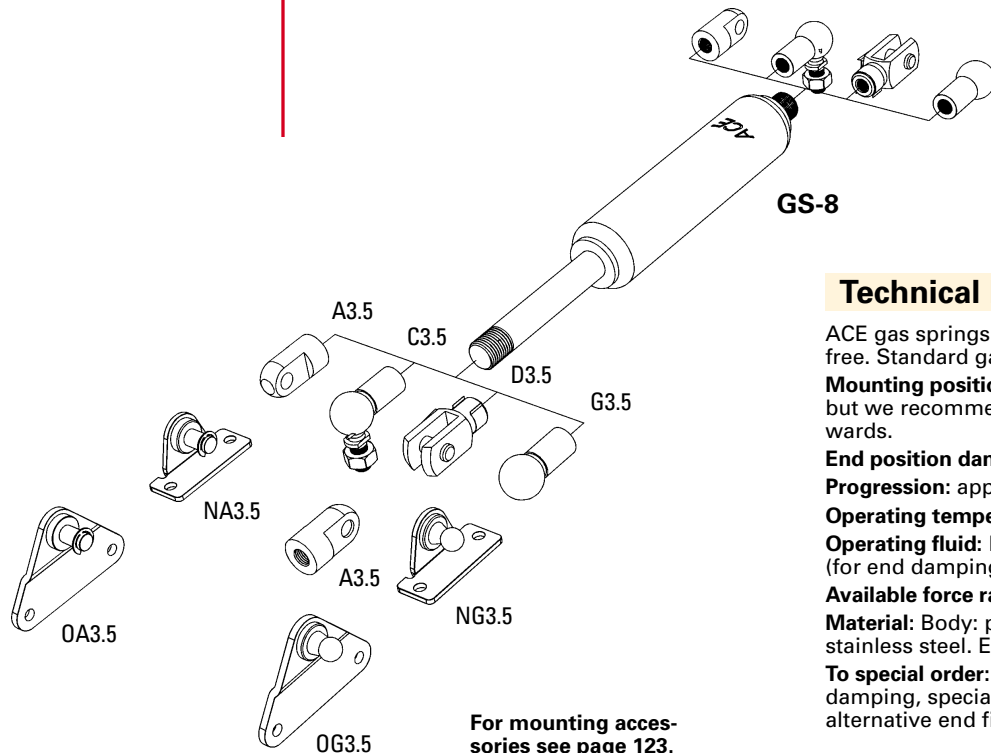
Type (Push Type) _____
 Body \varnothing (8 mm) _____
 Stroke (30 mm) _____
 Piston Rod End Fitting A3.5 _____
 Body End Fitting C3.5 _____
 Valve V3.5 _____
 Nominal Force F1 30 N _____

The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 123.

U3.5
Adjuster Knob

V3.5 See page 121.
Adjustment Valve

GS-8



For mounting accessories see page 123.

Technical Data

ACE gas springs are self-contained and maintenance free. Standard gas springs with valve – ex stock.

Mounting position: Can be mounted in any position but we recommend mounting with piston rod downwards.

End position damping length: approx. 5 mm.

Progression: approx. 28%, F2 max. 130 N.

Operating temperature range: -20°C to +80°C.

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F1 at 20°C: 10 to 100 N.

Material: Body: powder coated steel. Piston rod: stainless steel. End fittings: zinc plated steel.

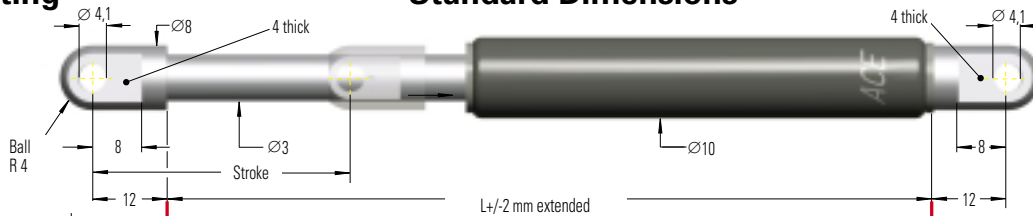
To special order: Without damping, extended length damping, special force curves, special lengths, alternative end fittings.

End Fitting

Standard Dimensions

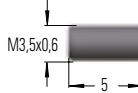
End Fitting

A3.5



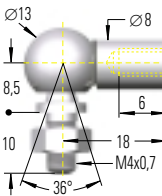
Eye **A3.5**

B3.5



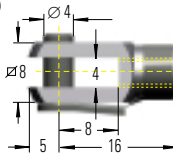
Stud Thread **B3.5**

C3.5



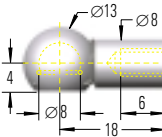
Angle Ball Joint **C3.5**

D3.5



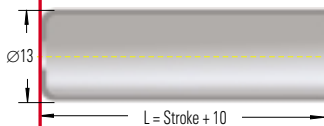
Clevis Fork **D3.5**

G3.5



Ball Socket **G3.5**

W3.5-10
Rod Shroud



Dimensions

Type	Stroke mm	L Extended
GS-10-20	20	72
GS-10-30	30	92
GS-10-40	40	112
GS-10-50	50	132
GS-10-60	60	152
GS-10-80	80	192

Ordering Example

GS-10-80-AC-V-60

Type (Push Type) _____
 Body ϕ (10 mm) _____
 Stroke (80 mm) _____
 Piston Rod End Fitting A3.5 _____
 Body End Fitting C3.5 _____
 Valve V3.5 _____
 Nominal Force F₁ 60 N _____

The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 123.

U3.5
Adjuster Knob

V3.5
Adjustment Valve

See page 121.

GS-10

Technical Data

ACE gas springs are self-contained and maintenance free. Standard gas springs with valve – ex stock.

Mounting position: Can be mounted in any position but we recommend mounting with piston rod downwards.

End position damping length: approx. 5 mm.

Progression: approx. 20%, F₂ max. 120 N.

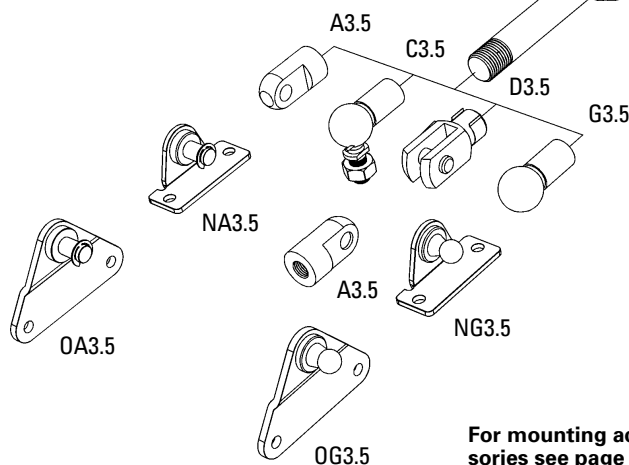
Operating temperature range: -20°C to +80°C.

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F₁ at 20°C: 10 to 100 N.

Material: Body: powder coated steel. Piston rod: stainless steel. End fittings: zinc plated steel.

To special order: Without damping, extended length damping, special force curves, special lengths, alternative end fittings.



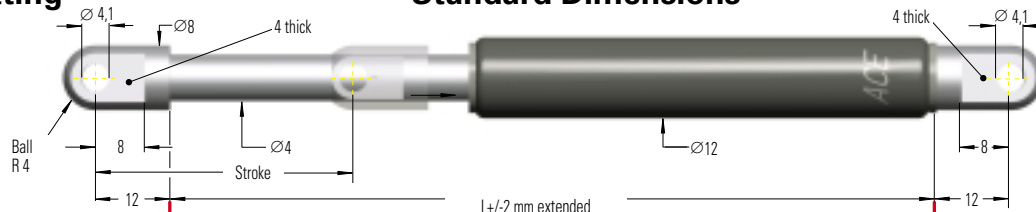
For mounting accessories see page 123.

End Fitting

Standard Dimensions

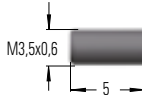
End Fitting

A3.5



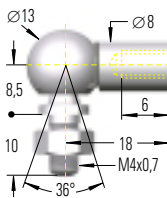
Eye **A3.5**

B3.5



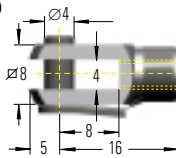
Stud Thread **B3.5**

C3.5



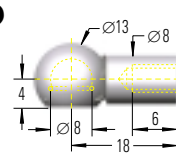
Angle Ball Joint **C3.5**

D3.5



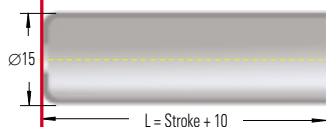
Clevis Fork **D3.5**

G3.5



Ball Socket **G3.5**

W3.5-12
Rod Shroud



Dimensions

Type	Stroke mm	L Extended	max. F1
GS-12-20	20	72	180 N
GS-12-40	40	112	180 N
GS-12-50	50	132	180 N
GS-12-60	60	152	180 N
GS-12-80	80	192	150 N
GS-12-100	100	232	150 N
GS-12-120	120	272	120 N
GS-12-150	150	332	100 N

Ordering Example

Type (Push Type) _____
 Body \varnothing (12 mm) _____
 Stroke (100 mm) _____
 Piston Rod End Fitting A3.5 _____
 Body End Fitting A3.5 _____
 Valve V3.5 _____
 Nominal Force F1 30 N _____

GS-12-100-AA-V-30

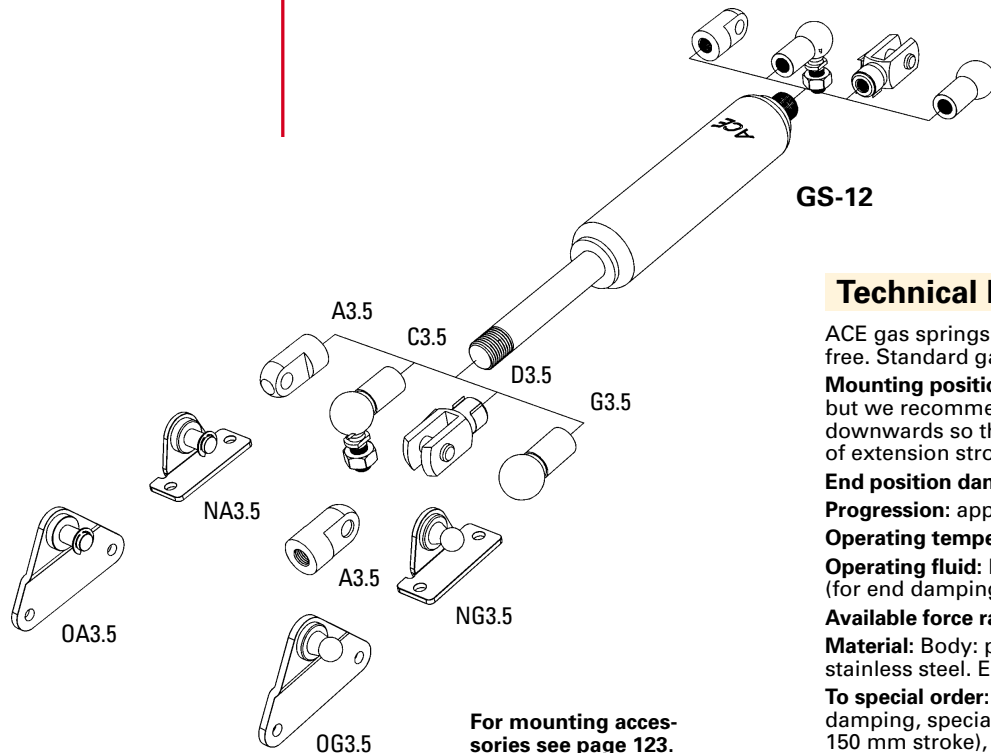
The end fittings are interchangeable.
For adjustment valve add suffix -V.
For mounting accessories see page 123.

U3.5
Adjuster Knob

V3.5
Adjustment Valve

See page 121.

GS-12



For mounting accessories see page 123.

Technical Data

ACE gas springs are self-contained and maintenance free. Standard gas springs with valve – ex stock.

Mounting position: can be mounted in any position but we recommend mounting with the piston rod downwards so that the damping is effective at end of extension stroke.

End position damping length: approx. 10 mm.

Progression: approx. 25 %, F2 max. 225 N.

Operating temperature range: -20°C to +80°C.

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F1 at 20°C: 10 to 180 N.

Material: Body: powder coated steel. Piston rod: stainless steel. End fittings: zinc plated steel.

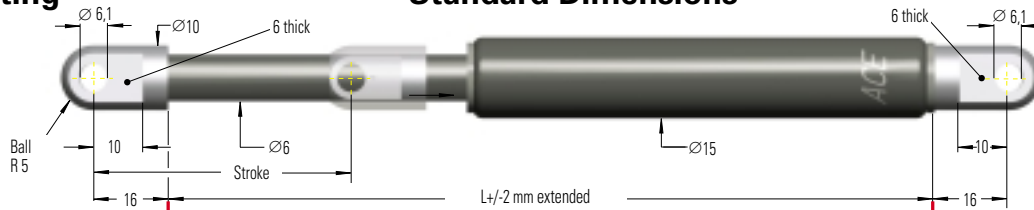
To special order: Without damping, extended length damping, special force curves, special lengths (max. 150 mm stroke), alternative end fittings.

End Fitting

Standard Dimensions

End Fitting

A5



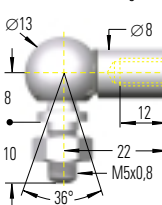
Eye A5

B5



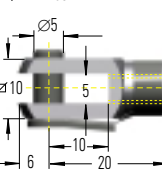
Stud Thread B5

C5



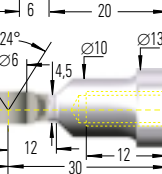
Angle Ball Joint C5

D5



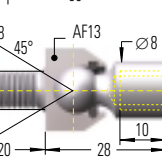
Clevis Fork D5

E5



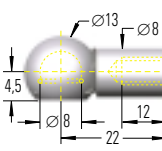
Swivel Eye E5

F5



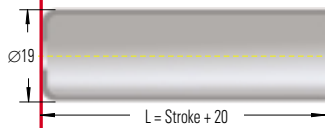
Inline Ball Joint F5

G5



Ball Socket G5

W5-15
Rod Shroud



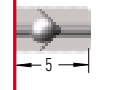
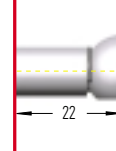
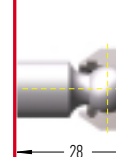
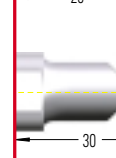
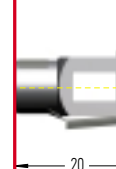
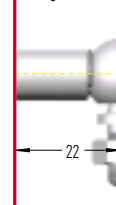
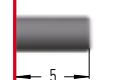
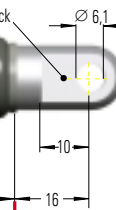
Dimensions

Type	Stroke mm	L Extended
GS-15-20	20	66
GS-15-40	40	106
GS-15-50	50	126
GS-15-60	60	146
GS-15-80	80	186
GS-15-100	100	226
GS-15-120	120	266
GS-15-150	150	326

Ordering Example GS-15-150-AC-V-400

Type (Push Type) _____
 Body ø (15 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting A5 _____
 Body End Fitting C5 _____
 Valve V5 _____
 Nominal Force F1 400 N _____

The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 123.



V5
Adjustment Valve
See page 121.

GS-15

Technical Data

ACE gas springs are self-contained and maintenance free. Standard gas springs with valve – ex stock.

Mounting position: Can be mounted in any position but we recommend mounting with the piston rod downwards so that the damping is effective at end of extension stroke.

End position damping length: approx. 10 mm.

Progression: approx. 27 %, F2 max. 500 N.

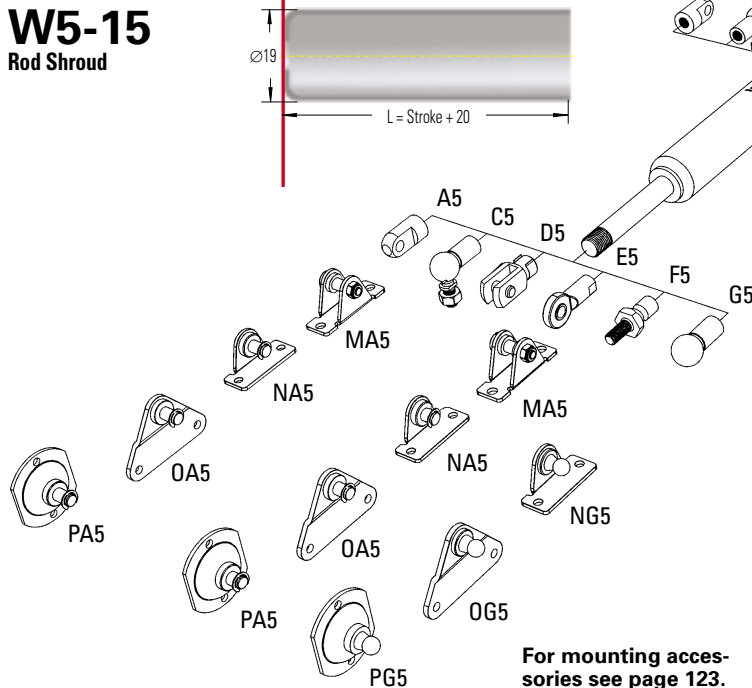
Operating temperature range: -20°C to +80°C.

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F1 at 20°C: 10 to 400 N.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

To special order: Without damping, extended length damping, special force curves, special lengths (max. 250 mm stroke), alternative end fittings, stainless steel (see page 126).



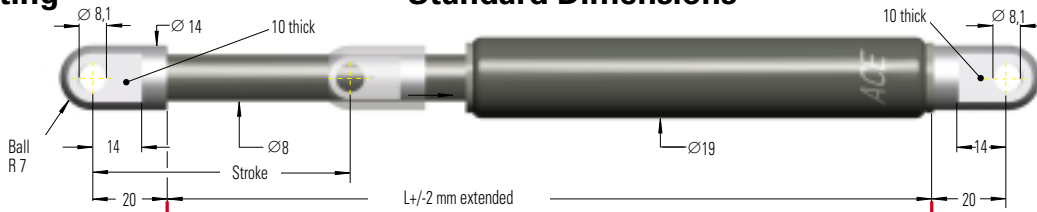
For mounting accessories see page 123.

End Fitting

Standard Dimensions

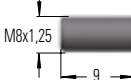
End Fitting

A8



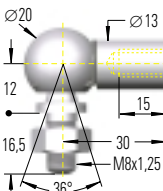
Eye A8

B8



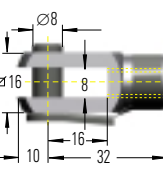
Stud Thread B8

C8



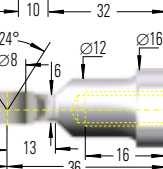
Angle Ball Joint C8

D8



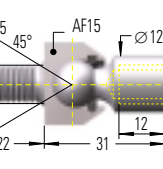
Clevis Fork D8

E8



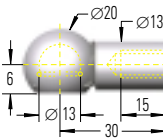
Swivel Eye E8

F8



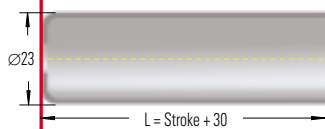
Inline Ball Joint F8

G8



Ball Socket G8

W8-19
Rod Shroud



Dimensions

Type	Stroke mm	L Extended
GS-19-50	50	164
GS-19-100	100	264
GS-19-150	150	364
GS-19-200	200	464
GS-19-250	250	564
GS-19-300	300	664

Ordering Example GS-19-150-AC-V-600

Type (Push Type) _____
 Body \varnothing (19 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting A8 _____
 Body End Fitting C8 _____
 Valve V8 _____
 Nominal Force F1 600 N _____

The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 124.

V8
Adjustment Valve

See page 121.

Technical Data

ACE gas springs are self-contained and maintenance free, with strong end position damping and slow extension speed. Standard gas springs with valve – ex stock.

Mounting position: Can be mounted in any position but we recommend mounting with the piston rod downwards so that the damping is effective at end of extension stroke.

End damping length: approx. 20 to 60 mm (depending on the stroke).

Progression: approx. 36 to 42 %, F2 max. 995 N.

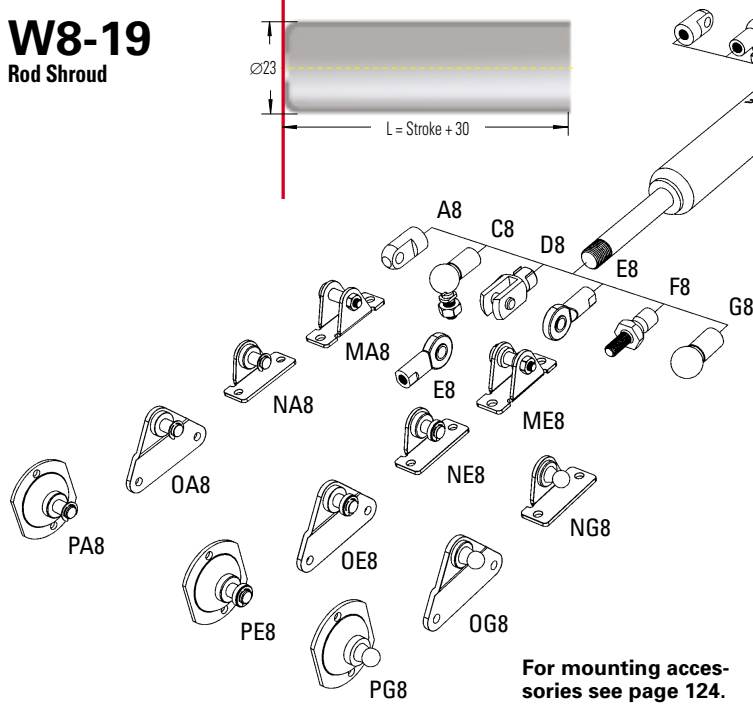
Operating temperature: -20°C to +80°C (with special seals up to 200°C).

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F1 at 20°C: 50 to 700 N.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

To special order: Without damping, standard length damping, special force curves, special lengths, alternative end fittings, stainless steel (see page 126).



For mounting accessories see page 124.

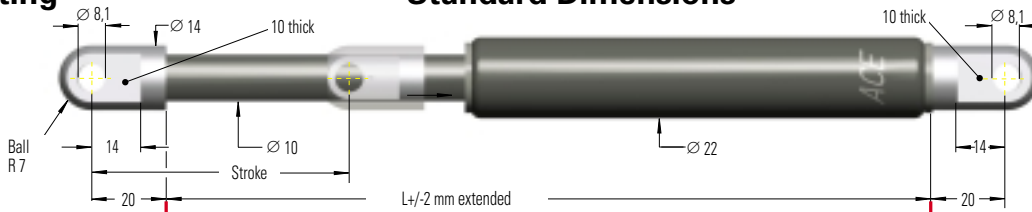
Issue 9.2004 Specifications subject to change

End Fitting

Standard Dimensions

End Fitting

A8



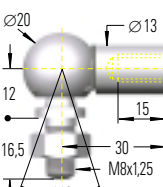
Eye **A8**

B8



Stud Thread **B8**

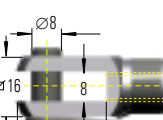
C8



Angle Ball Joint **C8**

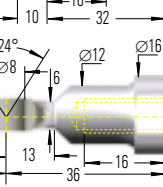
(Max. permitted force 1200 N)

D8



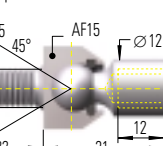
Clevis Fork **D8**

E8



Swivel Eye **E8**

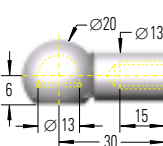
F8



Inline Ball Joint **F8**

(Max. permitted force 1200 N)

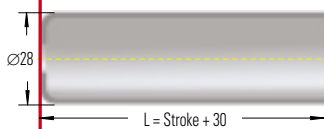
G8



Ball Socket **G8**

(Max. permitted force 1200 N)

W8-22
Rod Shroud



Dimensions

Type	Stroke mm	L Extended
GS-22-50	50	164
GS-22-100	100	264
GS-22-150	150	364
GS-22-200	200	464
GS-22-250	250	564
GS-22-300	300	664
GS-22-350	350	764
GS-22-400	400	864
GS-22-450	450	964
GS-22-500	500	1064
GS-22-550	550	1164
GS-22-600	600	1264
GS-22-650	650	1364
GS-22-700	700	1464

Ordering Example GS-22-150-AE-V-800

Type (Push type) _____
 Body \varnothing (22 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting A8 _____
 Body End Fitting E8 _____
 Valve V8 _____
 Nominal Force F_1 800 N _____

The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 124.

V8
Adjustment Valve

See page 121.

Technical Data

ACE gas springs are self-contained and maintenance free, with strong end position damping and slow extension speed. Standard gas springs with valve – ex stock.

Mounting Position: Can be mounted in any position but we recommend mounting with piston rod downwards so that damping is effective at end of extension stroke.

End damping length: approx. 20 to 70 mm (depending on the stroke).

Progression: approx. 39 to 50 %, F_2 max. 1950 N.

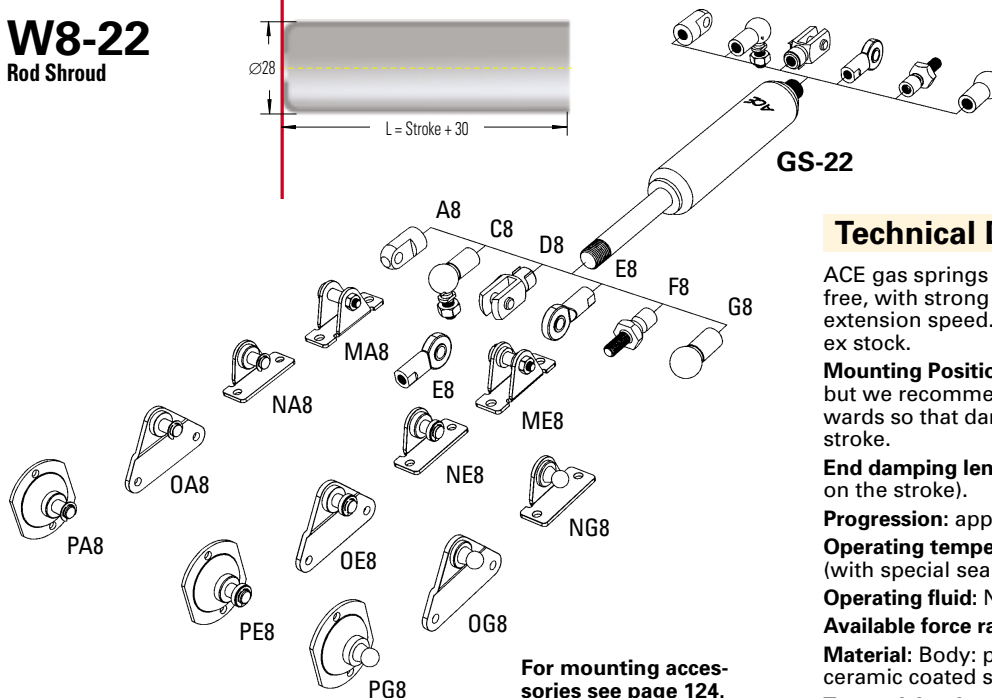
Operating temperature range: -20°C to +80°C (with special seals up to 200°C).

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F_1 at 20°C: 80 to 1300 N.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

To special order: Without damping, standard length damping, special force curves, special lengths, alternative end fittings, stainless steel (see page 126).



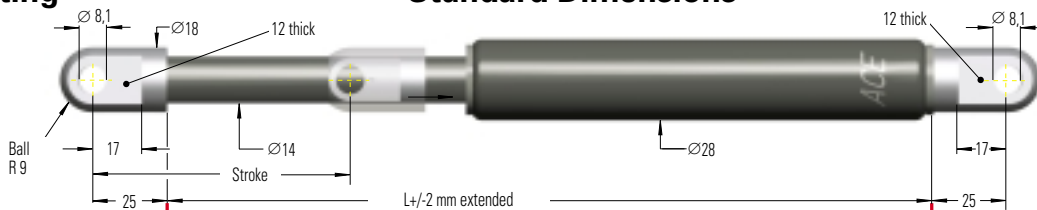
For mounting accessories see page 124.

End Fitting

Standard Dimensions

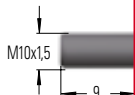
End Fitting

A10



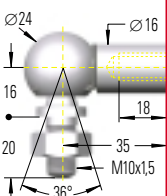
Eye **A10**

B10



Stud Thread **B10**

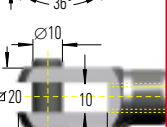
C10



Angle Ball Joint **C10**

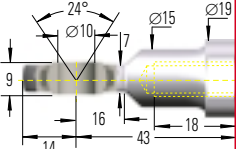
(Max. permitted force 1800 N)

D10



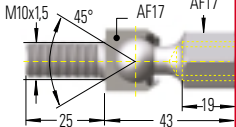
Clevis Fork **D10**

E10



Swivel Eye **E10**

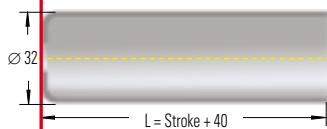
F10



Inline Ball Joint **F10**

(Max. permitted force 1800 N)

W10-28
Rod Shroud



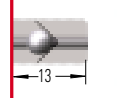
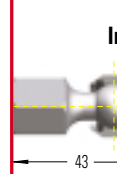
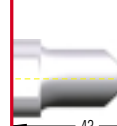
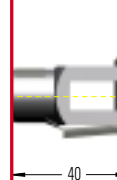
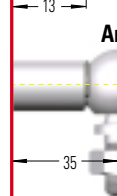
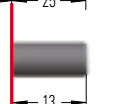
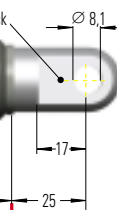
Dimensions

Type	Stroke mm	L Extended
GS-28-100	100	262
GS-28-150	150	362
GS-28-200	200	462
GS-28-250	250	562
GS-28-300	300	662
GS-28-350	350	762
GS-28-400	400	862
GS-28-450	450	962
GS-28-500	500	1062
GS-28-550	550	1162
GS-28-600	600	1262
GS-28-650	650	1362
GS-28-700	700	1462
GS-28-750	750	1562

Ordering Example GS-28-150-EE-V-1200

Type (Push type) _____
 Body ø (28 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting E10 _____
 Body End Fitting E10 _____
 Valve V10 _____
 Nominal Force F₁ 1200 N _____

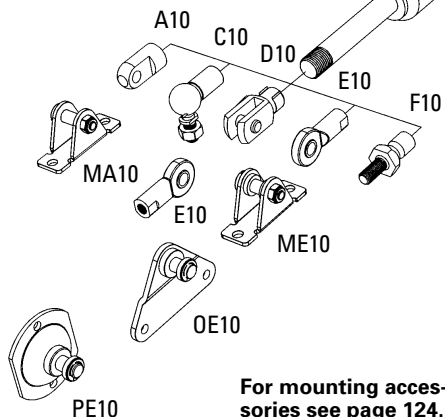
The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 124.



See page 121.

V10
Adjustment Valve

GS-28



For mounting accessories see page 124.

Technical Data

ACE gas springs are self-contained and maintenance free, with strong end position damping and slow extension speed. Standard gas springs with valve – ex stock.

Mounting position: Can be mounted in any position but we recommend mounting with piston rod downwards so that damping is effective at end of extension stroke.

End damping length: approx. 30 to 70 mm (depending on the stroke).

Progression: approx. 60 to 95 %, F₂ max. 4875 N.

Operating temperature range: -20°C to +80°C (with special seals up to 200°C).

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F₁ at 20°C: 100 to 2500 N.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

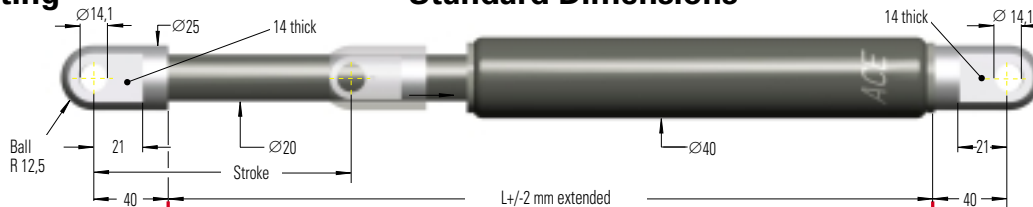
To special order: without damping, standard length damping, special force curves, special lengths, alternative end fittings, stainless steel (see page 126).

End Fitting

Standard Dimensions

End Fitting

A14



Eye **A14**

B14

Stud Thread **B14**

C14

Angle Ball Joint **C14**

(Max. permitted force 3200 N)

D14

Clevis Fork **D14**

E14

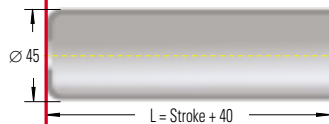
Swivel Eye **E14**

F14

Inline Ball Joint **F14**

(Max. permitted force 3200 N)

W14-40
Rod Shroud



U14
Adjuster Knob

See page 121.

V14
Adjustment Valve

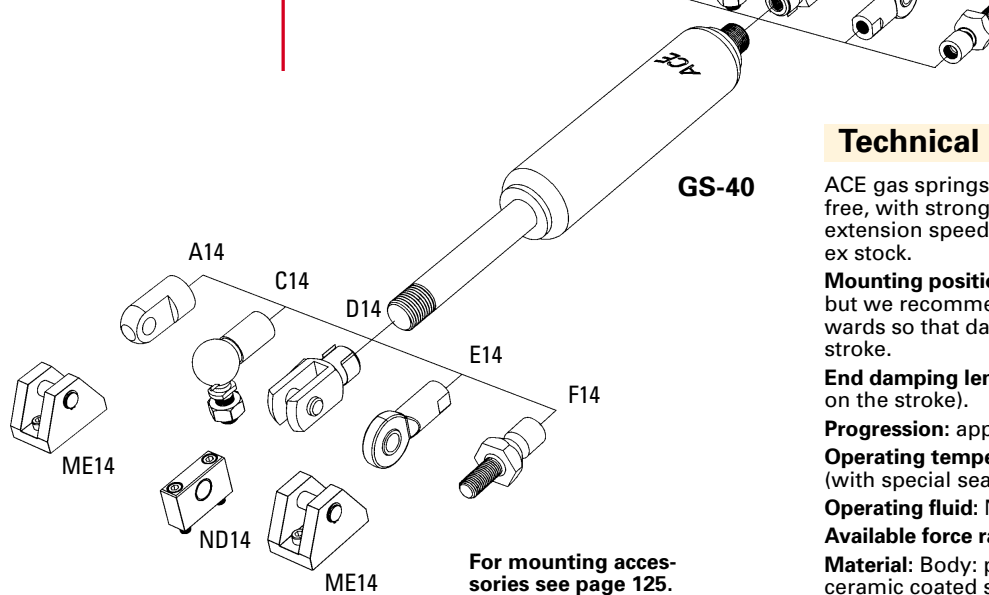
Dimensions

Type	Stroke mm	L Extended
GS-40-100	100	317
GS-40-150	150	417
GS-40-200	200	517
GS-40-300	300	717
GS-40-400	400	917
GS-40-500	500	1117
GS-40-600	600	1317
GS-40-800	800	1717
GS-40-1000	1000	2117

Ordering Example GS-40-150-DD-V-3500

Type (Push type) _____
 Body \varnothing (40 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting D14 _____
 Body End Fitting D14 _____
 Valve V14 _____
 Nominal Force F_1 3500 N _____

The end fittings are interchangeable.
 For adjustment valve add suffix -V.
 For mounting accessories see page 125.



For mounting accessories see page 125.

Technical Data

ACE gas springs are self-contained and maintenance free, with strong end position damping and slow extension speed. Standard gas springs with valve – ex stock.

Mounting position: Can be mounted in any position but we recommend mounting with piston rod downwards so that damping is effective at end of extension stroke.

End damping length: approx. 30–70 mm (depending on the stroke).

Progression: approx. 47 to 53 %, F_2 max. 7650 N.

Operating temperature range: -20°C to +80°C (with special seals up to 200°C).

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F_1 at 20°C: 500 to 5000 N.

Material: Body: powder coated steel. Piston rod: ceramic coated steel. End fittings: zinc plated steel.

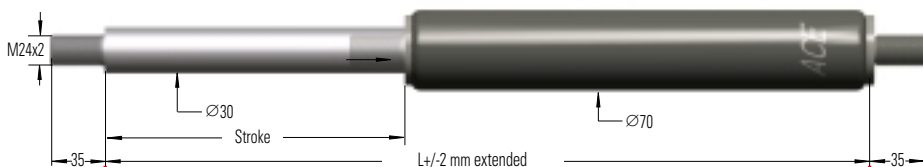
To special order: Without damping, standard length damping, special force curves, special lengths, alternative end fittings, stainless steel (see page 126).

End Fitting

Standard Dimensions

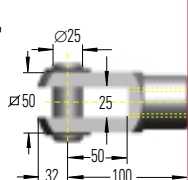
End Fitting

B24

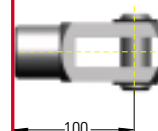


Stud Thread **B24**

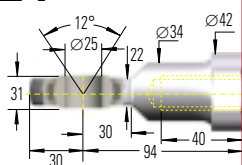
D24



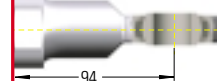
Clevis Fork **D24**



E24



Swivel Eye **E24**



Dimensions

Type	Stroke mm	L Extended
GS-70-100	100	320
GS-70-200	200	520
GS-70-300	300	720
GS-70-400	400	920
GS-70-500	500	1120
GS-70-600	600	1320
GS-70-700	700	1520
GS-70-800	800	1720

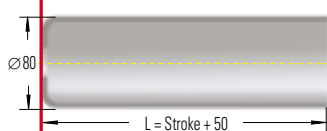
Ordering Example GS-70-200-EE-8000

Type (Push Type) _____
 Body ø (70 mm) _____
 Stroke (200 mm) _____
 Piston Rod End Fitting E24 _____
 Body End Fitting E24 _____
 Nominal Force F₁ 8000 N _____

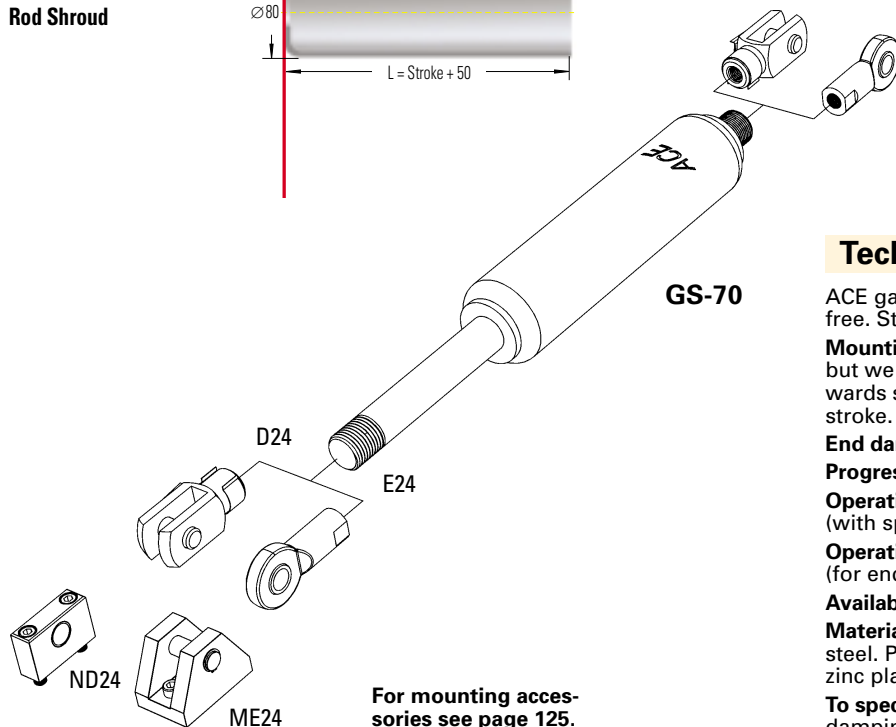
The end fittings are interchangeable.
 For mounting accessories see page 125.
 Standard version includes valve.

W24-70

Rod Shroud



GS-70



For mounting accessories see page 125.

Technical Data

ACE gas springs are self-contained and maintenance free. Standard gas springs with valve.

Mounting position: Can be mounted in any position but we recommend mounting with piston rod downwards so that damping is effective at end of extension stroke.

End damping length: approx. 10 mm.

Progression: approx. 25%, F₂ max. 16 250 N.

Operating temperature range: -20°C to +80°C (with special seals up to 200°C).

Operating fluid: Nitrogen gas and oil (for end damping).

Available force range F₁ at 20°C: 2 000 to 13 000 N.

Material: Body: powder coated steel or zinc plated steel. Piston rod: hard chrome plated. End fittings: zinc plated steel.

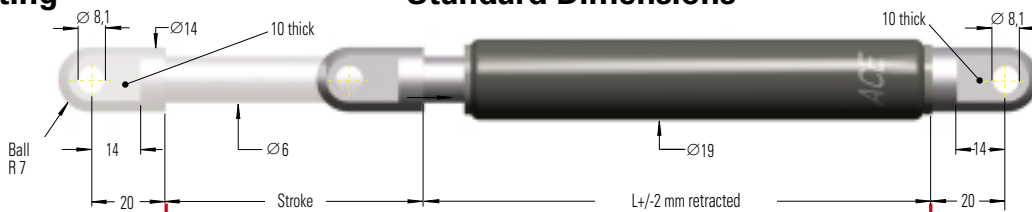
To special order: Without damping, extended length damping, special force curves, special lengths, alternative end fittings.

End Fitting

Standard Dimensions

End Fitting

A8



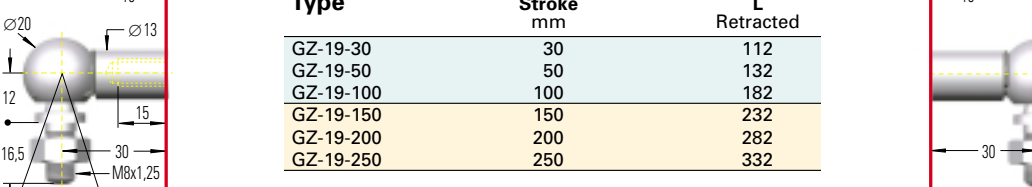
Eye **A8**

B8



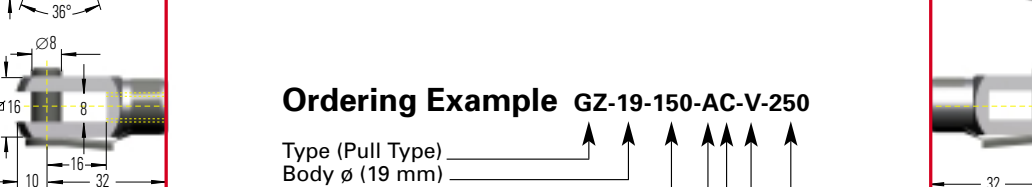
Stud Thread **B8**

C8



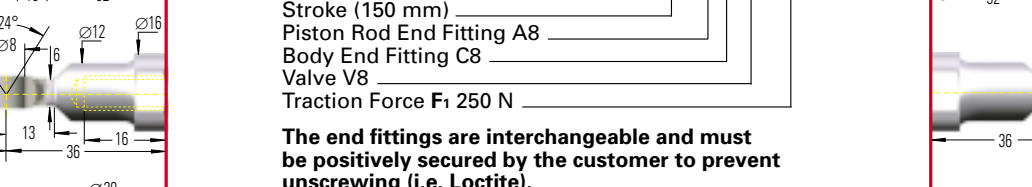
Angle Ball Joint **C8**

D8



Clevis Fork **D8**

E8



Swivel Eye **E8**

G8



Ball Socket **G8**

Dimensions

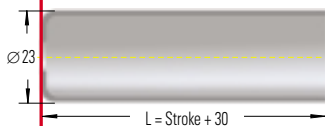
Type	Stroke mm	L Retracted
GZ-19-30	30	112
GZ-19-50	50	132
GZ-19-100	100	182
GZ-19-150	150	232
GZ-19-200	200	282
GZ-19-250	250	332

Ordering Example GZ-19-150-AC-V-250

Type (Pull Type) _____
 Body \varnothing (19 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting A8 _____
 Body End Fitting C8 _____
 Valve V8 _____
 Traction Force F₁ 250 N _____

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite).
 For adjustment valve add suffix -V
 For mounting accessories see page 124.

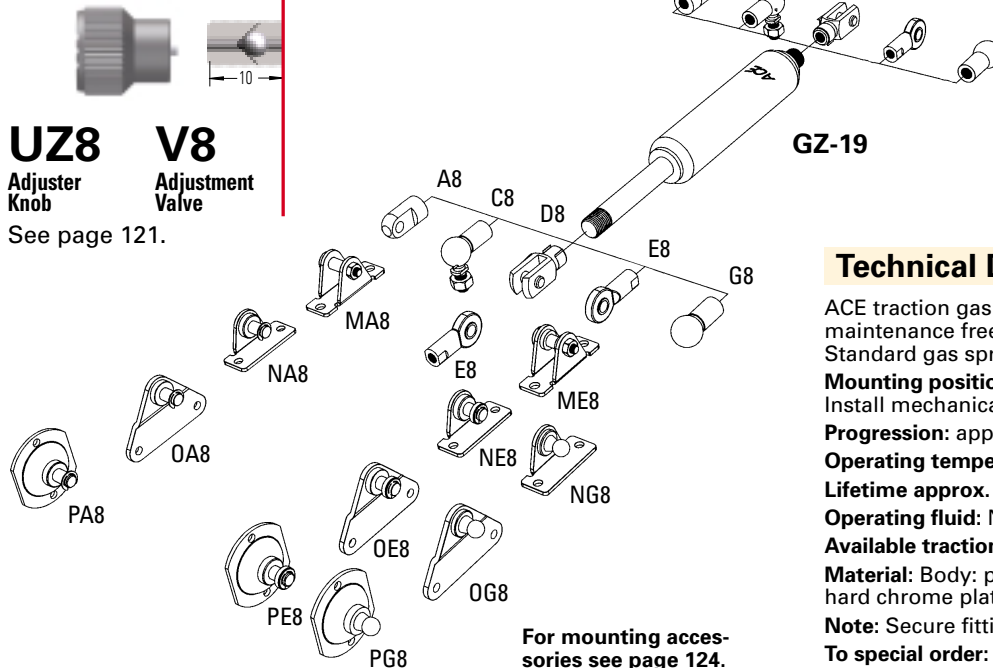
WZ8-19 Rod Shroud



UZ8 Adjuster Knob

See page 121.

V8 Adjustment Valve



Technical Data

ACE traction gas springs are self-contained and maintenance free and supplied without damping. Standard gas springs with valve – ex stock.
Mounting position: Can be mounted in any position. Install mechanical stop in extended position.
Progression: approx. 10%, F₂ max. 330 N.
Operating temperature range: -20°C to +80°C.
Lifetime approx. 2000 m.
Operating fluid: Nitrogen gas and oil (for lubrication).
Available traction force range F₁ at 20°C: 30 to 300 N.
Material: Body: powder coated steel. Piston rod: hard chrome plated. End fittings: zinc plated steel.
Note: Secure fittings with Loctite or similar.
To special order: Special force curves, special lengths, alternative end fittings.

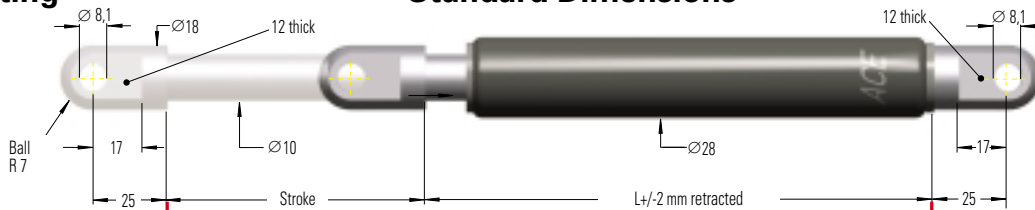
For mounting accessories see page 124.

End Fitting

Standard Dimensions

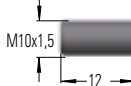
End Fitting

A10



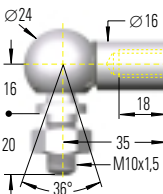
Eye A10

B10



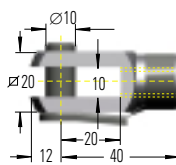
Stud Thread B10

C10



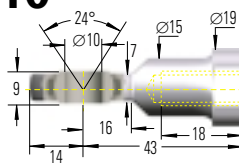
Angle Ball Joint C10

D10



Clevis Fork D10

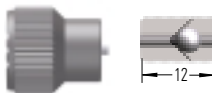
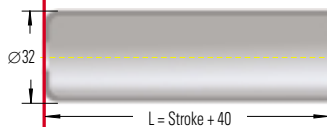
E10



Swivel Eye E10

WZ10-28

Rod Shroud



UZ10 V10

Adjuster Knob

Adjustment Valve

See page 121.

Dimensions

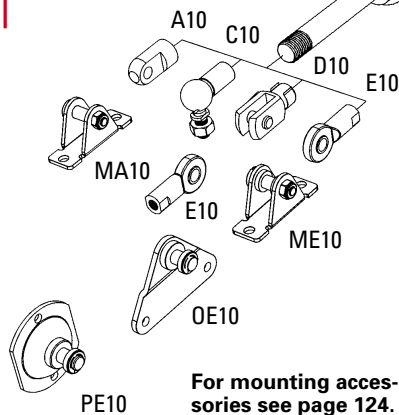
Type	Stroke mm	L Retracted
GZ-28-30	30	130
GZ-28-50	50	150
GZ-28-100	100	200
GZ-28-150	150	250
GZ-28-200	200	300
GZ-28-250	250	350
GZ-28-300	300	400
GZ-28-350	350	450
GZ-28-400	400	500
GZ-28-450	450	550
GZ-28-500	500	600
GZ-28-550	550	650
GZ-28-600	600	700
GZ-28-650	650	750

Ordering Example GZ-28-150-EE-V-800

Type (Pull Type) _____
 Body \varnothing (28 mm) _____
 Stroke (150 mm) _____
 Piston Rod End Fitting E10 _____
 Body End Fitting E10 _____
 Valve V10 _____
 Traction Force F_1 800 N _____

The end fittings are interchangeable and must be positively secured by the customer to prevent unscrewing (i.e. Loctite).
 For adjustment valve add suffix -V
 For mounting accessories see page 124.

GZ-28



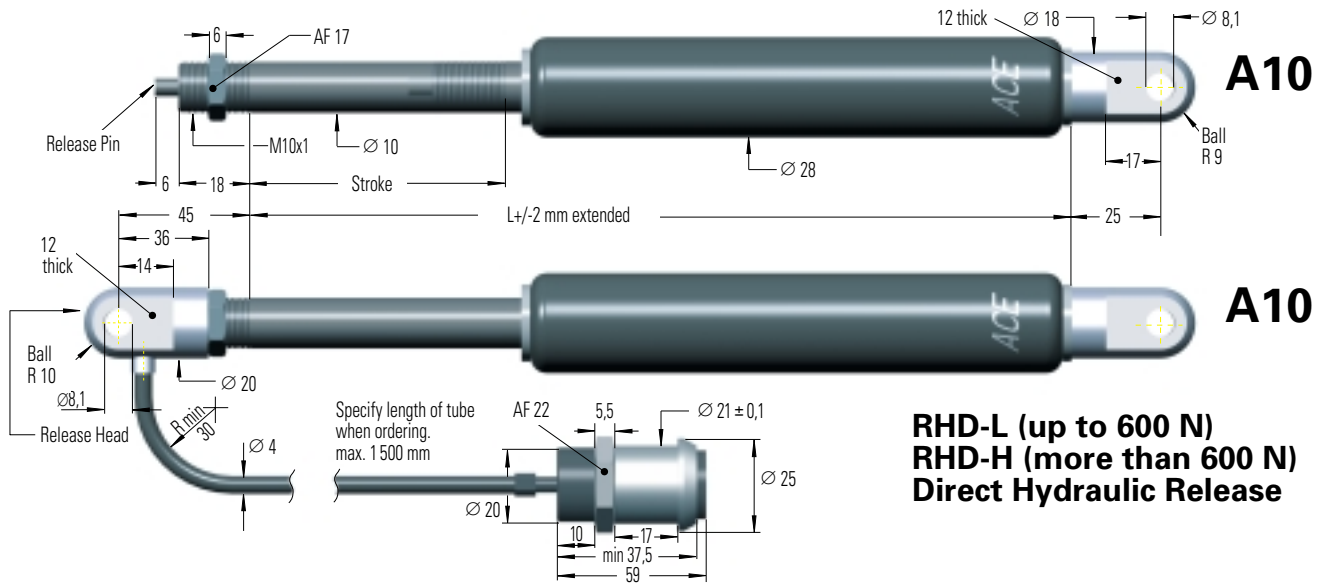
For mounting accessories see page 124.

Technical Data

ACE traction gas springs are self-contained and maintenance free. Standard gas springs with valve – ex stock.
Mounting position: Can be mounted in any position. Install mechanical stop in extended position.
Progression: approx. 20%, F_2 max. 1440 N.
Operating temperature range: -20°C to +80°C.
Lifetime approx. 2000 m.
Operating fluid: Nitrogen gas and oil (for lubrication).
Available traction force range F_1 at 20°C: 100 to 1200 N.
Material: Body: powder coated steel. Piston rod: hard chrome plated. End fittings: zinc plated steel.
Note: secure end fittings with Loctite or similar.
To special order: Protective rod shroud (dim L + 10 mm), special force curves, special lengths, alternative end fittings.

NEW

End Fitting



**RHD-L (up to 600 N)
RHD-H (more than 600 N)
Direct Hydraulic Release**

Technical Data

ACE gas springs are self-contained and maintenance free.

Mounting position: In any position.

Progression: approx. 50 %, $F_2 \text{ max} = 1950 \text{ N}$

Operating temperature range: -20°C to +80°C.

Hydraulic Remote Release: 10°C to 60°C.

Operating fluid: Nitrogen gas & oil.

Available force range: 100 N to 1300 N.

Rigid locking force: 6 to 8 times the extension force (GBS).

Material: Body: powder coated steel. Piston rod: hard chrome plated. End fittings: zinc plated steel.

To special order: Special lengths, force adjustment valve etc.

GBF Type: is locked by blocking gas flow across the piston.

GBS Type: is locked by blocking oil flow across the piston, giving a rigid hydraulic lock.

Dimensions

GBF-28 spring locking

Type	Stroke mm	L Extended
GBF-28-50	50	190
GBF-28-80	80	270
GBF-28-100	100	310
GBF-28-150	150	410
GBF-28-200	200	490
GBF-28-300	300	700
GBF-28-400	400	890

For mountings and end fittings for rear of body see page 124.

Dimensions

GBS-28 rigid locking

Type	Stroke mm	L Extended
GBS-28-35	35	190
GBS-28-60	60	270
GBS-28-100	100	333
GBS-28-130	130	418
GBS-28-150	150	495
GBS-28-200	200	553
GBS-28-250	250	710
GBS-28-300	300	800
GBS-28-450	450	1135
GBS-28-500	500	1250

Ordering Example GBF-28-150-1200-V-A

Type (Push Type) _____
 Spring Locking _____
 Body ø (28 mm) _____
 Stroke (150 mm) _____
 Nominal Force F_1 1200 N _____
 Valve V10 _____
 Rear Eye Fitting A10 _____

Ordering Example GBS-28-150-800-V-D

Type (Push Type) _____
 Rigid Locking _____
 Body ø (28 mm) _____
 Stroke (150 mm) _____
 Nominal Force F_1 800 N _____
 Valve V10 _____
 Rear Clevis Fork Fitting D10 _____

Hydraulic Remote Release System for Lockable Gas Springs.

The Hydraulic release system is maintenance free and self-contained. The release knob is designed for directly mounting into a control panel. The release system is available in direct, parallel and OR versions. The maximum connection tube length between the release knob and the lockable Gas Spring is 1500 mm.

Function: Depressing the remote release knob causes a small pressure rise which is transmitted to the release head fitted onto the end of the gas spring piston rod. This actuates the release pin in the end of the rod and "unlocks" the gas spring. As long as the release knob is depressed the gas spring is unlocked and operates as a normal gas spring. Once the release knob is released the gas spring locks again.

Ordering example: RHP-L-500-500-500 (x, y, z = 500 mm each)

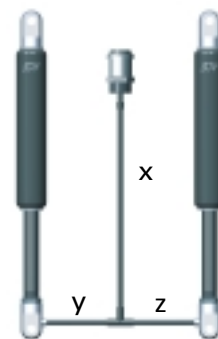
Mechanical release systems see page 121.

RHP-L up to 600 N

more than 600 N on request

Parallel-Release

Two gas springs with one hydr. release knob

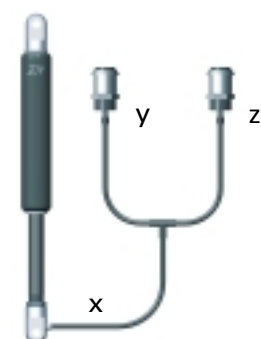


RHO-L up to 600 N

RHO-H more than 600 N

OR-Release

One gas spring with two hydr. release knobs

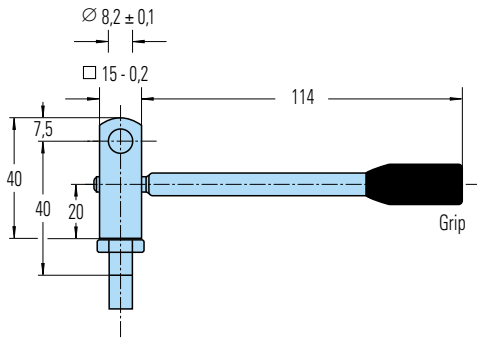
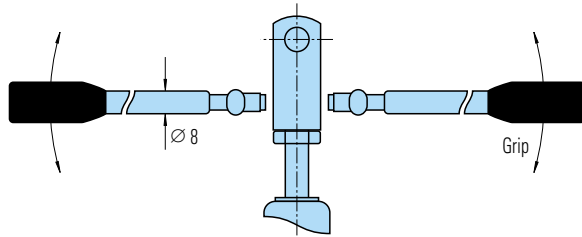


Mechanical Release Variable

RMV

Release the lock by moving the lever up or down. The 90° offset through hole allows a simple variable mounting.

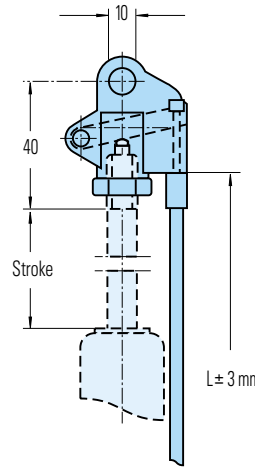
2 offset hole
90° offset



Lockable/Adjustable Release with Bowden Cable

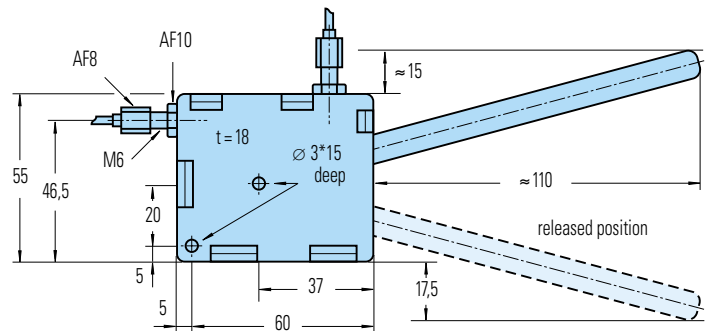
RMA

Single release by operating the lever or permanently release by locking the lever in the open position.



Standard length L for bowden wire (please indicate when ordering)

- 518 mm
- 768 mm
- 1018 mm
- 1268 mm
- 1518 mm



Adjustment Instructions Valve

1. Hold gas spring piston rod down.
2. Remove any fitting attached to the body end of the gas spring (GZ version the piston rod).
3. Insert adjuster knob on thread end on the cylinder body (on GZ version thread end on the piston rod).
When resistance is felt, proceed slowly but with caution. This opens the valve and you can hear the nitrogen escaping and reducing pressure. Turn back the adjusting knob immediately, to avoid too much nitrogen being discharged.
4. After adjustment, remove the Adjuster knob, mount the end fittings and test the gas spring in your application. If necessary repeat the procedure.

If you use 2 gas springs in parallel, both gas springs should have the same force to avoid bending forces or side load on the application. If necessary return to ACE to refill both gas springs to the same (average) force.

If too much nitrogen is discharged, the units can be returned to ACE for re-gassing.

GS



GZ



Just drill 4 holes – ACE does all the rest!

By taking advantage of the very extensive range of ACE End Fittings and Mounting Brackets you can easily and simply install our gas springs and hydraulic dampers. You profit from the wide variety of DIN Standard end fittings such as swivel eyes, clevis forks, angle ball joints, inline ball joints, and complementary ball sockets.

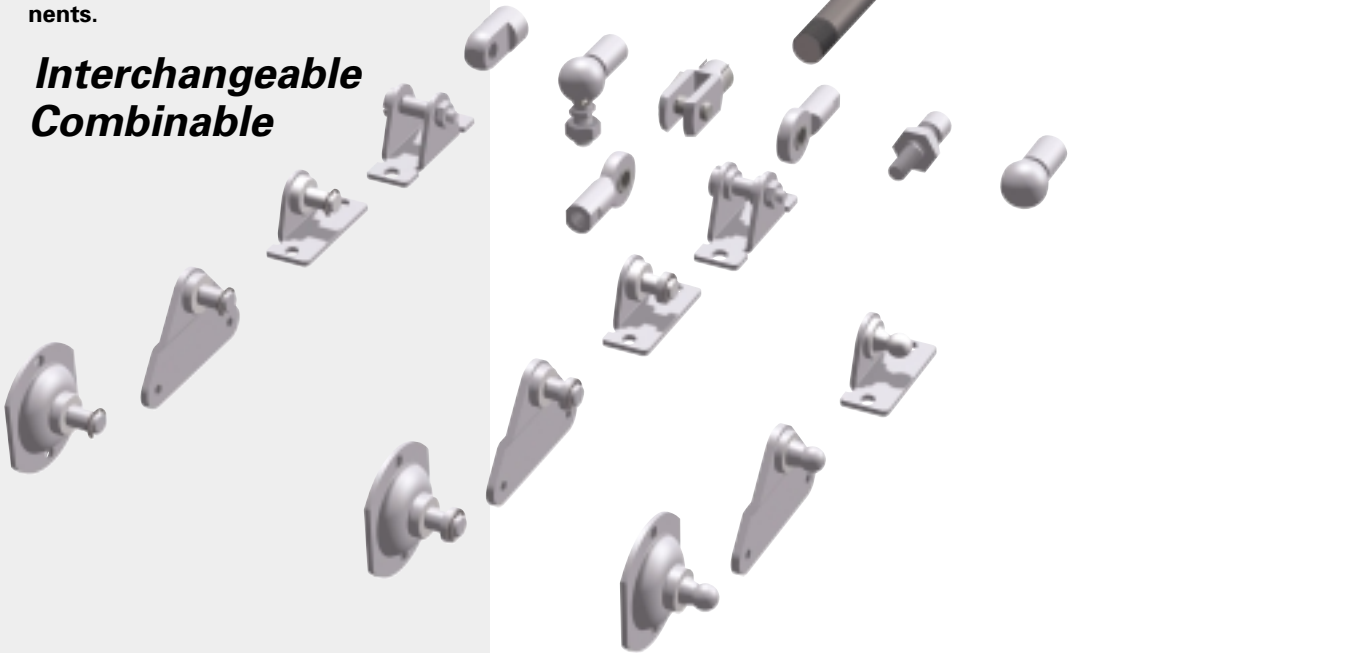
ACE also offers eye fittings made of wear resistant steel to meet the higher specification requirements found in industrial applications.

With over 30 different types available these newly developed mounting accessories provide an extensive range of combinations for optimum Installation.

With the ACE Selection Programme you can choose not only your gas springs but also the ideal end fittings and mounting brackets for your individual application example.

The complete range of accessories are also available as individual components.

Interchangeable Combinable



The wide range of Mounting Brackets available



Accessories M3.5x0.6 GS 8, GS 10, GS 12

<p>A3.5 Eye</p> <p>*max. force 225 N</p>	<p>C3.5 Angle Ball Joint DIN 71802</p> <p>*max. force 225 N</p>	<p>D3.5 Clevis Fork DIN 71752</p> <p>*max. force 225 N</p>	<p>G3.5 Ball Socket DIN 71805</p> <p>*max. force 225 N</p>
<p>*max. force 225 N</p>	<p>NA3.5 NG3.5</p>	<p>*max. force 225 N</p>	<p>OA3.5 OG3.5</p>

Accessories M5x0.8 GS 15, HB 15

<p>A5 Eye</p> <p>*max. force 800 N</p>	<p>C5 Angle Ball Joint DIN 71802</p> <p>*max. force 500 N</p>	<p>D5 Clevis Fork DIN 71752</p> <p>*max. force 800 N</p>	<p>E5 Swivel Eye DIN 648</p> <p>*max. force 800 N</p>	<p>F5 Inline Ball Joint</p> <p>Attention! Must only be used with compression loads.</p> <p>*max. force 500 N</p>
<p>G5 Ball Socket DIN 71805</p> <p>*max. force 500 N</p>	<p>*max. force 500 N</p>	<p>MA5</p>	<p>*max. force 500 N</p>	<p>NA5 NG5</p>
<p>*max. force 500 N</p>	<p>OA5 OG5</p>	<p>*max. force 500 N</p>	<p>PA5 PG5</p>	

* Attention! Max. static Load in Newtons. Beware force increase during compression (Progression) and observe max. force limit.

Accessories M8x1.25 GS 19, GS 22, GZ 19, HB 22, HB 28, DVC 32

<p>A8 Eye</p> <p>*max. force 3000 N</p>	<p>C8 Angle Ball Joint DIN 71802</p> <p>*max. force 1200 N</p>	<p>D8 Clevis Fork DIN 71752</p> <p>*max. force 3000 N</p>	<p>E8 Swivel Eye DIN 648</p> <p>*max. force 3000 N</p>	<p>F8 Inline Ball Joint</p> <p>Attention! Must only be used with compression loads.</p> <p>*max. force 1200 N</p>	
<p>G8 Ball Socket DIN 71805</p> <p>*max. force 1200 N</p>	<p>MA8 ME8</p>		<p>*max. force 1200 N NA8 NE8 NG8</p>		
<p>*max. force 1200 N</p> <p>OA8</p>	<p>OE8</p>	<p>OG8</p>	<p>*max. force 1200 N PA8 PE8 PG8</p>		

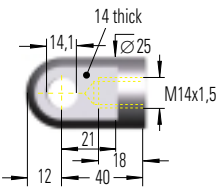
Accessories M10x1.5 GS 28, GZ 28, GBF 28, GBS 28

<p>A10 Eye</p> <p>*max. force 10000 N</p>	<p>C10 Angle Ball Joint DIN 71802</p> <p>*max. force 1800 N</p>	<p>D10 Clevis Fork DIN 71752</p> <p>*max. force 10000 N</p>	<p>E10 Swivel Eye DIN 648</p> <p>*max. force 10000 N</p>	<p>F10 Inline Ball Joint</p> <p>Attention! Must only be used with compression loads.</p> <p>*max. force 1800 N</p>
<p>*max. force 1800 N</p> <p>MA10 ME10</p>				
<p>*max. force 1200 N</p> <p>OE10</p>	<p>*max. force 1200 N PE10</p>			

* Attention! Max. static Load in Newtons. Beware force increase during compression (Progression) and observe max. force limit.

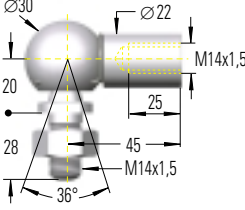
Accessories M14x1.5 GS 40, HB 40

A14 Eye



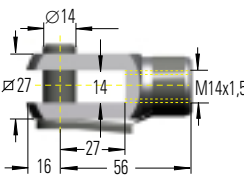
*max. force 10 000 N

C14 Angle Ball Joint
DIN 71802



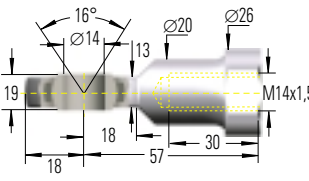
*max. force 3200 N

D14 Clevis Fork
DIN 71752



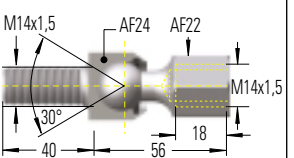
*max. force 10 000 N

E14 Swivel Eye
DIN 648



*max. force 10 000 N

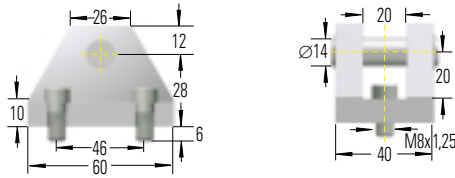
F14 Inline Ball Joint



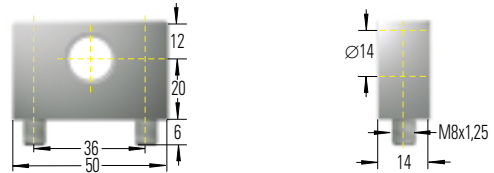
Attention! Must only be used with compression loads.

*max. force 3200 N

ME14 *max. force 10 000 N

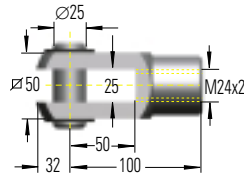


ND14 *max. force 10 000 N

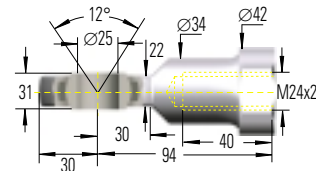


Accessories M24x2 GS 70, HB 70

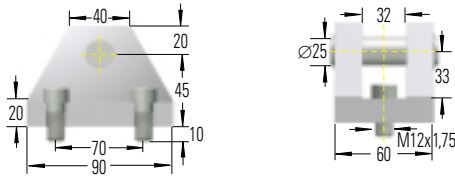
D24 *max. force 50 000 N Clevis Fork
DIN 71752



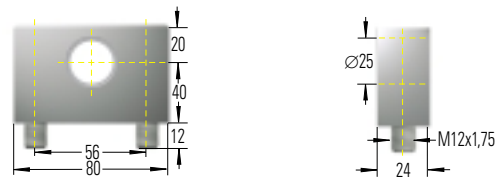
E24 *max. force 50 000 N Swivel Eye
DIN 648



ME24 *max. force 50 000 N



ND24 *max. force 50 000 N

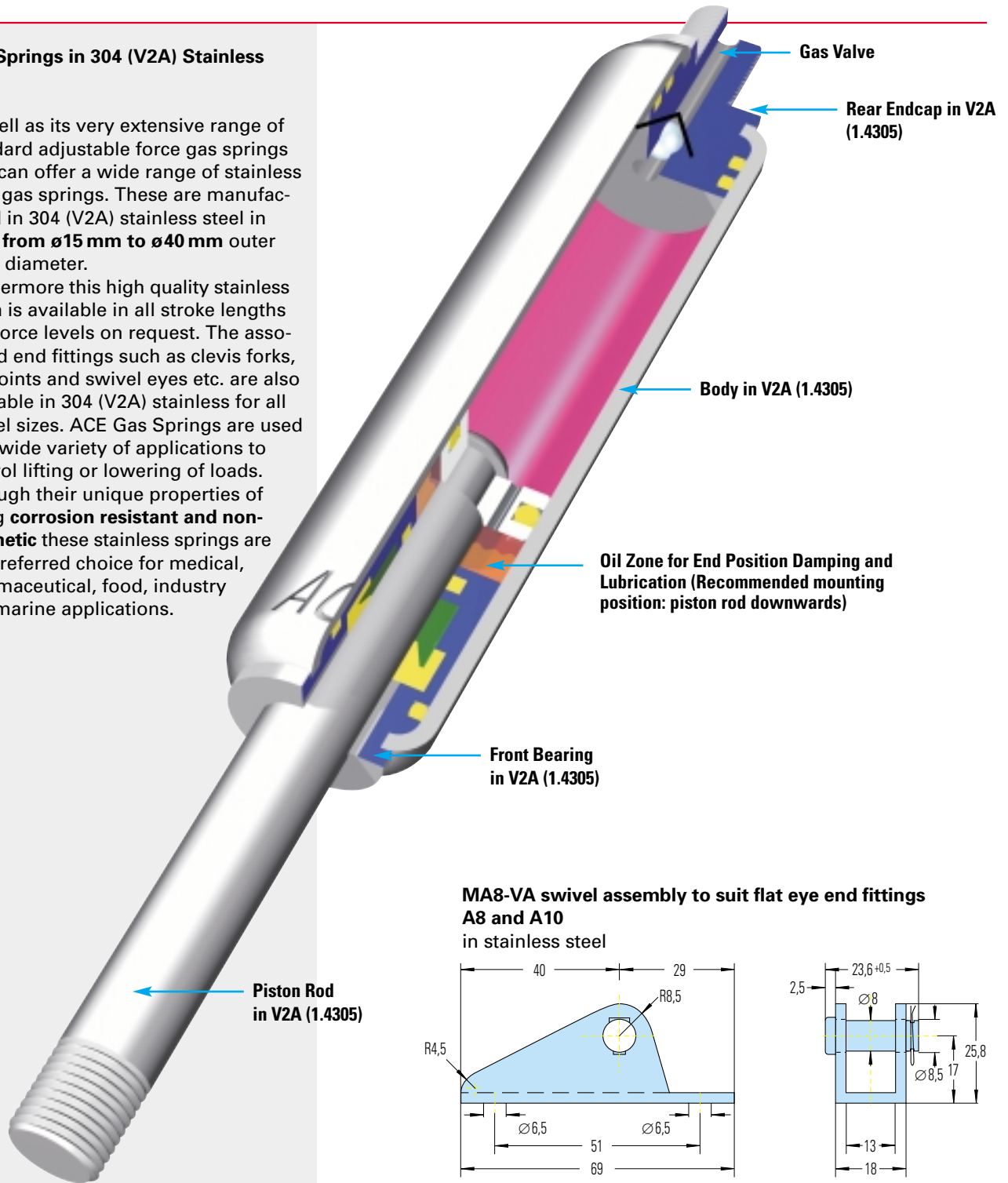


* Attention! Max. static Load in Newtons. Beware force increase during compression (Progression) and observe max. force limit.

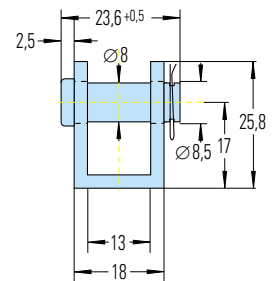
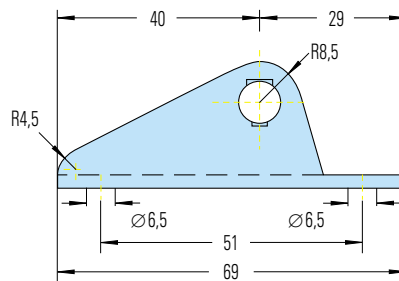
Gas Springs in 304 (V2A) Stainless Steel

As well as its very extensive range of standard adjustable force gas springs ACE can offer a wide range of stainless steel gas springs. These are manufactured in 304 (V2A) stainless steel in sizes **from $\varnothing 15$ mm to $\varnothing 40$ mm** outer body diameter.

Furthermore this high quality stainless finish is available in all stroke lengths and force levels on request. The associated end fittings such as clevis forks, ball joints and swivel eyes etc. are also available in 304 (V2A) stainless for all model sizes. ACE Gas Springs are used on a wide variety of applications to control lifting or lowering of loads. Through their unique properties of being **corrosion resistant and non-magnetic** these stainless springs are the preferred choice for medical, pharmaceutical, food, industry and marine applications.



MA8-VA swivel assembly to suit flat eye end fittings A8 and A10 in stainless steel

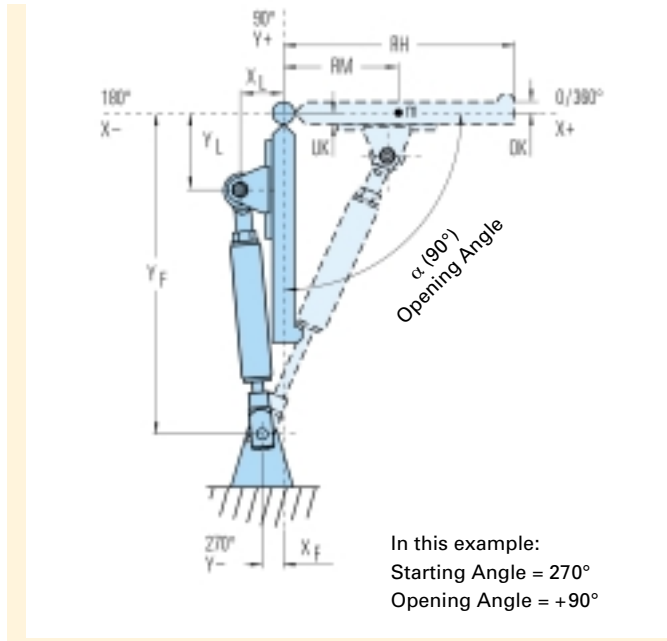


Gas springs ranging from model GS-15 to GS-40 are available in **Stainless Steel 1.4301 / 1.4305**

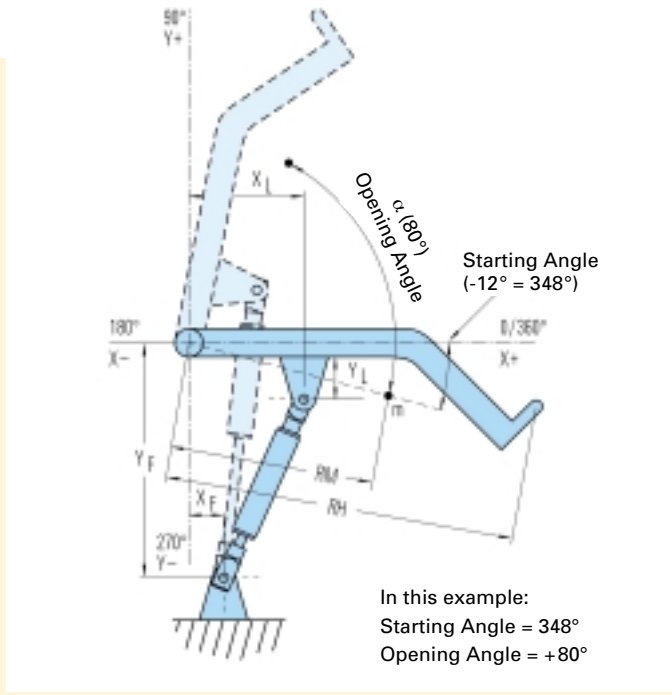
There are end fittings similar to our standard range available.



Case 1 (e. g. Flap)



Case 2 (e. g. Hood)



Push type

Pull type

Case 1

Case 2 (with attached sketch only)

Input Data

Gas Spring Fixing Points

The fixed point X_F and Y_F of the frame and the moving point X_L and Y_L of the flap are critical for the optimum operation. **Therefore please attach a sketch of your application on separate paper (a few lines with their dimensions are sufficient)!**

Moving mass m _____ kg
 No. of gas springs in parallel n _____ pcs
 Number of movements _____ /day
 Ambient temperature T _____ °C

(if not shown by the sketch)

Radius of centre of gravity R_M _____ mm
 Radius of hand force R_H _____ mm
 Starting angle (0° to 360°) _____ °
 Opening angle (-360° to +360°) α _____ °
 (- = downwards, + = upwards)
 Dimensions of the flap: thickness _____ mm
 Distance between flap and pivot:
 Upper side O_K = _____ mm, Lower side U_K = _____ mm

Comments: _____

Sender:

Co. _____
 Address _____

 Internet _____

Desired Mounting Fittings

End Fitting		End Fitting
<input type="checkbox"/> A		<input type="checkbox"/> A
<input type="checkbox"/> B	Stud Thread	<input type="checkbox"/> B
<input type="checkbox"/> C	Angle Ball Joint	<input type="checkbox"/> C
<input type="checkbox"/> D	Clevis Fork	<input type="checkbox"/> D
<input type="checkbox"/> E	Swivel Eye	<input type="checkbox"/> E
<input type="checkbox"/> F	Inline Ball Joint	<input type="checkbox"/> F
<input type="checkbox"/> G	Ball Socket	<input type="checkbox"/> G

The end fittings are interchangeable.
 e.g.: -CE C=Angle Ball Joint, E=Swivel Eye

Requirement per year: _____
 Machine type/reference: _____

Name _____
 Dept. _____
 Tel _____ Fax _____
 E-Mail _____

Please copy, complete and fax to ACE: Fax +49-2173-922 689!



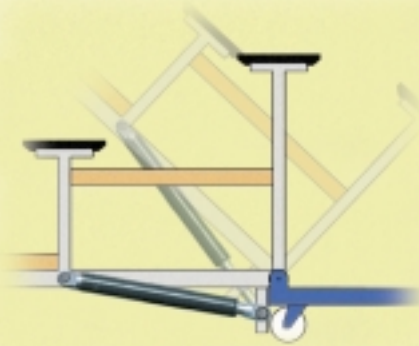
Secure opening and closing

ACE Gas Springs protect samples in an incubator used in chemistry and biology labs.

How can you keep a hood made of Plexiglas, under which valuable lab material is placed, secure in an open or closed position? With two maintenance-free, ready to install ACE gas springs type **GS-12-60-AA-X**. With 10 mm end-of-travel damping and an extension force of between 10 and 180 N, these gas springs will support and control the hood weight without difficulty. The hood is always easily opened and the gas springs will support it in this open position. The hood will also stay securely closed during the incubation period.



Mini incubator fitted with miniature gas springs



Easier folding system

With **ACE Industrial Gas Springs**, everything works.

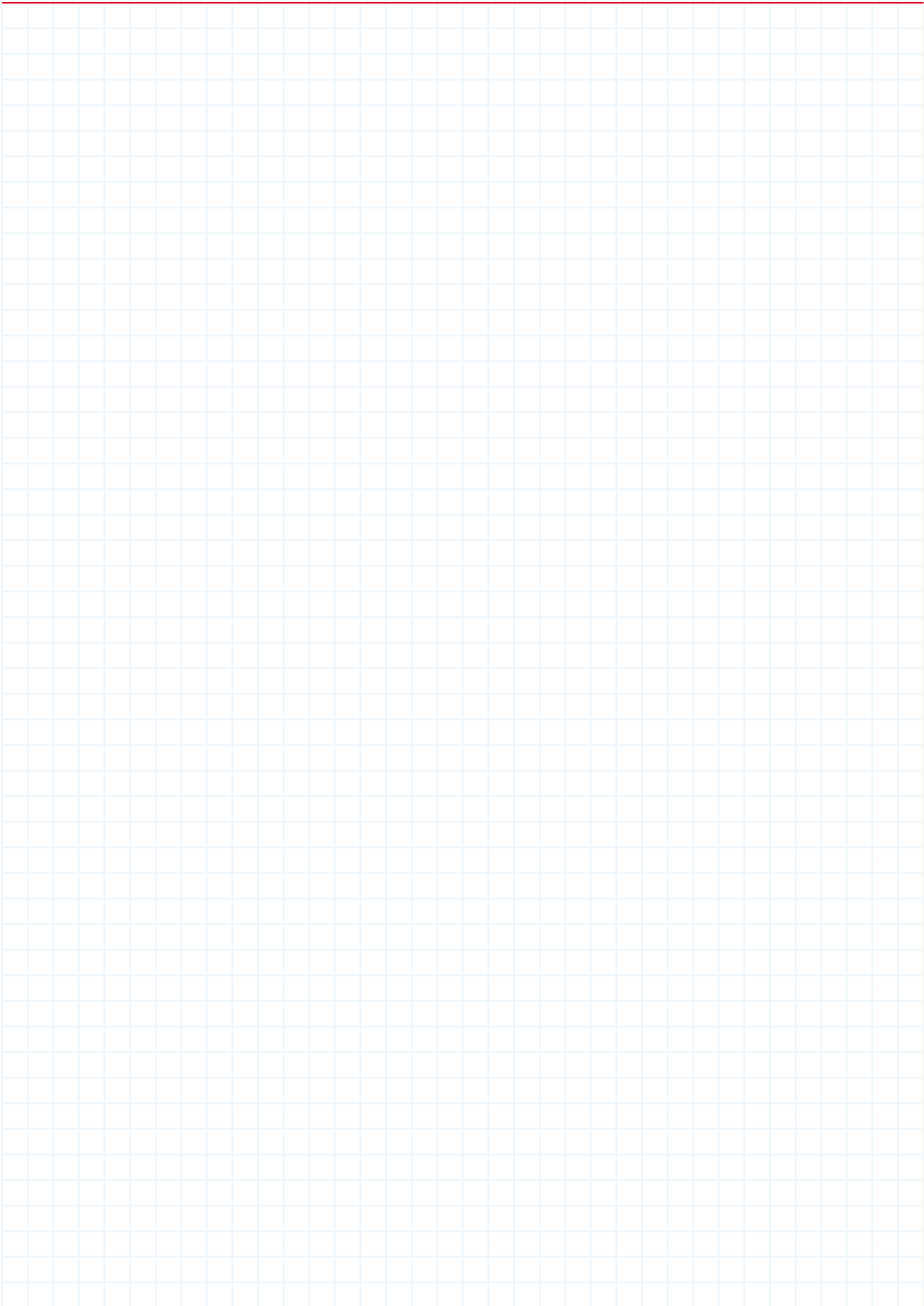
These innovative, foldable ringside stands proved too heavy to simply fold up by hand. Help came with the installation of two ACE industrial gas springs type **GS-28-300-CC-V** which are fitted with a special adjustment valve system. At 28 mm diameter, they have a stroke length of 300 mm and can provide an extension force of between 150 N and 2 500 N.

They thereby provide the muscle power to support the deadweight of the seat stand and allow easy hand operated set-up of these ringside seats.



Foldable, space-saving ringside stands

Issue 9.2004 Specifications subject to change

A large, empty grid of light blue lines on a white background, intended for taking notes.

FAX REQUEST

Company

Name

Department/Position

Street/PO Box

Postcode/City

Country

Telephone/Fax

E-Mail

Internet

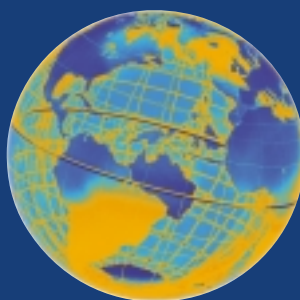


YES! We are interested in:

- further copy of the new ACE Catalogue.
- the new ACE CAD-Library with Selection programme on CD-Rom. 2D- and 3D-Version (standard formats).
- Training at our site.
- Technical assistance at our site.




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ACE CONTROLS
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P.O. Box 71, Farmington
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