



Gas Springs & Hydraulic Dampers



ACE Controls Inc.
World leader in deceleration technology
ISO 9001:2000 Certified

12/08(R)

ACE Controls, Inc.
World Headquarters
Farmington, Michigan U.S.A.
800-521-3320

ACE Stossdampfer GMBH
Langenfeld, Germany
0-2173-922610

ACE Controls Japan Ltd.
Chiba Prefecture, Japan
0-436-246711

ACE Controls International
Merseyside, United Kingdom
1-925-227171

Founded over 35 years ago, ACE Controls, Inc. is recognized as the world leader in the design and manufacture of deceleration devices for a wide variety of industries. Facilities are located in the United States, England, Germany and Japan together with extensive distribution throughout the world. ACE is able to provide an excellent and responsive sales and support network.

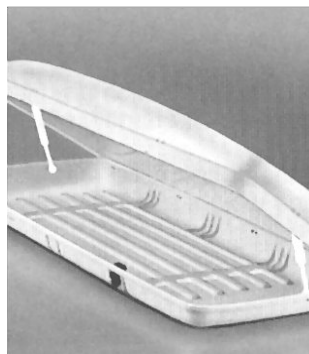
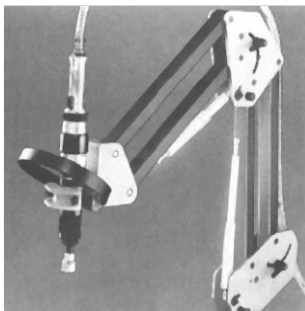
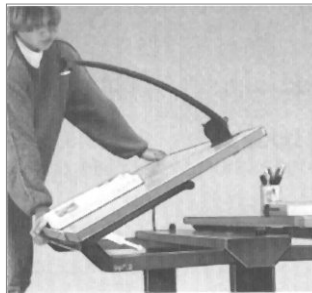
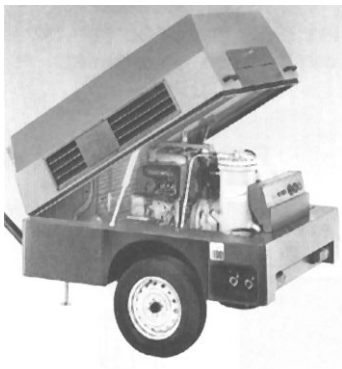
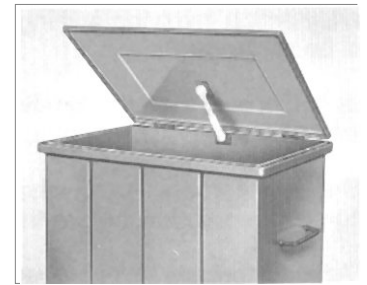
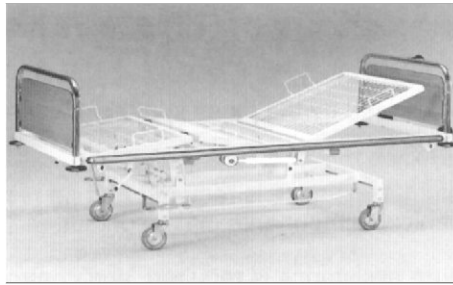
The ACE Controls product line includes gas springs, hydraulic dampers, industrial shock absorbers, stacker crane shocks as well as crane and heavy industrial shock absorbers, velocity controls, rotary dampers and TUBUS elastomer bumpers.

ACE's innovations include adjustable and self-compensating shock absorbers as well as CAD files and simulation software for shock absorber

applications and product selection. ACE Controls, Inc. is a certified ISO 9001:2000 manufacturer.

The ACE line of gas springs is ideal for counterbalancing loads to provide assistance in both lifting and lowering covers, guards and panels, as well as limiting the rate at which heavy covers, etc. can be moved.

ACE Controls' Applications Department is one of the most advanced in the industry. Engineers are available to assist you by providing full technical support for your gas spring and hydraulic damper application requirements. The ACE Controls Applications Department can be reached at 800-521-3320.



Additional Gas Spring Applications Include:

Computers
 Photocopiers
 Aircraft Overhead Compartments
 Aircraft Galley Equipment
 Truck Engine Covers
 Truck Side Panels
 Electrical Enclosure Cabinets

Boat Engine Hatches
 Bus/Coach Engine Covers
 Bus/Coach Courier Seats
 Fork Lifts
 Conveyor Belt Tensioning
 Roof Ventilation Hatches
 Manhole/Access Covers

Molding Machines
 Executive Desks
 Smoke Vents
 Stair Lifts
 Security Cabinets
 Washing Machine Lids
 Automatic Cash Dispensers

Function

In every action involving a lifting or lowering motion, e.g. when opening a hatch lid, there are masses in movement which must be controlled.

If this is ignored, then the kinetic energy caused by the mass in motion can result in considerable damage. There are several ways that ACE offers to control this motion.

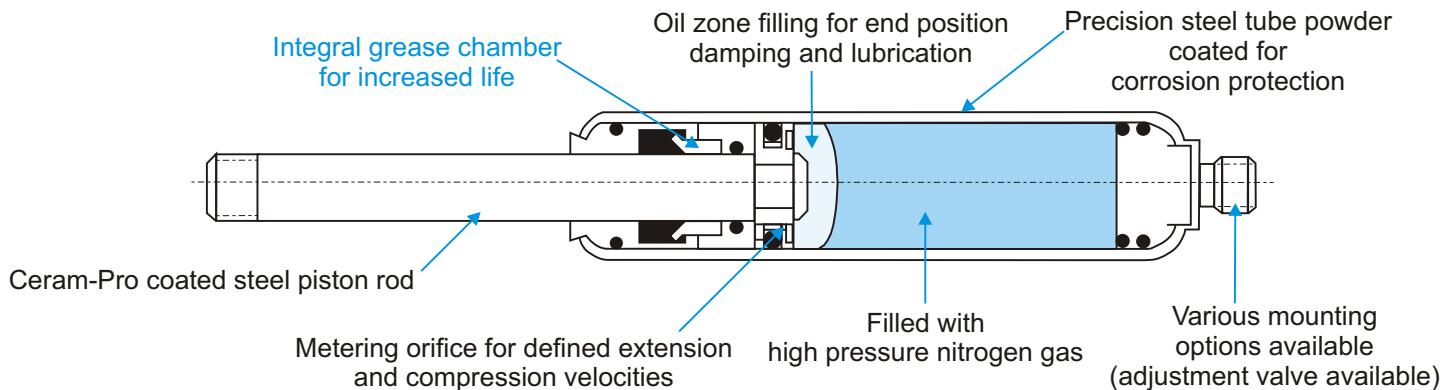
a) Shock absorbers - used when no return assistance is required and no restriction of the velocity is required, control being provided shortly before the mechanical components make contact.

b) Velocity controls - used when no return assistance is required, and control of velocity throughout the motion is required.

c) Rotary dampers - used in light load situations requiring no return assistance and controlled velocity throughout the motion.

d) Gas springs - used when return assistance or load support (counterbalance) is required throughout the motion.

The gas springs can be provided in a wide range of body sizes, stroke lengths and the force provided can be specified to suit the specific application. The extension and compression velocities can also be customized on request.



Construction and Operation

ACE gas springs are maintenance free self-contained systems which are filled with high pressure nitrogen gas to a defined pressure. They also contain a small quantity of oil to provide end position damping.

During operation, the nitrogen gas flows through the metering orifice and allows the load to be lowered in a controlled manner. The force of the gas spring works against the weight and prevents it from accelerating and damaging mechanical components on closure.

Upon reversal the nitrogen flows back through the piston orifice and the gas spring force assists the action, reducing the effort required to reset the mechanism.

The opening and closing speeds can be varied by altering the size of the metering orifice.

For cushioning on the extension stroke, mount with the rod down. For cushioning on the compression stroke, mount with the rod up.

An integral grease chamber behind the rod seals ensures lasting lubrication which can increase the life of ACE gas springs by at least 100% compared to other products on the market.

The Ceram-Pro coated steel piston rod and powder coated precision steel body ensure excellent corrosion protection and provide a long maintenance free working life.

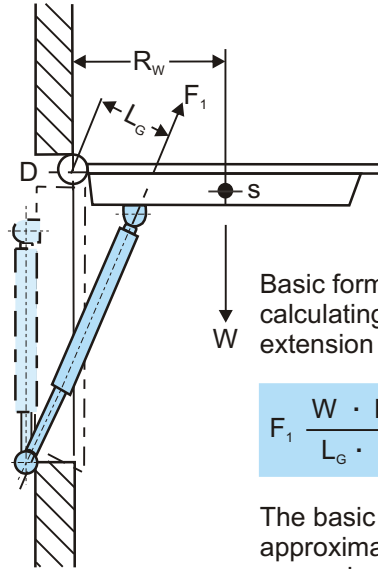
The wide variety of available mounting accessories provide mounting versatility and options.

Use the following application parameters to calculate a suitable ACE gas spring:

1. Weight of the lid or flap **lbs (kg)**
2. Position of the center of gravity **in (mm)**
3. Sketch of the application layout

Symbols used:

- | | | |
|----------------|-----------------------------------|-----------------|
| W | Force due to weight of the lid | lbs (kg) |
| R _w | Radius of center of gravity | in (mm) |
| L _G | Distance to gas spring | in (mm) |
| s | Center of gravity | - |
| D | Pivot point | |
| n | Number of gas springs in parallel | |



Example

$$\begin{aligned}
 W &= 90 \text{ lbs (41 kg)} \\
 R_w &= 30 \text{ in (762 mm)} \\
 L_G &= 6 \text{ in (152.4 mm)} \\
 n &= 2 \\
 F_1 &= \frac{90 \cdot 30}{6 \cdot 2} \\
 F_1 &= 225 \text{ lbs (1000 N)}
 \end{aligned}$$

Basic formula for calculating required extension force:

$$F_1 = \frac{W \cdot R_w}{L_G \cdot n} \text{ lbs (N)}$$

Chosen force:
 $F_1 = 225 \text{ lbs (1000 N)}$
 Chosen gas spring:
 GS-22-200-AA-1000

The basic formula given enables an approximate calculation of the required gas spring force for one mounting position geometry.

In order to save time we recommend that the calculation and selection of the most suitable gas spring be completed by ACE.

With our sophisticated selection software we can quickly determine the resultant opening or closing forces throughout the complete movement and recommend the optimum mounting points, gas spring model and nominal force.

Please fax us the completed Application Data form on page 10.

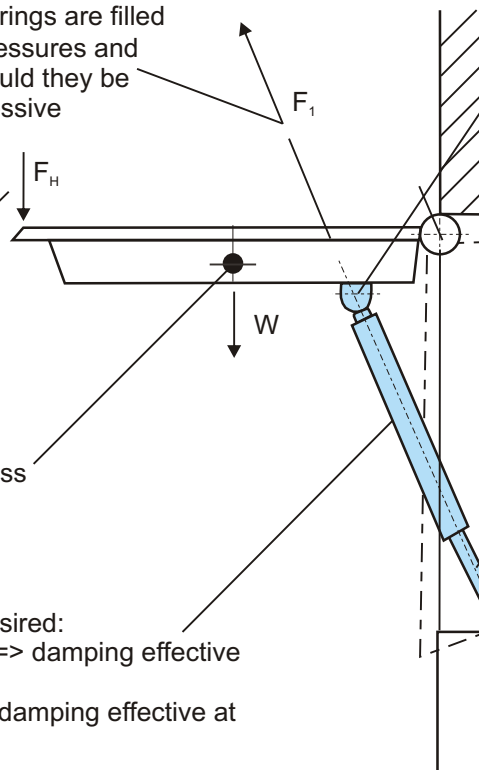
ACE gas springs are self contained, maintenance free devices and are supplied ready for installation. The following points should be noted to ensure the longest possible working life:

Gas spring force F_1 : Gas springs are filled with nitrogen at very high pressures and under no circumstances should they be opened or subjected to excessive tensile loads.

External force F_H : for example manual (hand) force to close the flap.

Weight force W : due to mass acting at center of gravity.

Gas spring orientation as desired:
 With piston rod downwards => damping effective at end of extension stroke.
 With piston rod upwards => damping effective at end of compression stroke.



Choose a standard available gas spring from the ACE range featured in this catalog before determining the mounting position coordinates, or preferably allow ACE to do the calculations and provide a printout suggesting the most suitable model and mounting positions.

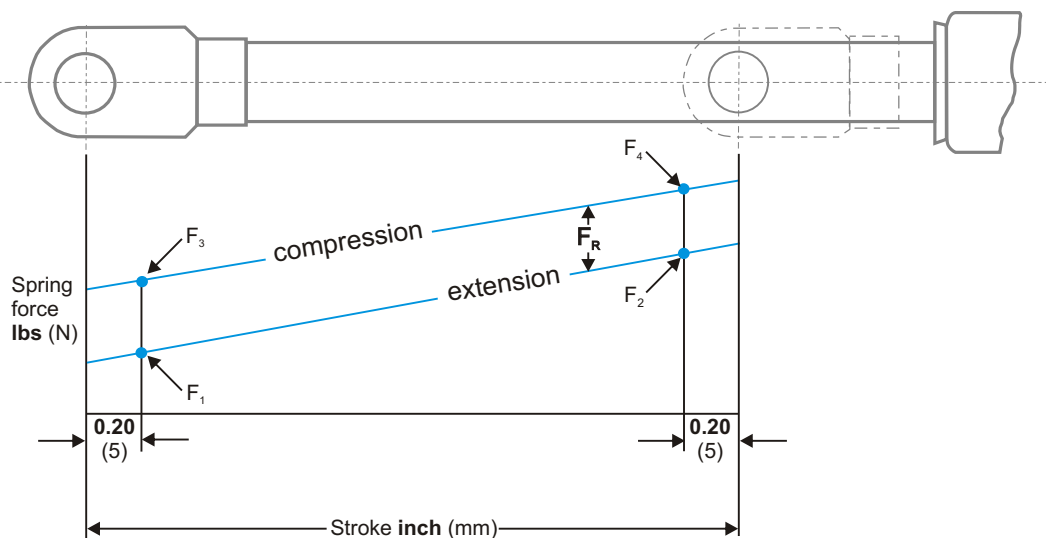
Where possible arrange the mounting positions so that the effective torque provided by the gas spring positively holds the flap in its closed position.

Protect the piston rod from impact damage, scratches, dirt or paint contamination. The gas spring barrel must not be deformed or damaged.

The gas spring must not be exposed to bending forces or side loads. If using eyelet fittings support the eye on both sides and allow some float. We recommend using ball joints on most applications as these help to eliminate any misalignment.

Gas Spring Force - Stroke Characteristics

Gas Spring - Push Type



Type	Progression* approximate %	Friction F_R approximate lbs (N)
GS-15	27	4 (20)
GS-19	33	7 (30)
GS-22	38	7 (30)
GS-28	52	9 (40)

F_1 = Nominal Force at 68° F (20° C) (this figure is normally used when specifying gas springs)

F_1 to F_2 = Force on extension stroke

F_3 to F_4 = Force on compression stroke

*The progression (slope of the force line in the characteristic diagram 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 approximate progression values given above for standard springs can be altered upon request.

Effect of temperature: The nominal F_1 force figure is given at 68° F (20° C).

An increase in temperature of 18° F or 10° C will result in approximately a 3.4% increase in the force.

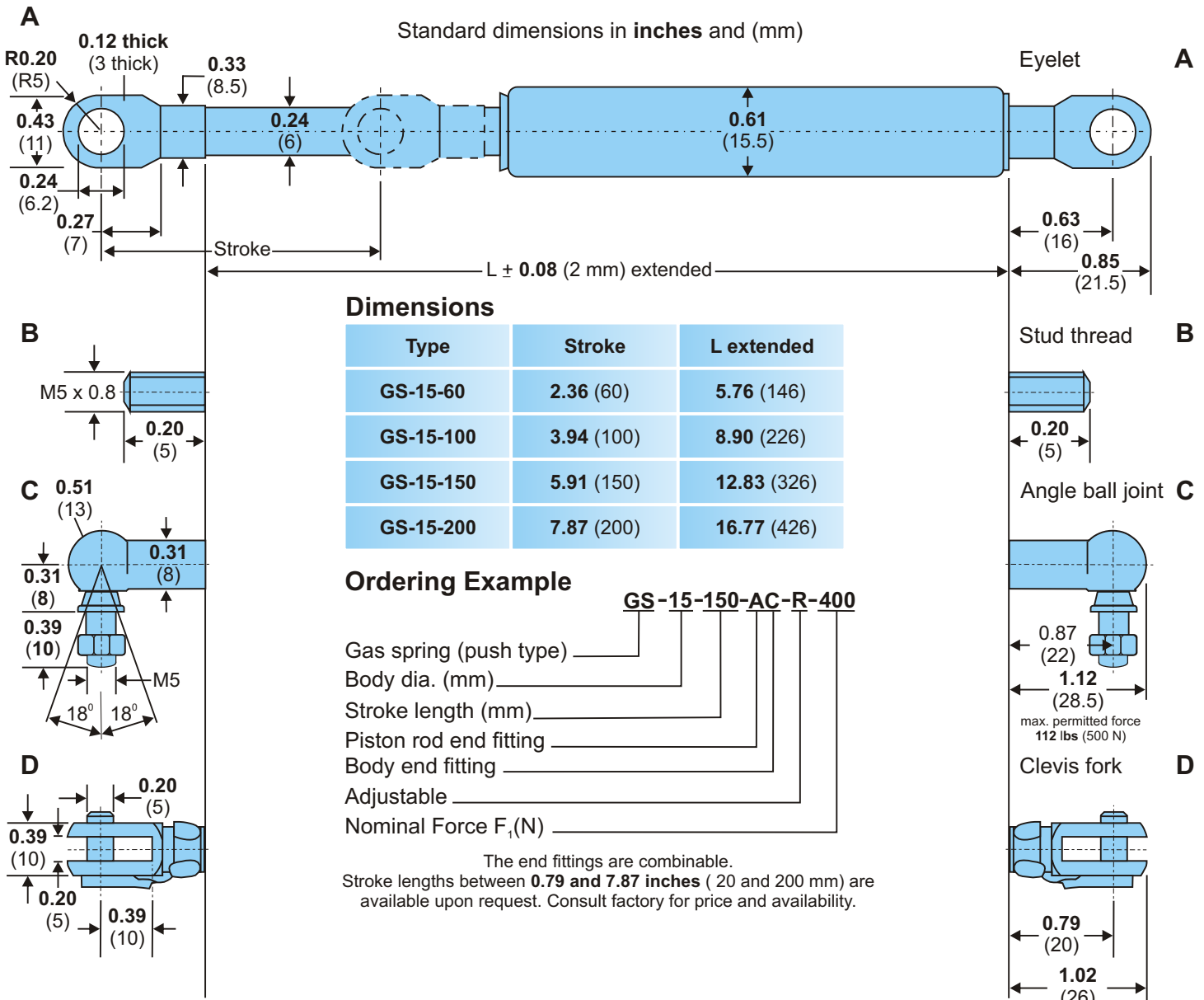
General extension force tolerance is +40N/-20N or $\pm 5 - 7\%$.

Note: Initial breakaway force may be higher if units are stored for a long period without use.

Additional Gas Spring Available Options

1. Lockable gas springs: GBF & GBS 22, 28 & 40
 2. Gas springs (push type): GS-40
 3. Gas springs (pull type): GZ-19, GZ-28 (GZ models are a special order)
- Note: GS and GZ gas springs are available as fixed force options with optional lengths.

Extension force range **2 to 90 lbs** (10 to 400 N)



Dimensions

Type	Stroke	L extended
GS-15-60	2.36 (60)	5.76 (146)
GS-15-100	3.94 (100)	8.90 (226)
GS-15-150	5.91 (150)	12.83 (326)
GS-15-200	7.87 (200)	16.77 (426)

Ordering Example

GS-15-150-AC-R-400

- Gas spring (push type) _____
- Body dia. (mm) _____
- Stroke length (mm) _____
- Piston rod end fitting _____
- Body end fitting _____
- Adjustable _____
- Nominal Force F_1 (N) _____

The end fittings are combinable.
Stroke lengths between **0.79 and 7.87 inches** (20 and 200 mm) are available upon request. Consult factory for price and availability.

Technical Data

ACE Gas springs are self contained and maintenance free.

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 position damping length: approximately 0.39 (10 mm)

Force progression: approximately 27%

Temperature range: -22 to +176° F (-30 to +80° C)

Fluid: nitrogen gas and oil (for end position damping)

Force range: 2 to 90 lbs (10 to 400 N)

Material: Ceram-Pro coated steel piston rod for corrosion protection, body: powder coated steel

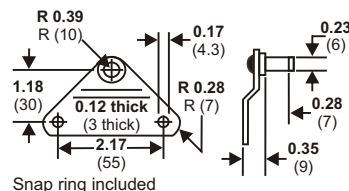
End fittings: zinc plated steel or aluminum

Options: without damping, extended length damping, special force curves, special lengths, alternative end fittings, M5 adjusting knob

Mounting Brackets (zinc plated steel)

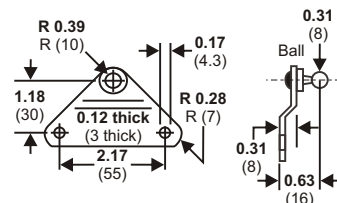
GSB-01

max. force **112 lbs** (500 N)



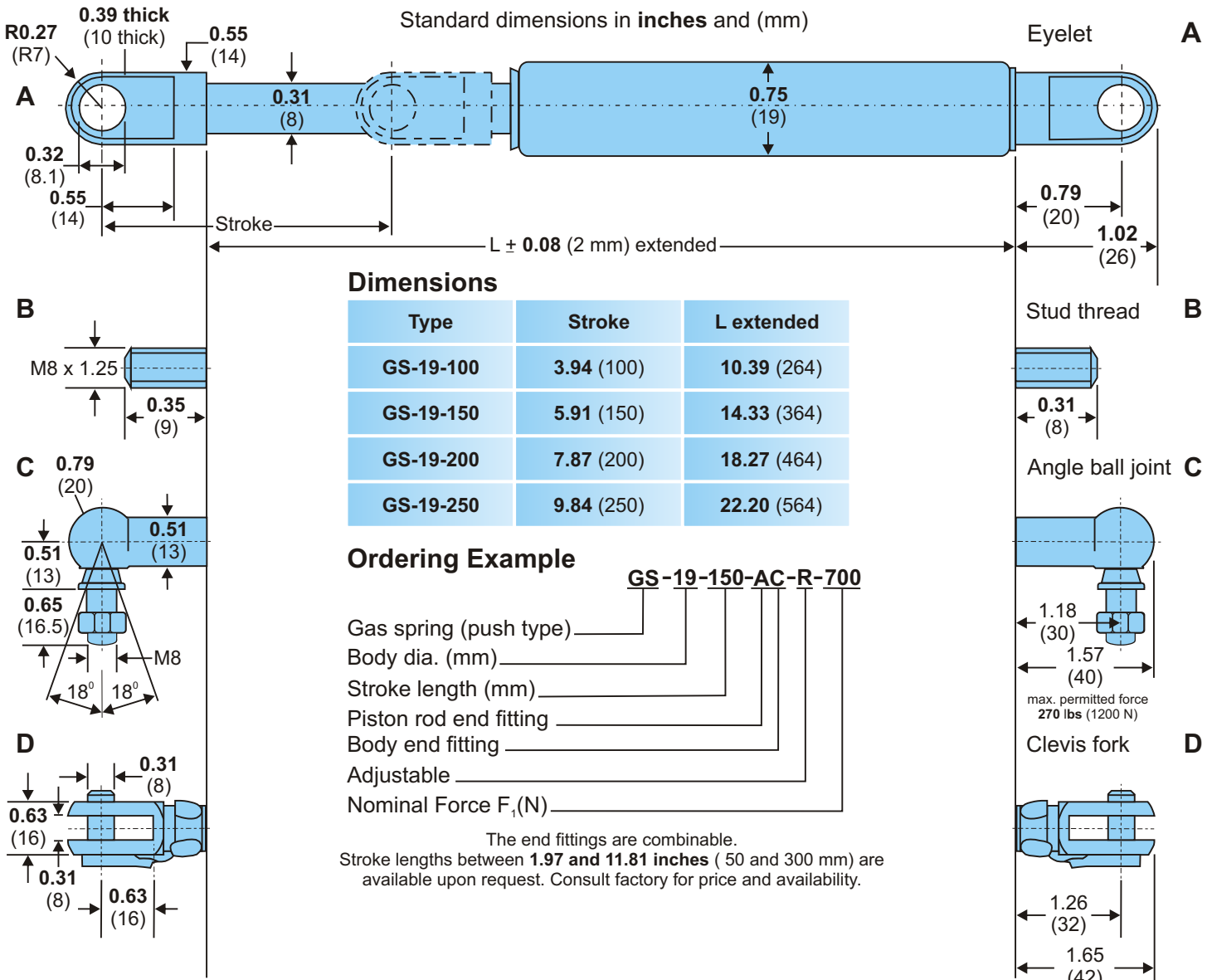
GSB-02

max. force **112 lbs** (500 N)



Note: Remember rising force curve on compression.

Extension force range **11 to 157 lbs** (50 to 700 N)



Dimensions

Type	Stroke	L extended
GS-19-100	3.94 (100)	10.39 (264)
GS-19-150	5.91 (150)	14.33 (364)
GS-19-200	7.87 (200)	18.27 (464)
GS-19-250	9.84 (250)	22.20 (564)

Ordering Example

GS-19-150-AC-R-700

- Gas spring (push type) _____
- Body dia. (mm) _____
- Stroke length (mm) _____
- Piston rod end fitting _____
- Body end fitting _____
- Adjustable _____
- Nominal Force F_1 (N) _____

The end fittings are combinable.
Stroke lengths between **1.97 and 11.81 inches** (50 and 300 mm) are available upon request. Consult factory for price and availability.

Technical Data

ACE Gas springs are self-contained and maintenance free.

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 position damping length: approximately 0.39 (10 mm)

Force progression: approximately 33%

Temperature range: -22 to +176° F (-30 to +80° C) with special seals up to + 392° F (+200° C)

Fluid: nitrogen gas and oil (for end position damping)

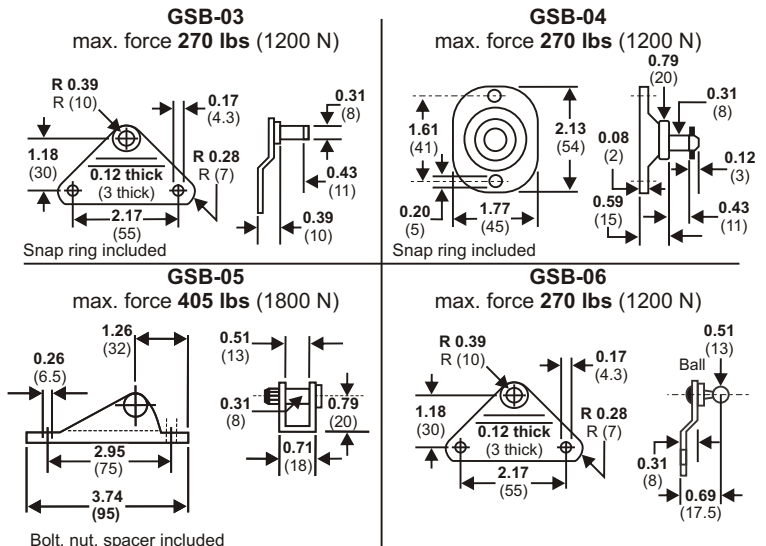
Force range: 11 to 157 lbs (50 to 700 N)

Material: Ceram-Pro coated steel piston rod for corrosion protection, body: powder coated steel

End fittings: zinc plated steel or aluminum

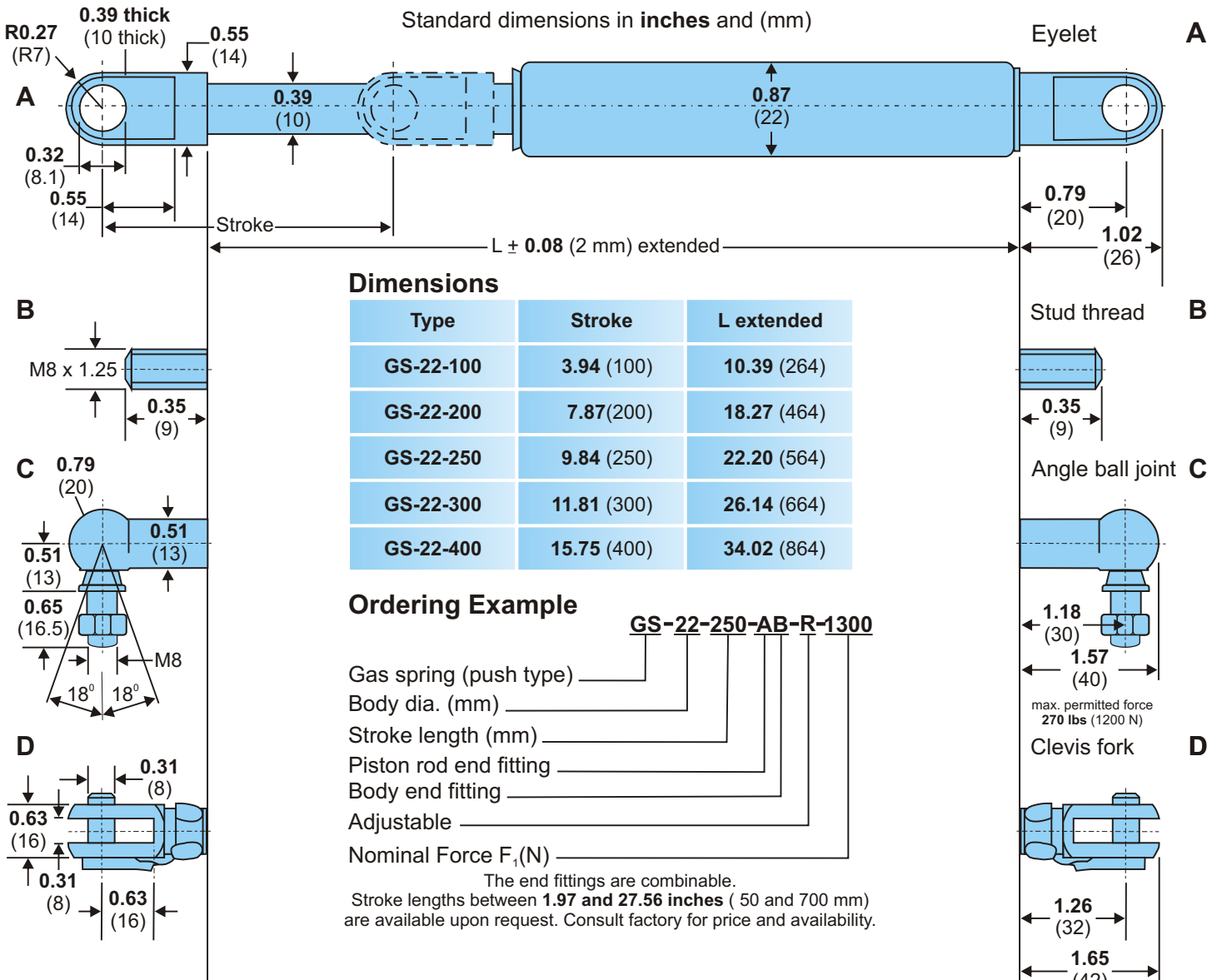
Options: without damping, extended length damping, special force curves, special lengths, alternative end fittings, M8 adjusting knob

Mounting Brackets (zinc plated steel)



Note: Remember rising force curve on compression.

Extension force range **18 to 292 lbs** (80 to 1,300 N)



Dimensions

Type	Stroke	L extended
GS-22-100	3.94 (100)	10.39 (264)
GS-22-200	7.87(200)	18.27 (464)
GS-22-250	9.84 (250)	22.20 (564)
GS-22-300	11.81 (300)	26.14 (664)
GS-22-400	15.75 (400)	34.02 (864)

Ordering Example

GS-22-250-AB-R-1300

- Gas spring (push type) _____
- Body dia. (mm) _____
- Stroke length (mm) _____
- Piston rod end fitting _____
- Body end fitting _____
- Adjustable _____
- Nominal Force F_i (N) _____

The end fittings are combinable.
Stroke lengths between **1.97 and 27.56 inches** (50 and 700 mm) are available upon request. Consult factory for price and availability.

Technical Data

ACE Gas springs are self-contained and maintenance free.

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 position damping length: approximately 0.39 (10 mm)

Force progression: approximately 38%

Temperature range: -22 to +176° F (-30 to +80° C) with special seals up to +392° F (+200° C)

Fluid: nitrogen gas and oil (for end position damping)

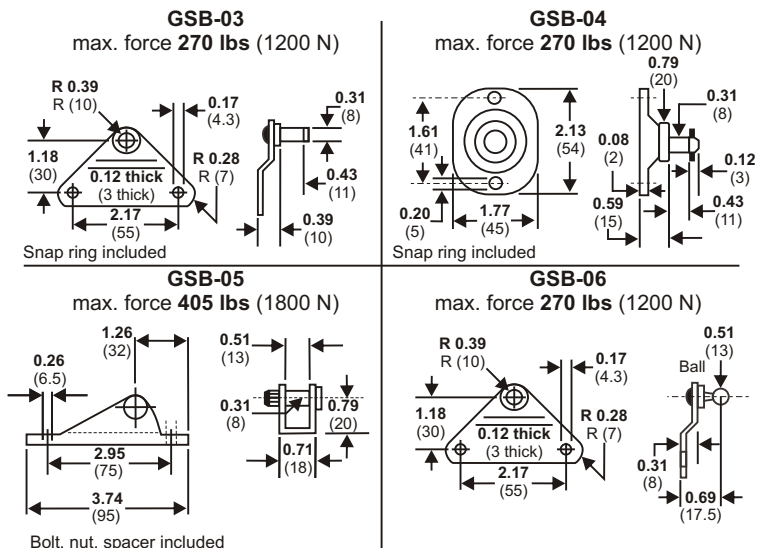
Force range: 18 to 292 lbs (80 to 1300 N)

Material: Ceram-Pro coated steel piston rod for corrosion protection, body: powder coated steel

End fittings: zinc plated steel or aluminum

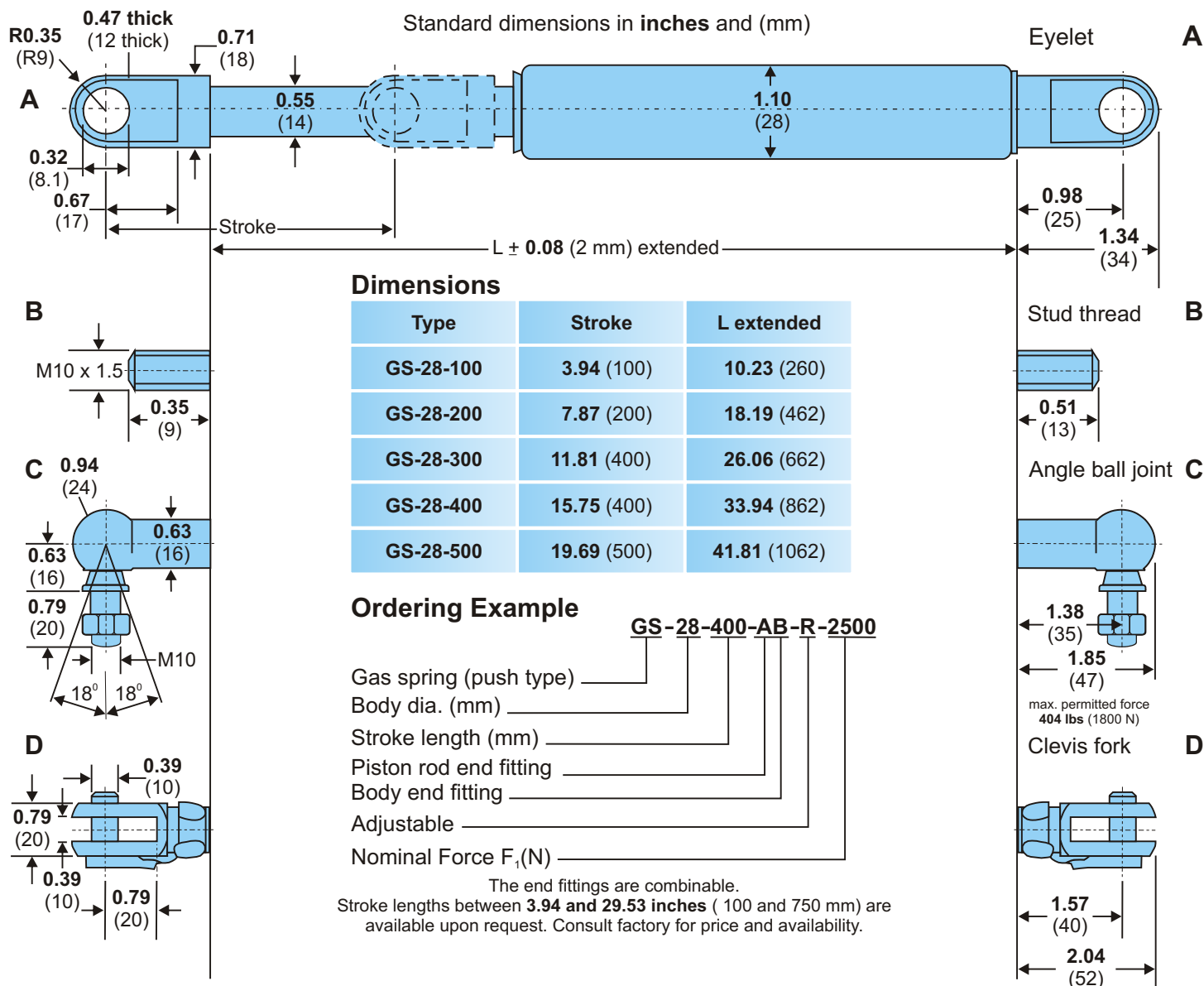
Options: without damping, extended length damping, special force curves, special lengths, alternative end fittings, M8 adjusting knob

Mounting Brackets (zinc plated steel)



Note: Remember rising force curve on compression.

Extension force range **22 to 562 lbs** (100 to 2,500 N)



Technical Data

ACE Gas springs are self-contained and maintenance free.

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 position damping length: approximately 0.39 (10 mm)

Force progression: approximately 52%

Temperature range: -22 to +176° F (-30 to +80° C) with special seals up to +392° F (+200° C)

Fluid: nitrogen gas and oil (for end position damping)

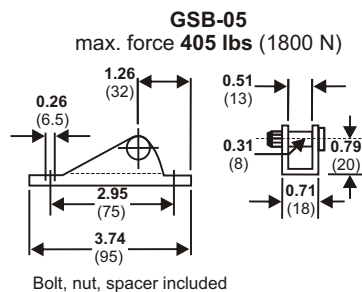
Force range: 22 to 562 lbs (100 to 2500 N)

Material: Ceram-Pro coated steel piston rod for corrosion protection, body: powder coated steel

End fittings: zinc plated steel or aluminum

Options: without damping, extended length damping, special force curves, special lengths, alternative end fittings, M10 adjusting knob

Mounting Bracket (zinc plated steel)



Note: Remember rising force curve on compression.

Requirement per year _____

Name _____
 Company _____
 Address _____
 Telephone _____
 Fax _____
 E-mail _____
 Comments _____

Gas Spring Type

Input Data

Radius of center of gravity	R_w	_____	in (mm)
Moving weight	w	_____	lbs (kg)
Radius of hand force	R_H	_____	in (mm)
Desired max. handforce	F_H	_____	lbs (N)
No of gas springs in parallel	n	_____	pcs
Starting angle (0 to 360°)		_____	°
Opening angle (-360 to +360°)	α	_____	°

Gas Spring fixing points (complete if desired)

Fixed point	(x-coord.) x_1	_____	in (mm)
Fixed point	(y-coord.) y_1	_____	in (mm)
Moving point	(x-coord.) x_2	_____	in (mm)
Moving point	(y-coord.) y_2	_____	in (mm)

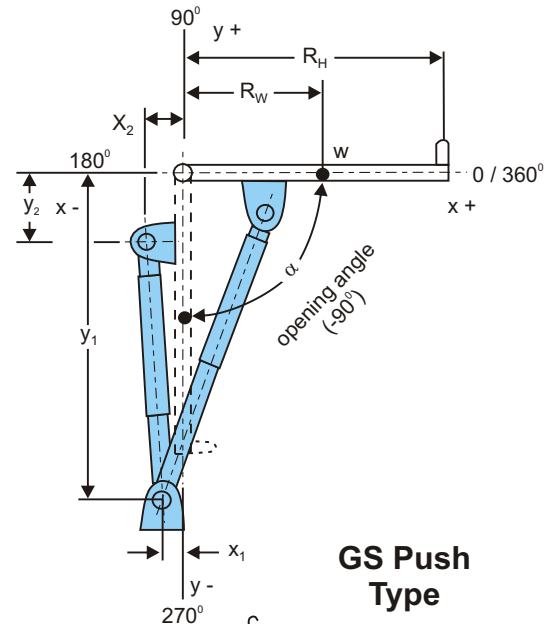
Desired Mounting Fittings

- | | | |
|-----------------------------------|------------------|-----------------------------------|
| <input type="checkbox"/> A | Eyelet | <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 |

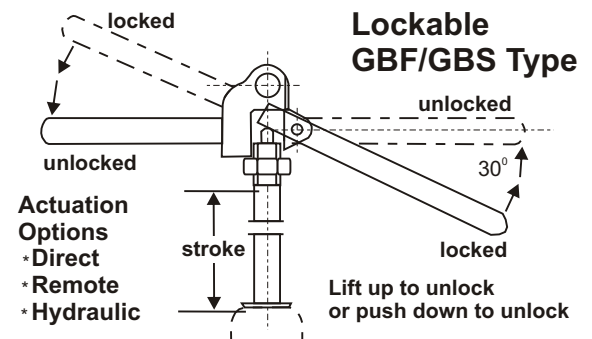
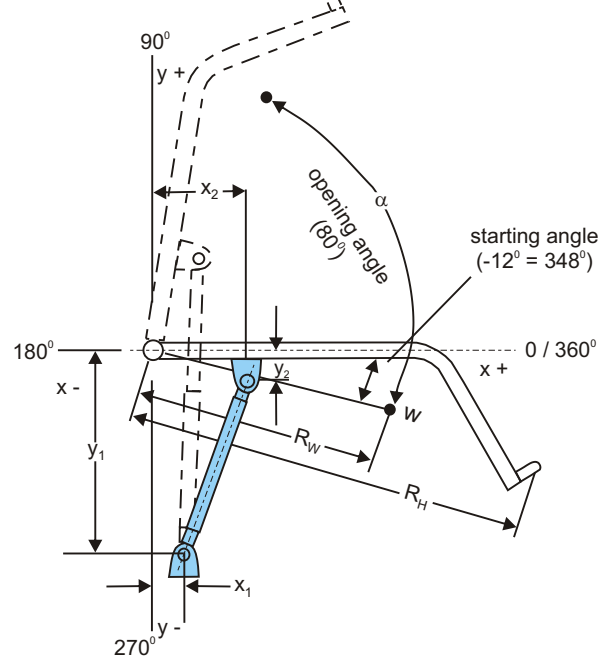
Please fax to:
ACE Controls, Inc.
248-476-2470

ACE Controls is dedicated to continuous improvement. ACE therefore reserves the right to change models, dimensions or specifications without notice or obligation.

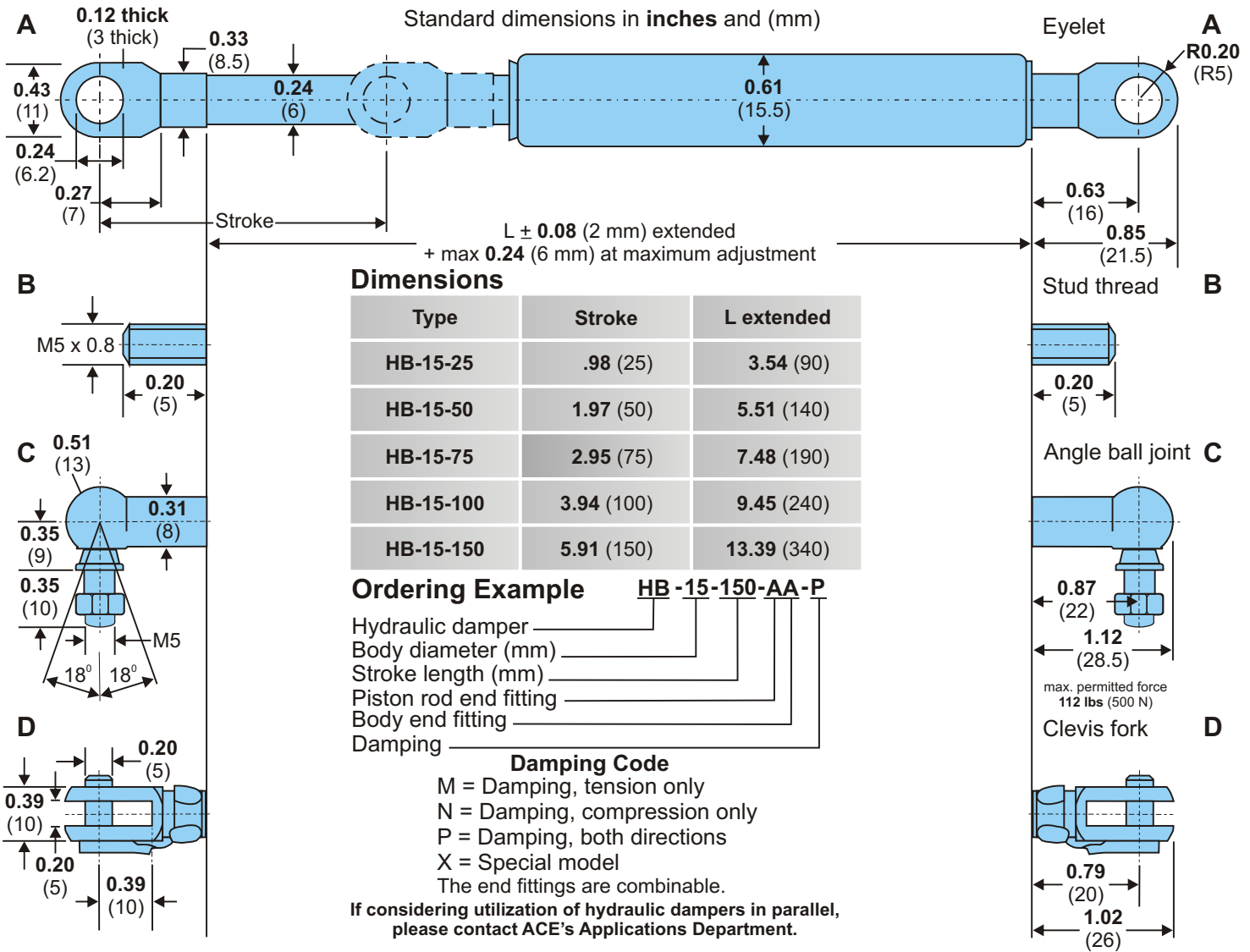
© ACE Controls, Inc. 2008. No portion of this catalog, except where specified, may be reproduced without ACE Controls' written permission.



GS Push Type



GBF and GBS types are available in 22 mm, 28 mm and 40 mm diameters with optional lengths. For range of types not shown in this catalog consult your local distributor or ACE Controls directly.



Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Mounting position: can be mounted in any position

Adjustment: pull the piston rod out to its fully extended position. While pulling on the rod, turn it clockwise or counter-clockwise until the desired damping is achieved. The adjustment is multi-turn and correct damping may require several trial and error adjustments.

Attention: dampers have free travel accounting for approximately 20% of stroke

Mechanical stop: required 1 to 1.5 mm before end of stroke

Temperature range: -22° to +176° F (-30° to +80° C), with special seals up to 248° F (120° C)

Fluid: petroleum oil

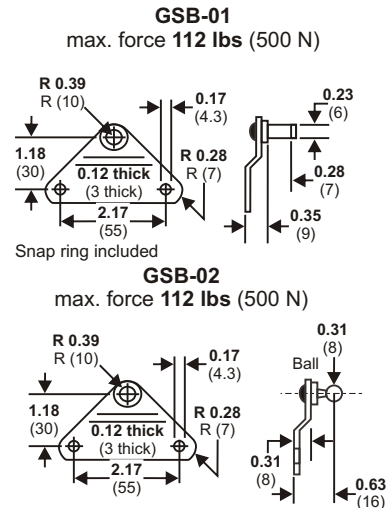
Minimum force: 4 lbs (20 N)
Maximum force: 180 lbs (800 N)

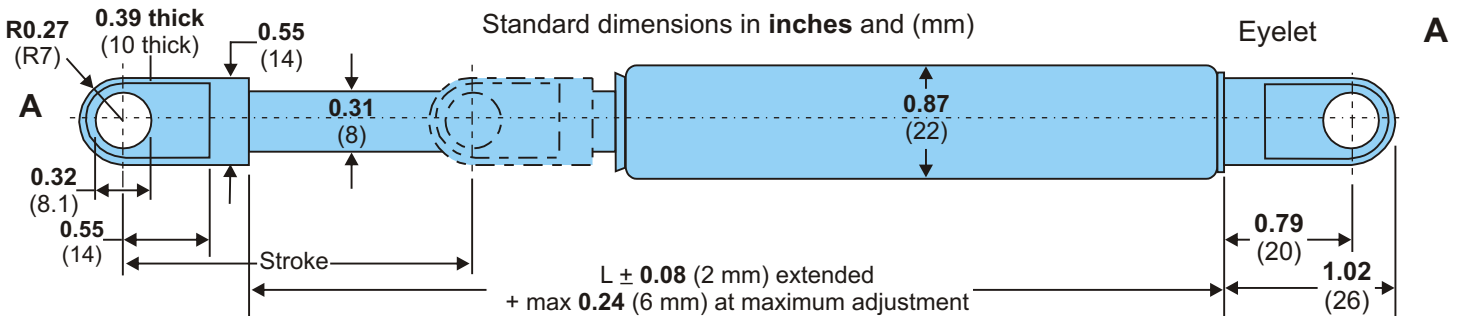
Material: chrome steel piston rod
 body: black anodized aluminum

End fittings: zinc plated steel or aluminum

Options: units with other damping characteristics, other stroke lengths and alternative end fittings

Mounting Brackets (zinc plated steel)





Dimensions

Type	Stroke	L extended
HB-22-50	1.97 (50)	5.90 (150)
HB-22-100	3.94 (100)	9.84 (250)
HB-22-150	5.91 (150)	13.78 (350)
HB-22-200	7.87 (200)	17.72 (450)
HB-22-250	9.84 (250)	21.65 (550)
HB-22-300	11.81 (300)	25.58 (650)
HB-22-350	13.78 (350)	29.52 (750)
HB-22-400	15.75 (400)	33.46 (850)

Ordering Example

HB-22-150-AA-P

- Hydraulic damper _____
- Body diameter (mm) _____
- Stroke length (mm) _____
- Piston rod end fitting _____
- Body end fitting _____
- Damping _____

Damping Code

- M = Damping, tension only
- N = Damping, compression only
- P = Damping, both directions
- X = Special model

The end fittings are combinable.

If considering utilization of hydraulic dampers in parallel, please contact ACE's Applications Department.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Mounting position: can be mounted in any position

Adjustment: pull the piston rod out to its fully extended position. While pulling on the rod, turn it clockwise or counter-clockwise until the desired damping is achieved. The adjustment is multi-turn and correct damping may require several trial and error adjustments.

Attention: dampers have free travel accounting for approximately 20% of stroke

Mechanical stop: required 1 to 1.5 mm before end of stroke

Temperature range: -22° to +176° F (-30° to +80° C), with special seals up to 248° F (120° C)

Fluid: petroleum oil

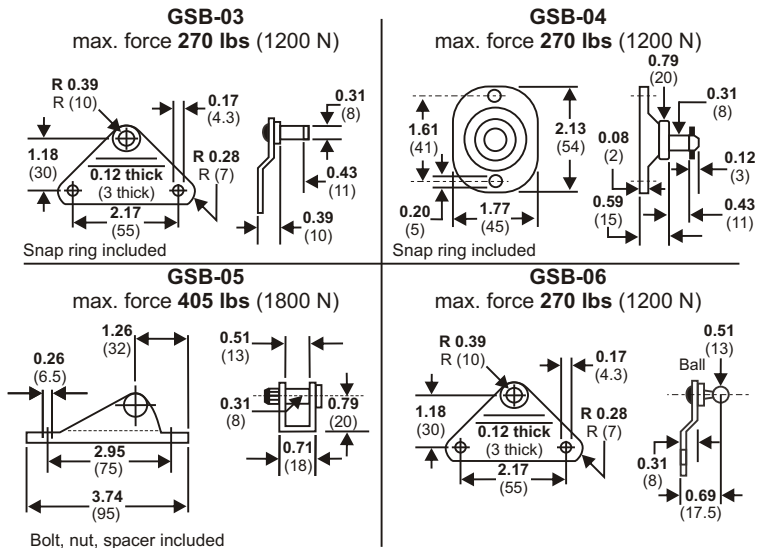
Minimum force: 7 lbs (30 N)
Maximum force: 405 lbs (1,800 N)

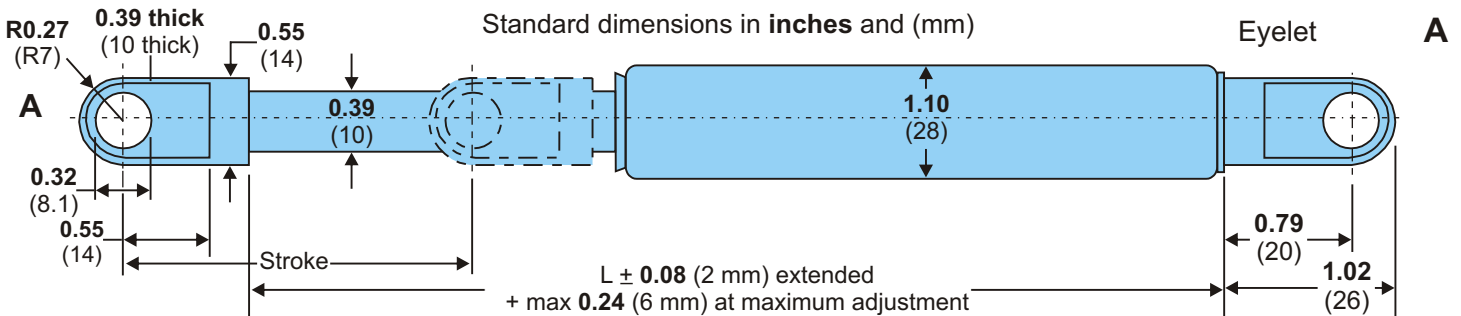
Material: chrome steel piston rod
body: black anodized aluminum

End fittings: zinc plated steel or aluminum

Options: units with other damping characteristics, other stroke lengths, alternative end fittings and protective rod sleeves

Mounting Brackets (zinc plated steel)



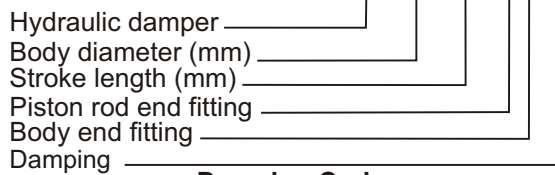


Dimensions

Type	Stroke	L extended
HB-28-50	1.96 (50)	6.3 (160)
HB-28-100	3.94 (100)	10.24 (260)
HB-28-150	5.91 (150)	14.17 (360)
HB-28-200	7.87 (200)	18.11 (460)
HB-28-250	9.84 (250)	22.05 (560)
HB-28-300	11.81 (300)	25.98 (660)
HB-28-350	13.78 (350)	29.92 (760)
HB-28-400	15.75 (400)	33.86 (860)
HB-28-500	19.69 (500)	41.73 (1060)

Ordering Example

HB-28-150-AA-P



Damping Code

- M = Damping, tension only
 - N = Damping, compression only
 - P = Damping, both directions
 - X = Special model
- The end fittings are combinable.

If considering utilization of hydraulic dampers in parallel, please contact ACE's Applications Department.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Mounting position: can be mounted in any position

Adjustment: pull the piston rod out to its fully extended position. While pulling on the rod, turn it clockwise or counter-clockwise until the desired damping is achieved. The adjustment is multi-turn and correct damping may require several trial and error adjustments.

Attention: dampers have free travel accounting for approximately 20% of stroke

Mechanical stop: required 1 to 1.5 mm before end of stroke

Temperature range: -22° to +176° F (-30° to +80° C), with special seals up to 248° F (120° C)

Fluid: petroleum oil

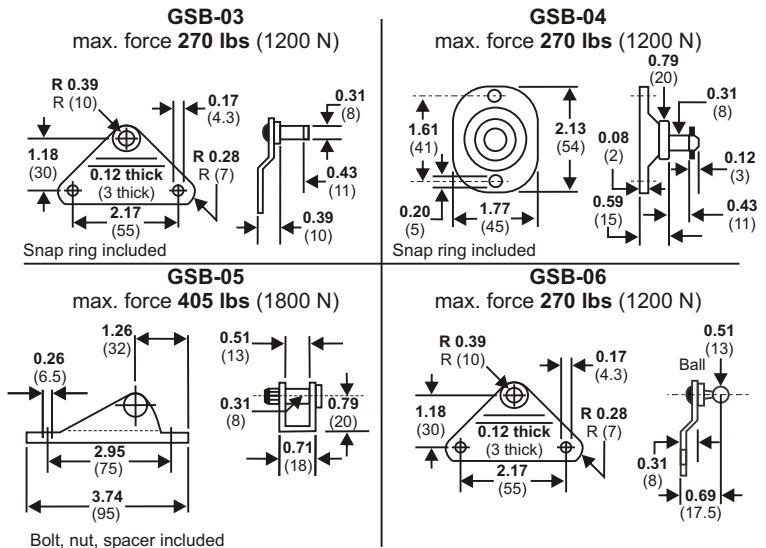
Minimum force: 7 lbs (30 N)
Maximum force: 674 lbs (3,000 N)

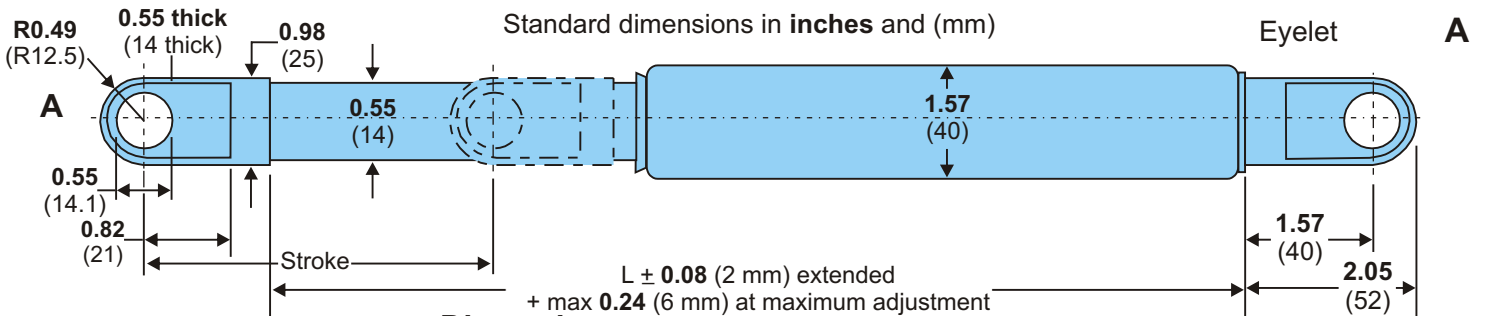
Material: chrome steel piston rod
 body: black anodized aluminum

End fittings: zinc plated steel or aluminum

Options: units with other damping characteristics, other stroke lengths, alternative end fittings and protective rod sleeves

Mounting Brackets (zinc plated steel)





Dimensions

Type	Stroke	L extended
HB-40-100	3.94 (100)	10.83 (275)
HB-40-150	5.91 (150)	14.76 (375)
HB-40-200	7.87 (200)	18.70 (475)
HB-40-300	11.81 (300)	26.57 (675)
HB-40-400	15.75 (400)	34.45 (875)
HB-40-500	19.69 (500)	42.32 (1075)
HB-40-600	23.62 (600)	50.20 (1275)
HB-40-700	27.56 (700)	58.07 (1475)
HB-40-800	31.50 (800)	65.94 (1675)

Ordering Example

HB-40-300-AA-P
 Hydraulic damper _____
 Body diameter (mm) _____
 Stroke length (mm) _____
 Piston rod end fitting _____
 Body end fitting _____
 Damping _____

Damping Code

- M = Damping, tension only
 - N = Damping, compression only
 - P = Damping, both directions
 - X = Special model
- If considering utilization of hydraulic dampers in parallel, please contact ACE's Applications Department.
 The end fittings are combinable.

Technical Data

ACE hydraulic dampers are self-contained and maintenance free.

Mounting position: can be mounted in any position

Adjustment: pull the piston rod out to its fully extended position. While pulling on the rod, turn it clockwise or counter-clockwise until the desired damping is achieved. The adjustment is multi-turn and correct damping may require several trial and error adjustments.

Attention: dampers have free travel accounting for approximately 20% of stroke

Mechanical stop: required 1 to 1.5 mm before end of stroke

Temperature range: -22° to +176° F (-30° to +80° C), with special seals up to 248° F (120° C)

Fluid: petroleum oil

Minimum force: 7 lbs (30 N)
Maximum force: 2,248 lbs (10,000 N)

Material: chrome steel piston rod
 body: black anodized aluminum

End fittings: zinc plated steel or aluminum

Options: units with other damping characteristics, other stroke lengths, alternative end fittings and protective rod sleeves

Mounting Bracket (zinc plated steel)

ME14

max. force **2,248 lbs (10,000 N)**

