SUSPA INDUSTRY

# *Series 16*
# Gas Springs

Lift, support, damping and adjustment devices

# Gas Springs: Series 16

For nearly 50 years, SUSPA has offered a proven, time-tested, high-performance gas spring line: SERIES 16. Conforming to the highest worldwide standards for lifting and counter-balancing, it features simple, easy motion. The basic design allows for a wide variety of applications with different forces, and takes into consideration ecological conservation.

## SUSPA - Your partner from design through production

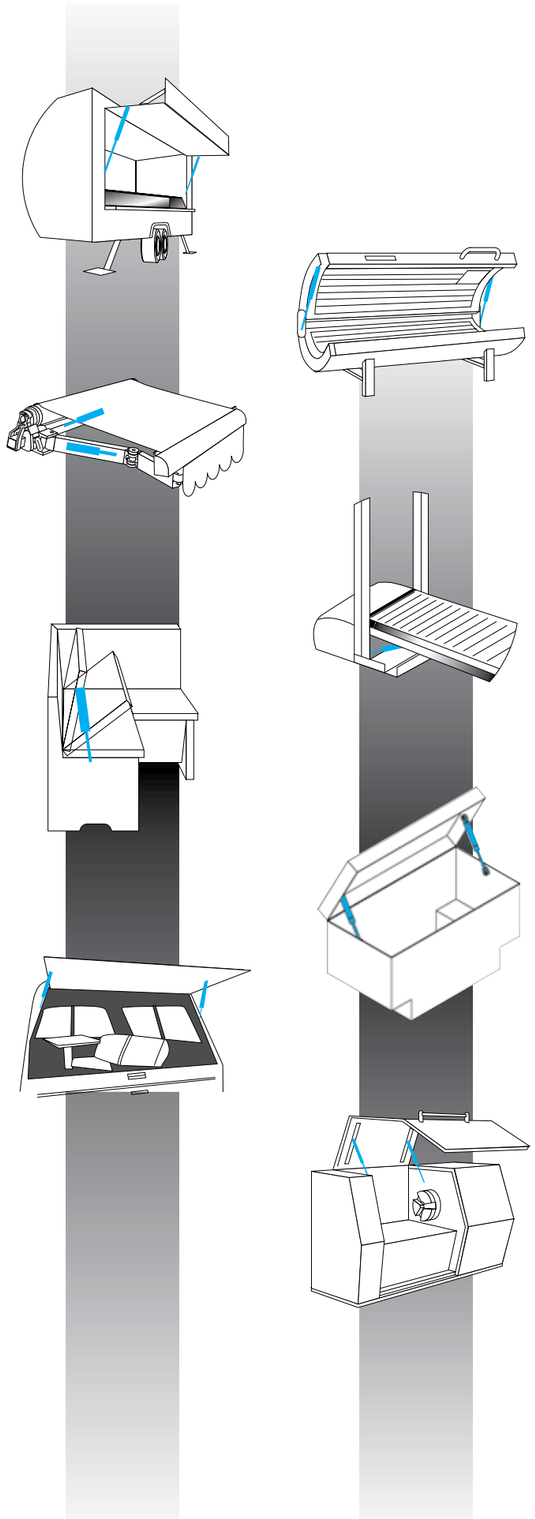
- SUSPA support from concept through production leads to optimum gas spring performance for your application.
- SUSPA service is quick and reliable, regardless of the volume of your order.
- SUSPA gas springs are resistant to nearly all environmental conditions.
- SUSPA *Hyrdo-Strut* gas springs block on compression, allowing infinite positioning of the piston rod.
- SUSPA also offers non-pressurized dampers, designed for your specific application.
- SUSPA products meet global standards.

## A few words about quality

The demand for quality and reliability in adjustment components is constantly increasing. Compliance with certifications such as ISO 9001 and ISO TS 16949 is becoming imperative. SUSPA continues to be on the leading edge with the highest product standards. **All cylinders in this brochure are covered by a 5-year limited warranty.** (Warranty to it the orignial purchaser of the cylinder, not the end user.)

SUSPA has achieved worldwide recognition for quality and ecological effectiveness. This involves design, engineering, production and distribution. We devote attention to details such as delivery, shipping logistics, product performance and durability.

SUSPA components meet rigid quality standards prior to assembly, while random sampling is performed on all production lots.



## A Variety of Applications

With thousands of applications already in existence, the potential new uses for SUSPA gas springs are virtually limitless.

SUSPA gas springs offer a unique alternative to conventional mechanical coil springs used in lifting or counterbalancing devices.

Some residential uses include skylights, lawn and garden equipment, exercise equipment, awnings and fold-up benches.

In health care, hospital beds, operating room tables and even tanning beds are equipped with gas springs.

In office settings, gas springs and dampers have proven to be acceptable and useful. Some applications include overhead office bins, copy machines, blueprint plotters, mail processing equipment and counterbalance arms for computer terminals.

Automotive uses include tailgates, engine hoods, tonneau covers, pick-up cap windows and luggage doors on busses.

SUSPA gas springs and dampers are used on the shop floor in applications such as machine guards, conveyor gates and flex-arms.

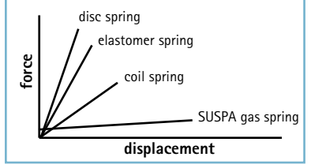
# Definitions and Operations

A gas spring is a self-contained, hermetically-sealed hydropneumatic linear actuator containing pressurized nitrogen gas, which provides an output force.

SUSPA gas springs offer a unique alternative to conventional mechanical or coil spring lifting or counterbalancing devices. The advantages of these springs involve a combination of a relatively flat force curve, controlled forces and extension speed, and damping at the end of the stroke. The spring rate for a gas cylinder, as the illustration (below) shows, is far less than for any mechanical spring.

Each gas spring also contains a specific amount of oil, which lubricates the seal, piston and piston rod. The oil and gas within the cylinder moves from one side of the piston head to the other when compressed or extended, providing a damping effect. This flow can be controlled either on extension, compression, or both.

### Comparable forces




In its "unloaded" static state, the piston rod within the cylinder extends outside of the gas-pressurized tube. The extended output force (P1) is a result of the difference between the internal gas pressure and the outside atmospheric pressure. As the piston rod is compressed, the internal pressure and output force increase according to the rod volume displaced. During rod extension, the internal pressure and output force decrease according to the reduced internal rod volume.

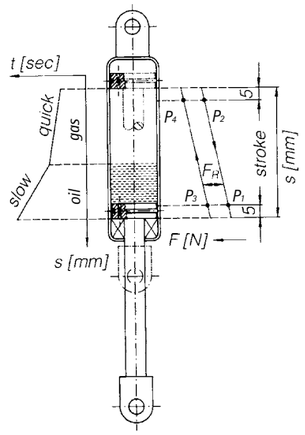
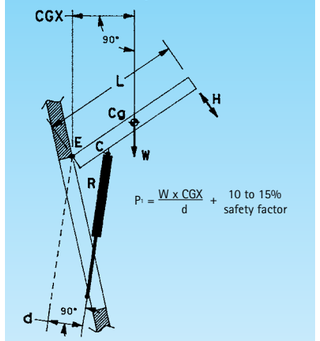



Figure A

### Force Required to Maintain Lid in Open Position




$$P_1 = \frac{W \times CGX}{d} + \text{10 to 15\% safety factor}$$

C - Upper Mounting Point
D - Lower Mounting Point
E - Pivot Point
Cg - Center of Gravity
CGX - Horizontal Distance from Center of Gravity to Hinge
d - Effective Lever Arm of SUSPA Gas Cylinder = Smallest Perpendicular Distance from Gas Cylinder to Pivot.
P1 - Extended Force (on extension)
P2 - Compressed Force (on extension)
P3 - Extended Force (on compression)
P4 - Compressed Force (on compression)
FR - Friction
H - Hand Force
L - Handle Length
W - Weight/Mass

# Choosing tube/rod combinations

### Choose your end fittings for the most flexibility

Ball sockets allow for misalignment far better than clevises and eyelets. Any misalignment with clevis-type end fittings may cause binding, which may adversely affect the system's operation characteristics and the cylinders' durability. If clevis end fittings are required, choose pivot pins which are smaller than the hole diameter specified for the model. When choosing end fittings which are threaded onto the cylinder, check that the end fitting threads match with the threads on the cylinder. Information on this is contained in the table on each *SERIES 16* product description, beginning on page 9.

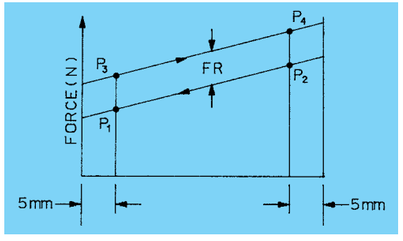
### Determine the extended length of the cylinder

The fully-extended length of the cylinder can be calculated by adding the tube length, rod stroke and both end fitting lengths. The solid length of the cylinder can be established by adding the tube length and both end fitting lengths. It is <u>not recommended</u> that you design the cylinder to the solid (compressed) length of the cylinder. 10mm of unused stroke (in the compressed position) generally is designed into the system to allow for mounting location tolerances and overtravel.

### Choose a tube longer than the rod

Our published directions specify using a 27mm additional tube length for a Model **16-1** cylinder; 37mm additional tube length for a **16-2**, **16-3** and **16-4** cylinder. This <u>minimum</u> value, which can be exceeded, makes cylinders such as a Model 16-4-262-200-(end fittings)-(P1 force) possible. A 16-4-180-175-(end fittings)-(P1 force) cylinder is not recommended.

Figure B






# Analyzing forces

While the overall success of a design depends on gas spring placement, accurate force analysis is required for a successful application. This is commonly accomplished by summing the moments around the hinge point.

A moment is the term used to describe a force multiplied by a distance:

$$M = F \times d$$

**F** is the force in Newtons or pounds and **d** is the shortest perpendicular distance from the line of action of the force to the centerline of the pivot. This is illustrated in figures **F** and **G**. Consistent units of measure must be used throughout a design. If the information is supplied in inches and pounds, work the entire equation in inches and pounds, then convert.

In the following equations, **W** is the weight, **N** is the number of cylinders, **H** is the hand load, and **L** is the lid length.

In figures **F** and **G**, the moment due to the weight of the lid is:

$$M_{lid} = W \times CGX$$

The moment due to the cylinder is:

$$M_{cyl} = N \times P_2 \times d$$

The moment due to the hand force is:

$$M_{hand} = H \times L$$

In order to determine whether a moment is positive or negative, the "right hand rule" must be used: *if the fingers of your right hand curl in the direction of the force, and your thumb points up, the moment is positive.* If your thumb points downward when the fingers curl around in the direction of the force, the moment is considered **negative.** Thus, in figures **F** and **G** the moment for the cylinder is positive, the moment for the weight **W** is negative, and the moment for the hand force is positive.

Summing the moments around the pivot, then, produces the following equation:

$$M_{net} = M_{cyl} + M_{hand} - M_{lid}$$

$$M_{net} = (N \times P_2 \times d) + (H \times L) - (w \times CGX) = 0$$

Solving for the hand force is done thus:

$$H = \frac{(W \times CGX) - (N \times P_2 \times d)}{L}$$

This analysis can be used for any angle of opening for the lid, provided that the cylinder moments have been determined properly.

The cylinder output force does not vary with the extended length of the cylinder, and the output force at any length is easily approximated by plotting the force curve for a SUSPA gas cylinder and measuring the force.

Figure **B** (page 4) is an example of a plotted force curve. This demonstrates the location of $P_1$ and $P_2$ forces on a force diagram. Note, also, that 10mm of overtravel is normally allowed in the **compressed position.** This is a **minimum** value for overtravel safety, and may be exceeded.

The $P_2/P_1$ ratio realistically can fall between 1.3 and 1.8 for most tube/rod combinations (and can be decreased slightly below 1.3 if a long tube is used in conjunction with a short rod). The ratio can be modified, depending on the amount of oil inside the cylinder, and will vary by application and construction.

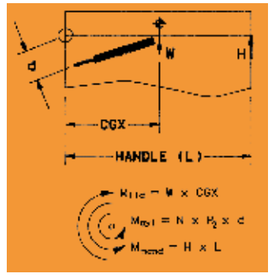



Figure C

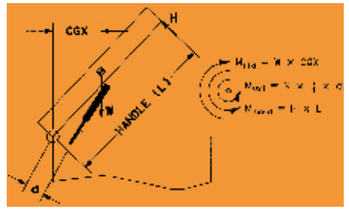



Figure D

# Choosing mounting locations

The most common cylinder applications are represented in figures C, D and E. These locations most often offer the best lid opening characteristics. As sketched, the mounting points are dimensioned from the pivot when the lid is in the **closed** position. When information is to be sent to the Suspa design engineers, using this format will enhance turn-around time and require less clarification.

In the illustrations, the dimensions identified as **FX** and **FY** are referred to as the fixed mounting points, and the dimensions marked **MX** and **MY** are referred to as the moving mounting points. The location of the center of gravity is represented by the dimensions **CGX** and **CGY.** The accuracy of locating the center of gravity and weight is crucial for complete design analysis. Again, **all** dimensions should be given for the lid in the **closed position.**

Note: It is recommended that the gas spring usually be mounted with the rod end down.

Figure E

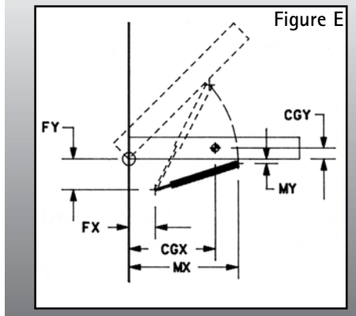



Figure F

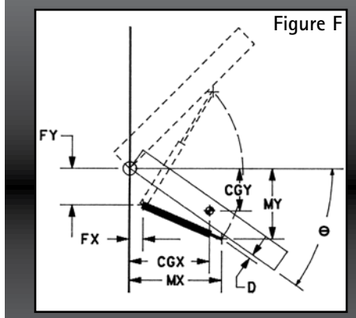
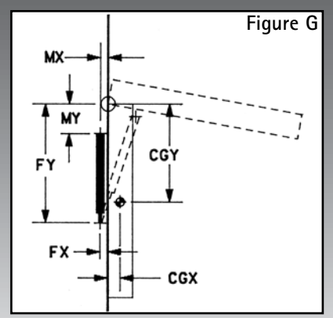



Figure G




# Determining forces

The required output force can be determined as is shown in figure A on **page 4**. Proportionately, the piston rod diameter, relative to the tube diameter, influences the extended-to-compressed force ratio ($P_1$ to $P_2$ or $P_3$ to $P_4$). Lower ratios require a small piston rod and large tube diameter combination, such as Model **16-3**.

In applications using extremely long strokes, coupled with high forces, strong consideration should be given to larger piston rod diameters, as they offer greater strength. Side- loading always should be avoided.

# Durability

SUSPA *SERIES 16* gas springs undergo a standard test for durability. The test consists of 15,000 cycles ambient, plus 1,000 cycles at the temperature extremes of -30°C and +80°C (-22°F and 176°F) at a maximum rate of six cycles per minute, with an acceptable maximum pressure loss of 10% or less. *SERIES 16* gas springs are not rated for a specified number of cycles. They are designed for the characteristics of nitrogen gas, and are tested for pressure loss.

# Temperature

SUSPA *SERIES 16* gas springs are rated for use at temperature extremes of -30°C and +80°C (-22°F and 176°F) and are temperature compensated to 20°C (68°F) during assembly. Output force will temporarily increase or decrease by 3.4% for every 10°C change in temperature from 20°C.



# Application Information

*Note: Copy this page and fill in the information to assure expedient handling of your application at SUSPA.*

SUSPA, Incorporated
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Grand Rapids, MI 49548-3497
616-241-4200
FAX 616-531-3310
E-mail: gd@suspa-inc.com
*www.suspa.com*

Date _____ E-Mail _____

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

Phone _____ Fax _____

Application Description _____

_____

Our Application would be best described by type: ☐ A ☐ B ☐ C

Figure E

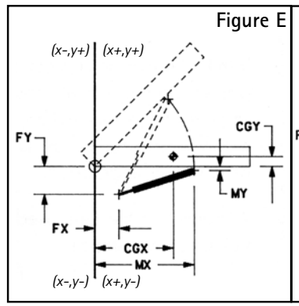



Figure F

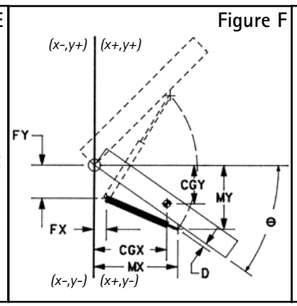
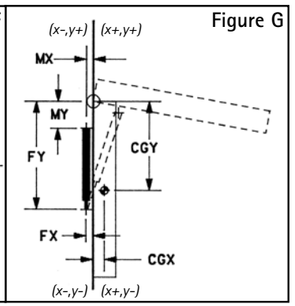



Figure G




**To expedite this design, please provide all possible dimensions ( in millimeters )**

**Performance Characteristics**

☐ Opening angle _____°

☐ Self Rising

☐ Self Rising after _____° lift. (15-30° standard)

Is the cover latched or locked? ( Y / N )

**Preferred Mounting Method:**

☐ Ball Socket _____

☐ Clevis Eye _____

Currently using gas cylinders? ( Y / N )

Manufacturer _____

Part Number _____

**Performance Characteristics**

Weight of lid/door _____ (Lbs/Kg)

Number of cylinders per lid/door _____

All dimensions are from Pivot Center Line

With lid in closed position. Circle correct sign of dimension.

$Fx^+$ _____ $Fy^+$ _____ $Mx^+$ _____ $My^+$ _____ $CGx^+$ _____ $CGy^+$ _____

Distance from hinge to handle _____

--------Type B Application only----------

ø = Angle from horizontal _____

D = Distance from mounting surface _____

T = Thickness of lid or door _____

**Please include a cross sectional sketch noting any mounting restrictions.**
**SUSPA application simulation reports are provided for reference only.**

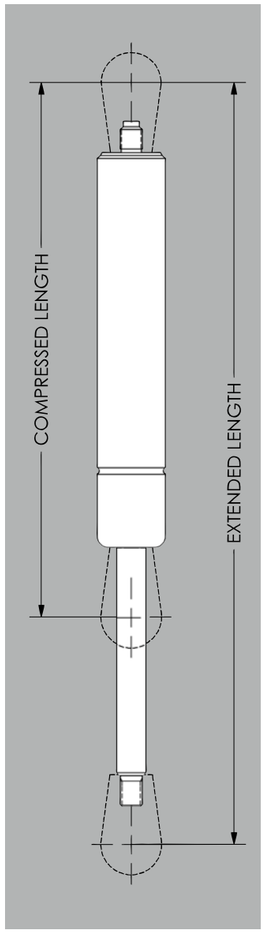
Correct incorporation and use of SUSPA provided gas cylinders or dampers is the sole responsibility of the user
Lack of proper information may delay processing of design.

# Series 16
# Standard Gas Springs

SUSPA offers a variety of **Standard 16 SERIES** gas lift cylinders to meet the increasing needs of customers who want *fast shipments* of SUSPA gas springs at economical prices. Nine combinations currently are available, incorporating the most popular lengths and output forces.

All **Standard 16 SERIES** gas lift cylinders carry the SUSPA five year warranty from date of manufacture. Any deviations from the models listed here can be produced on *request*-- thousands of different configurations are possible.

The proper selection of SUSPA gas springs, and the incorporation of them into specific products, remain the sole responsibility of the buyer. SUSPA reserves the right to make changes without advance notice.




| SGS No. | Model No. | Part No. | P1 Force (N) | P1 Force (lbs) |
|---|---|---|---|---|
| 1 | 16-2-237-160-A101-B101<br>Center-to-Center length<br>Extended: 17.1" (435mm)<br>Compressed: 10.8" (275mm) | C16-02622 | 124 | 28 |
| | | C16-02648 | 156 | 35 |
| | | C16-06874 | 178 | 40 |
| | | C16-04270 | 200 | 45 |
| | | C16-04445 | 245 | 55 |
| | | C16-06867 | 267 | 60 |
| | | C16-08777 | 289 | 65 |
| | | C16-08789 | 356 | 80 |
| | | C16-06889 | 432 | 97 |
| | | C16-06756 | 470 | 105 |
| | | C16-11253 | 600 | 135 |
| 2 | 16-2-263-200-A101-B101<br>Center-to-Center length<br>Extended: 19.7" (500mm)<br>Compressed: 11.8" (300mm) | C16-08568 | 89 | 20 |
| | | C16-09786 | 133 | 30 |
| | | C16-08316 | 178 | 40 |
| | | C16-08260 | 267 | 60 |
| | | C16-08053 | 356 | 80 |
| | | C16-08054 | 445 | 100 |
| | | C16-08055 | 534 | 120 |
| | | C16-08376 | 600 | 135 |
| 3 | 16-4-262-200-A16-B16<br>Center-to-Center length<br>Extended: 19.5" (494mm)<br>Compressed: 11.6" (294mm) | C16-00816 | 222 | 50 |
| | | C16-00087 | 290 | 65 |
| | | C16-00088 | 385 | 86 |
| | | C16-00086 | 435 | 98 |
| | | C16-00010 | 510 | 115 |
| | | C16-00011 | 595 | 134 |
| | | C16-00001 | 712 | 160 |
| | | C16-00009 | 830 | 187 |
| | | C16-00357 | 1000 | 225 |
| 4 | 16-4-262-200-A11-B11<br>Center-to-Center length<br>Extended: 20.6" (522mm)<br>Compressed: 12.7" (322mm) | C16-08111 | 290 | 65 |
| | | C16-03472 | 385 | 86 |
| | | C16-05470 | 435 | 98 |
| | | C16-03473 | 510 | 115 |
| | | C16-03474 | 595 | 134 |
| | | C16-04650 | 712 | 160 |
| | | C16-06340 | 830 | 186 |
| | | C16-03475 | 1000 | 225 |
| 5 | 16-2-132-080-A101-B101<br>Center-to-Center length<br>Extended: 9.8" (250mm)<br>Compressed: 6.7" (170mm) | C16-03213 | 58 | 13 |
| | | C16-10334 | 98 | 22 |
| | | C16-09322 | 178 | 40 |
| | | C16-10445 | 222 | 50 |
| | | C16-12103 | 334 | 75 |
| | | C16-10446 | 445 | 100 |
| 6 | 16-2-172-100-A101-B101<br>Center-to-Center length<br>Extended: 12.2" (310mm)<br>Compressed: 8.3" (210mm) | C16-02716 | 58 | 13 |
| | | C16-03795 | 107 | 24 |
| | | C16-10788 | 156 | 35 |
| | | C16-12104 | 222 | 50 |
| | | C16-12105 | 289 | 65 |
| | | C16-12106 | 356 | 80 |
| | | C16-12107 | 445 | 100 |
| 7 | 16-4-371-260-A198-B198<br>Center-to-Center length<br>Extended: 26.34" (669mm)<br>Compressed: 16.10" (409mm) | C16-13334 | 385 | 87 |
| | | C16-12666 | 445 | 100 |
| | | C16-12038 | 534 | 120 |
| | | C16-12181 | 667 | 150 |
| 8 | 16-4-452-410-A198-B198<br>Center-to-Center length<br>Extended: 35.43" (900mm)<br>Compressed: 19.29" (490mm) | C16-15952 | 178 | 40 |
| | | C16-10198 | 267 | 60 |
| | | C16-10944 | 356 | 80 |
| | | C16-15953 | 445 | 100 |
| 9 | 16-4-452-410-A011-B011<br>Center-to-Center length<br>Extended: 36.3" (922mm)<br>Compressed: 20.2" (512mm) | C16-28662 | 445 | 100 |
| | | C16-22581 | 556 | 125 |
| | | C16-28663 | 78 | 175 |
| | | C16-28664 | 890 | 200 |
| | | C16-28665 | 1000 | 225 |
| | | C16-28666 | 1115 | 250 |

## End Fittings

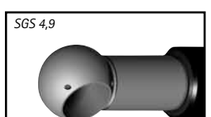
*SGS 1, 2, 5, 6, 7 & 8*

10mm Plastic Ball Socket

NOTE: SGS 1, SGS 2, SGS 5, SGS 6, SGS 7 and SGS 8 are available with 10mm diameter ball studs. Please specify part No. P67-00001 for 5/16-18 UNC 2A threads or part No. P67-00047 for M8 x 1.25-6G threads.

*SGS 3*

*SGS 4,9*



13mm Steel Ball Socket

Available with P67-00002 13mm dia. ball 5/16-18 UNC-2A threads or P67-00116 13mm dia. ball M8X1.25-6G threads. Requires two each: P68-00019 CLIP.



# SERIES 16-1

Tube bodies are treated with a highly corrosion-resistant coating. The piston rods are induction-hardened prior to receiving a durable, black nitride surface.

Each SUSPA gas spring is manufactured with a specific quantity of oil, which serves both as a lubricant and damping medium. Relatively higher oil quantities increase damping and also increase the extended-to-compressed force ratio.

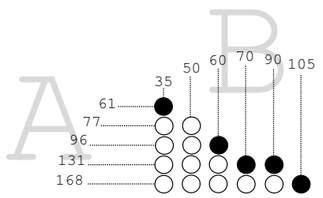
Maximum compressed forces will exceed extended forces by 30% to 80%, depending on internal oil quantity.

## 16-1

Minimum force ($P_1$) 60N

Maximum force ($P_1$) 350N

Order Example
16-1-168-105-A4-B4-200N
(A) (B) (end fittings) ($P_1$)

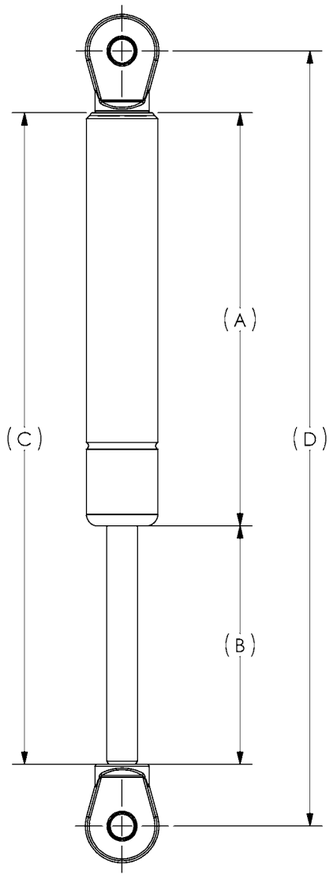



Minimum tube length
(A) = rod (B) + 27

ALL DIMENSIONS IN MILLIMETERS

INDEX: One inch = 25.4 millimeters
One pound = 4.448 Newtons
○ = Available Combinations
● = Most Commonly Used
*Custom sizes available, call for details.

Minimum and maximum forces are expressed in the extended position ($P_1$).




| | |
|---|---|
| Minimum Tube Lengths | 61 |
| Maximum Tube Lengths | 225 |
| Tube Diameter | 15mm |
| Rod Diameter | 6mm |
| Thread Tube End | M6 x 1.0mm |
| Thread Rod End | M6 x 1.0mm |

# SERIES 16-2

Tube bodies are treated with a highly corrosion-resistant coating. The piston rods are induction-hardened prior to receiving a durable, black nitride surface.

Each SUSPA gas spring is manufactured with a specific quantity of oil, which serves both as a lubricant and damping medium. Relatively higher oil quantities increase damping and also increase the extended-to-compressed force ratio.

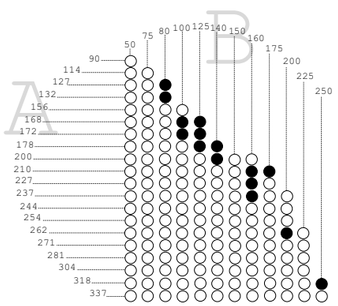
Maximum compressed forces will exceed extended forces by 30% to 80%, depending on internal oil quantity.

## 16-2

Minimum force ($P_1$) 60N

Maximum force ($P_1$) 600N

**Order Example**
**16-2-237-160-A101-B101-300N**
(A) (B) (end fittings) ($P_1$)

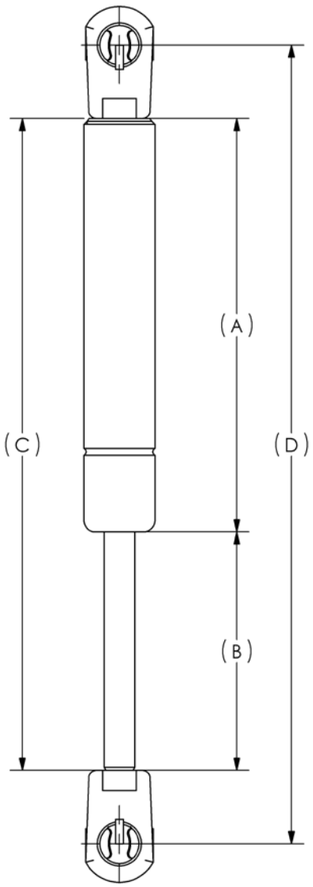



Minimum tube length
(A) = rod (B) + 37

ALL DIMENSIONS IN MILLIMETERS

INDEX: One inch = 25.4 millimeters
One pound = 4.448 Newtons
○ = Available Combinations
● = Most Commonly Used
*Custom sizes available, call for details.

Minimum and maximum forces are expressed in the extended position ($P_1$).




| | |
|---|---|
| Minimim Tube Length | 85 |
| Maximum Tube Length | 340 |
| Tube Diameter | 19mm |
| Rod Diameter | 8mm |
| Thread Tube End | M6 x 1.0mm |
| Thread Rod End | M6 x 1.0mm |



# SERIES 16-3

Tube bodies are treated with a highly corrosion-resistant coating. The piston rods are induction-hardened prior to receiving a durable, black nitride surface.

Each SUSPA gas spring is manufactured with a specific quantity of oil, which serves both as a lubricant and damping medium. Relatively higher oil quantities increase damping and also increase the extended-to-compressed force ratio.

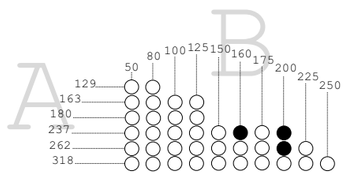
Maximum compressed forces will exceed extended forces by 30% to 80%, depending on internal oil quantity.

## 16-3

Minimum force ($P_1$) 100N

Maximum force ($P_1$) 600N

**Order Example**
**16-3-262-200-A285-B144-400N**
(A) (B) (end fittings) ($P_1$)

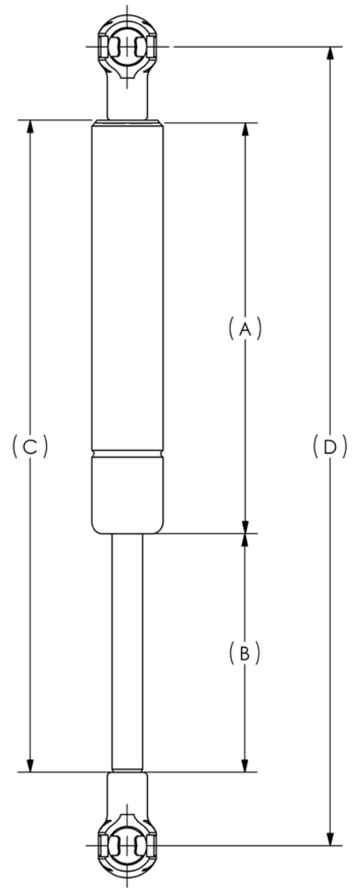



Minimum tube length
(A) = rod (B) + 37

ALL DIMENSIONS IN MILLIMETERS

INDEX: One inch = 25.4 millimeters
One pound = 4.448 Newtons
○ = Available Combinations
● = Most Commonly Used
*Custom sizes available, call for details.

Minimum and maximum forces are expressed in the extended position ($P_1$).




| | |
|---|---|
| Minimim Tube Length | 85 |
| Maximum Tube Length | 535 |
| Tube Diameter | 22mm |
| Rod Diameter | 8mm |
| Thread Tube End | M8 x 1.25mm |
| Thread Rod End | M6 x 1.00mm |

# SERIES 16-4

Tube bodies are treated with a highly corrosion-resistant coating. The piston rods are induction-hardened prior to receiving a durable, black nitride surface.

Each SUSPA gas spring is manufactured with a specific quantity of oil, which serves both as a lubricant and damping medium. Relatively higher oil quantities increase damping and also increase the extended-to-compressed force ratio.

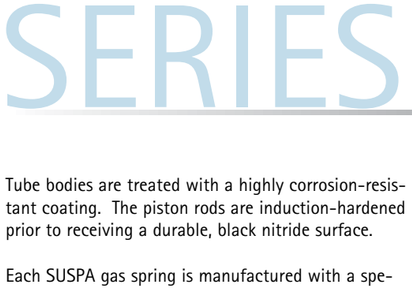
Maximum compressed forces will exceed extended forces by 30% to 80%, depending on internal oil quantity.

## 16-4

*Minimum force ($P_2$)* 100N

Maximum force ($P_1$) 1000N

**Order Example**
**16-4-452-410-A16-B16-700N**
(A) (B) (end fittings) ($P_1$)

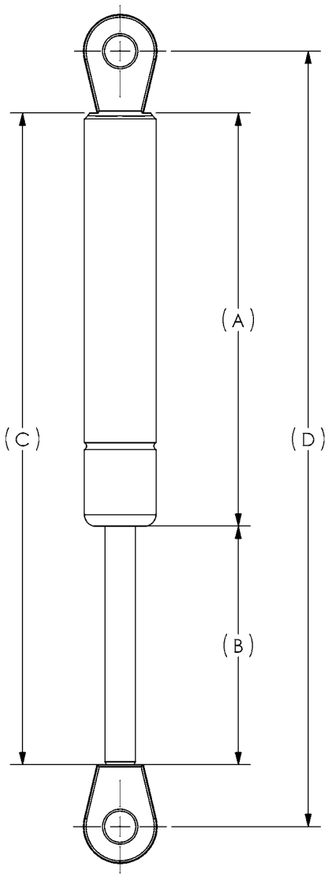



Minimum tube length
(A) = rod (B) + 37

ALL DIMENSIONS IN MILLIMETERS

INDEX: One inch = 25.4 millimeters
One pound = 4.448 Newtons
○ = Available Combinations
● = Most Commonly Used
*Custom sizes available, call for details.

Minimum and maximum forces are expressed in the extended position ($P_1$).




| | |
|---|---|
| Minimim Tube Length | 85 |
| Maximum Tube Length | 535 |
| Tube Diameter | 22mm |
| Rod Diameter | 10mm |
| Thread Tube End | M8 x 1.25mm |
| Thread Rod End | M8 x 1.25mm |



# SERIES 16-6

Tube bodies are treated with a highly corrosion-resistant coating. The piston rods are induction-hardened prior to receiving a durable, black nitride surface.

Each SUSPA gas spring is manufactured with a specific quantity of oil, which serves both as a lubricant and damping medium. Relatively higher oil quantities increase damping and also increase the extended-to-compressed force ratio.

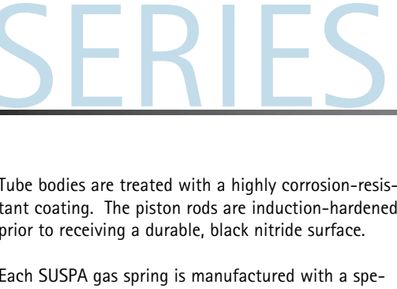
Maximum compressed forces will exceed extended forces by 30% to 80%, depending on internal oil quantity.

## 16-6

Minimum force ($P_2$) 200N

Maximum force ($P_1$) 2200N

**Order Example**
**16-6-474-400-A73-B73-1100N**
(A) (B) (end fittings) ($P_1$)




Minimum tube length for stroke ≤ 300
(A) = rod (B) + 43

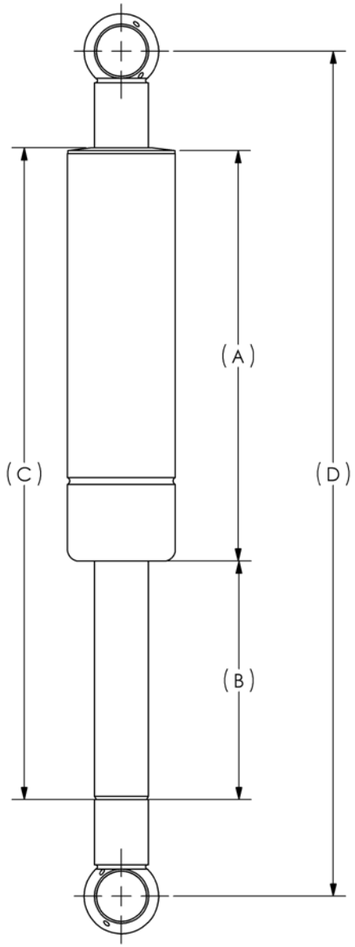
Minimum tube length for stroke > 300
(A) = rod (B) + 55

ALL DIMENSIONS IN MILLIMETERS

INDEX: One inch = 25.4 millimeters
One pound = 4.448 Newtons
○ = Available Combinations
● = Most Commonly Used

Minimum and maximum forces are expressed in the extended position ($P_1$).

**This product is manufactured in Germany and requires longer lead times.**




| | |
|---|---|
| Minimim Tube Length | 118 |
| Maximum Tube Length | 668 |
| Tube Diameter | 28mm |
| Rod Diameter | 14mm |
| Thread Tube End | M8 x 1.25mm |
| Thread Rod End | M8 x 1.25mm |

# HYDRO-STRUT 29-4 DAMPERS

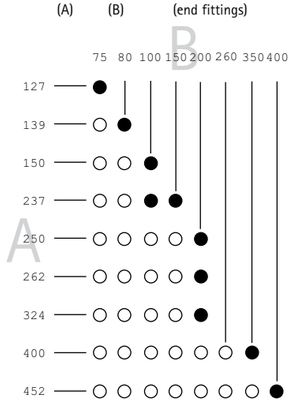
Tube bodies are treated with a highly corrosion-resistant coating. The piston rods are induction-hardened prior to receiving a durable, black nitride surface.

Each SUSPA gas spring is manufactured with a specific quantity of oil, which serves both as a lubricant and damping medium. Relatively higher oil quantities increase damping and also increase the extended-to-compressed force ratio.

## 29-4

Minimum force ($P_1$) 200N  Maximum force ($P_1$) 1000N

**Order Example**
**29-4-262-200-A11-B13-700N**
(A) (B) (end fittings) ($P_1$)



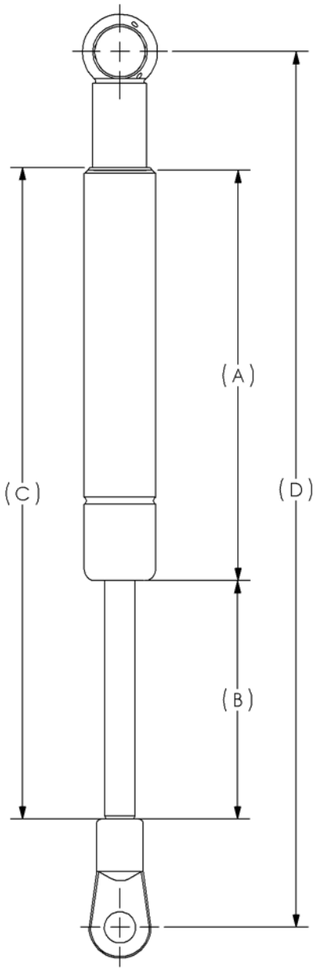

Minimum tube length
A ≥ B + 50

ALL DIMENSIONS IN MILLIMETERS

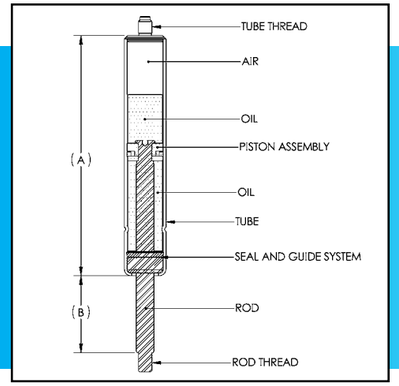
INDEX: One inch = 25.4 millimeters
One pound = 4.448 Newtons
○ = Available Combinations
● = Most Commonly Used

Minimum and maximum forces are expressed in the extended position ($P_1$).

Blocking on compression is available in light (200N), medium (400-600N) or heavy (800-1000N). Please specify.



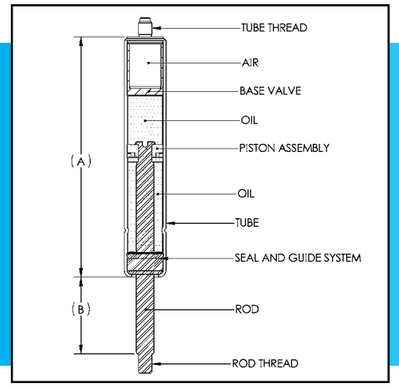

| | |
|---|---|
| Minimim Tube Length | 127 |
| Maximum Tube Length | 452 |
| Tube Diameter | 22mm |
| Rod Diameter | 10mm |
| Thread Tube End | M8 x 1.25mm |
| Thread Rod End | M8 x 1.25mm |




## Standard Dampers

Standard non-pressurized dampers are designed for low force, motion control applications. The dampers are filled with a combination of oil and air. The ratio between the oil and the air effects the amount of dampened stroke length. *Idle stroke is present because the oil and the air are not separated. This type of damper is ideal for applications that do not utilize the entire stroke length or require consistant damping in one direction only.

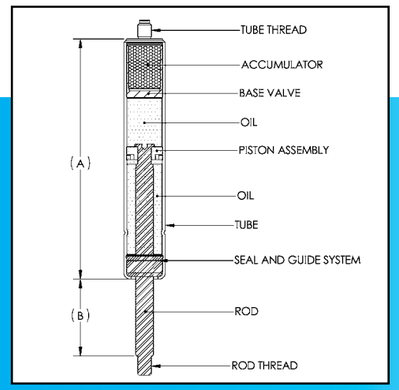
**characteristics**
- Available in all 16 Series sizes.
- No extension force.
- Idle stroke.*
- Mounting position- Piston rod down.
- Damping available on extension, compression or both.
- Damping force may vary with different orifices and oil viscosity.




## Dampers with Base Valve

This damper is very similar to the standard damper with an added component. A base valve is inserted into the bottom of the tube to separate the air from the oil. The base valve eliminates the *idle stroke that is present in standard dampers. This leads to a smoother, more consistent damping force along the entire stroke length.

**characteristics**
- Only available in 16-2 Series.
- No extension force.
- No idle stroke.*
- Mounting position- Piston rod down.
- Damping available on extension, compression or both.
- Damping force may vary with different orifices and oil viscosity.




## Dampers with Base Valve and Accumulator

A foam accumulator is inserted in the base valve to replace the air. The accumulator contracts and expands when the damper is compressed or extended to accommodate the rod volume change. This allows the damper to be mounted horizontally or vertically. The function of the accumulator produces a damper that provides consistent damping force along the entire stroke length.

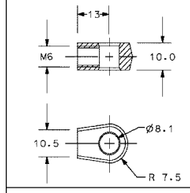
**characteristics**
- Only available in 16-2 Series.
- No extension force.
- No idle stroke.*
- Mounting position- Horizontal or vertical regardless of piston rod orientation.
- Damping available on extension, compression or both.
- Damping force may vary with different orifices and oil viscosity.

| | Series | 16-1 | 16-2 | 16-3 | 16-4 |
|---|---|---|---|---|---|
| DIMENSIONS | Rod Length (B) | 25-175mm | 50-285mm | 50-285mm | 50-500mm |
| | Rod Diameter | 6mm | 8mm | 8mm | 10mm |
| | Thread Rod End | M6x1.0mm | M6x1.0mm | M6x1.0mm | M8x1.25 |
| | Tube Length (A) | 61-225mm | 85-340mm | 85-535mm | 85-535mm |
| | Min. Tube Length (A)=Rod(B) + | 27mm | **37-114mm | 37mm | 37mm |
| | Tube Diameter | 15mm | 19mm | 22mm | 22mm |
| | Thread Tube End | M6x1.0mm | M6x1.0mm | M8x1.25 | M8x1.25 |

**Minimum tube length depends on base valve chosen.
*Idle Stroke: Area of reduced damping caused by the air pocket compressing or by air and oil mixing.

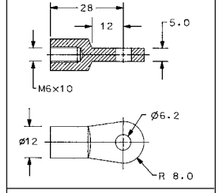
# END FITTINGS M6

## A10 B10 CLEVIS



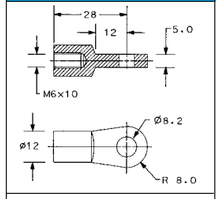

065-00164 ZINC

## A1 B1 CLEVIS



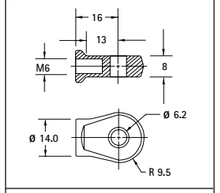

065-00094 ZINC

## A2 B2 CLEVIS



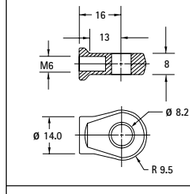

065-00070 ZINC

## A4 B4 CLEVIS



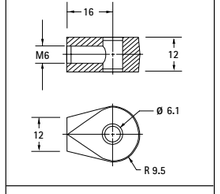

P68-00586 PLASTIC

## A6 B6 CLEVIS



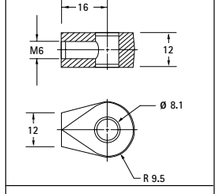

P68-00583 PLASTIC

## A220 B220 CLEVIS



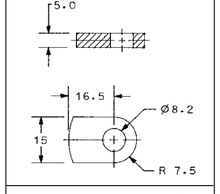

065-10005 ZINC

## A221 B221 CLEVIS



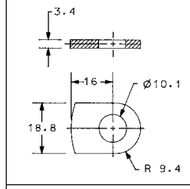

065-10006 ZINC

## A23 B23 WELDED RETAINER



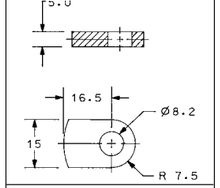

STEEL
058-00237 (BLACK PAINTED)

## A49 B49 WELDED RETAINER



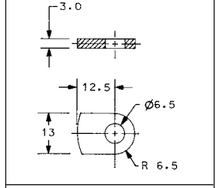

STEEL
P68-00506 (BLACK PAINTED)

## A61 B61 WELDED RETAINER



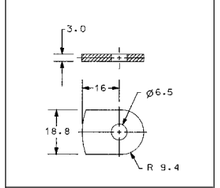

STEEL
P68-00513 (BLACK PAINTED)

## A64 B64 WELDED RETAINER




STEEL
P68-00514 (BLACK PAINTED)

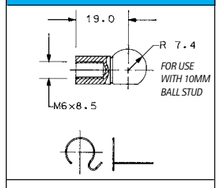
## A91 B91 WELDED RETAINER




STEEL
P68-00570 (BLACK PAINTED)

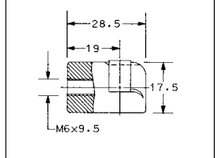
## A3A B3A BALL SOCKET
ZINC PLATED D68-00508

## A3B B3B BALL SOCKET
ZINC PLATED (BLACK) D68-00509



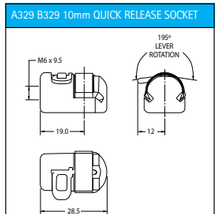

CLIP P68-00011 (ORDER SEPARATELY)

## A101 B101 10mm BALL SOCKET
PLASTIC D68-01000



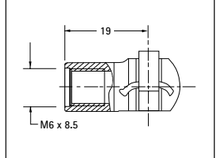

CLIP INCLUDED FOR USE WITH 10MM BALL STUD

## A329 B329 10mm QUICK RELEASE SOCKET




D68-01094 PLASTIC

## A144 B144 SOCKET

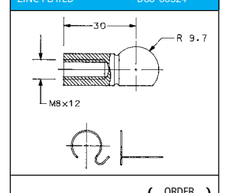



D68-01051 STEEL



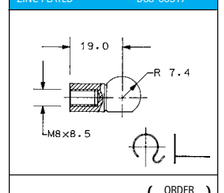
# END FITTINGS M8

## A11 B11 13MM BALL SOCKET
ZINC PLATED D68-00524



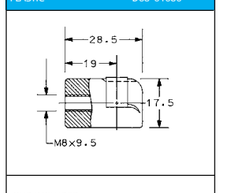

CLIP P68-00019 (ORDER SEPARATELY)

## A14A B14A 10MM BALL SOCKET
ZINC PLATED D68-00517



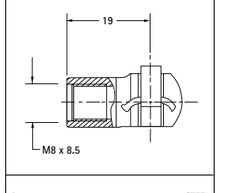

CLIP P68-00011 (ORDER SEPARATELY)

## A198 B198 10MM BALL SOCKET
PLASTIC D68-01030



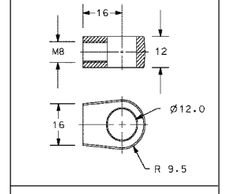

CLIP INCLUDED

## A285 B285 10MM BALL SOCKET



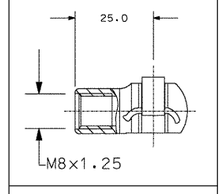

D68-01041 STEEL

## A26 B26 CLEVIS



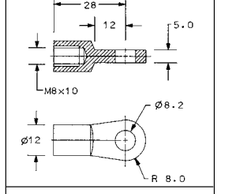

065-00029 ZINC

## A321 B321 13MM BALL SOCKET



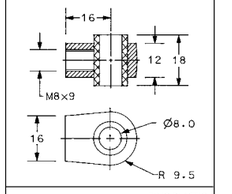

D68-01088 STEEL

## A13 B13 CLEVIS



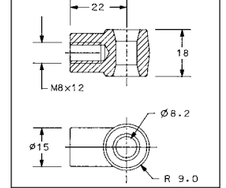

065-00071 ZINC

## A16 B16 CLEVIS



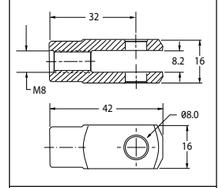

ZINC PLASTIC
D68-01006 BUSHING

## A20 B20 CLEVIS



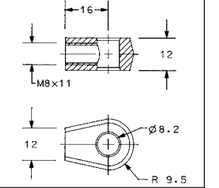

065-00191 ZINC

## A21 B21 FORK



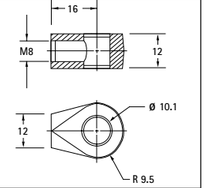

068-00124 ZINC

## A30 B30 CLEVIS



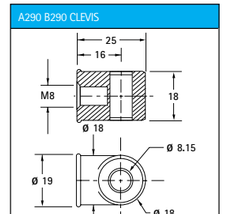

065-00155 ZINC

## A31 B31 CLEVIS



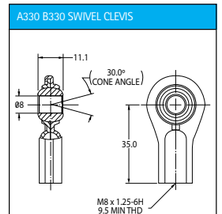

065-00145 ZINC

## A290 B290 CLEVIS



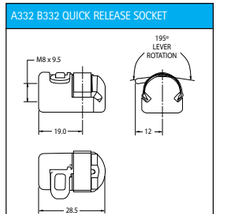

P68-00581 PLASTIC

## A330 B330 SWIVEL CLEVIS




P68-00609 ZINC

## A332 B332 QUICK RELEASE SOCKET




D68-01095 ZINC

| | TUBE DIAMETER | ROD DIAMETER | THREAD SIZE | |
|---|---|---|---|---|
| | | | TUBE | ROD |
| 16-1 | 15 mm | 6 mm | M6 x 1.0mm | M6 x 1.0mm |
| 16-2 | 19 mm | 8 mm | M6 x 1.0mm | M6 x 1.0mm |
| 16-3 | 22 mm | 8 mm | M8 x 1.25mm | M6 x 1.0mm |
| 16-4 | 22 mm | 10 mm | M8 x 1.25mm | M8 x 1.25mm |
| 16-6 | 28 mm | 14 mm | M8 x 1.25mm | M8 x 1.25mm |
| 29-4 | 22 mm | 10 mm | M8 x 1.25mm | M8 x 1.25mm |

Unless noted, all threads are Class 6G (external) and 6H (internal).

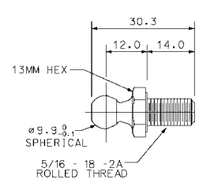
A = Fitting placed on tube end. B = Fitting placed on rod end.

- All fittings are interchangeable to either end (except some 16-3 series)
- All dimensions are nominal and are expressed in millimeters.
- Welded retainers compatable on all series.

# END FITTINGS

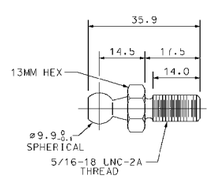
# BALL STUD & BRACKET

**10MM BALL STUD**



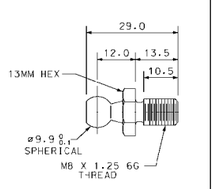

P67-00001
ZINC-PLATED STEEL

**10MM BALL STUD**



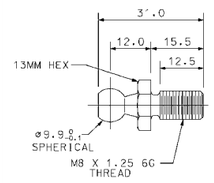

P67-00008
ZINC-PLATED STEEL

**10MM BALL STUD**



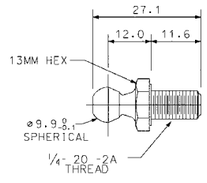

P67-00047
ZINC-PLATED STEEL (YELLOW)

**10MM BALL STUD**



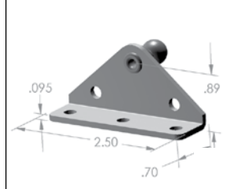

P67-00049
ZINC-PLATED STEEL (YELLOW)

**10MM BALL STUD**




P67-00118
ZINC-PLATED STEEL

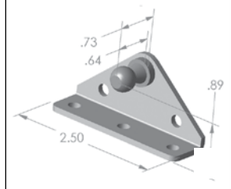
**10MM BALL BRACKET**




P67-00200
ZINC

P67-00201
BLACK E-COAT

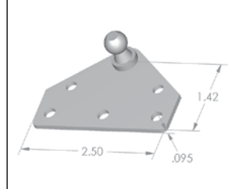
**10MM BALL BRACKET**




P67-00202
ZINC

P67-00203
BLACK E-COAT

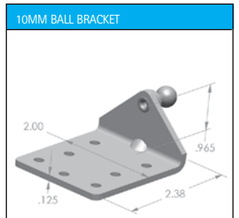
**10MM BALL BRACKET**




P67-00204
ZINC

P67-00205
BLACK E-COAT

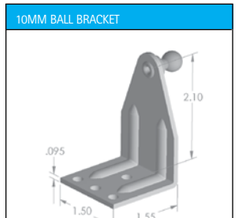
**10MM BALL BRACKET**




P67-00206
ZINC

P67-00207
BLACK E-COAT

**10MM BALL BRACKET**

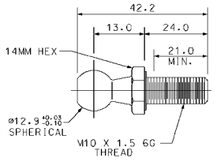



P67-00208
ZINC

P67-00209
BLACK E-COAT

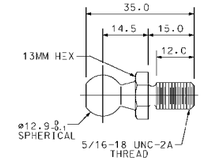
- SUSPA's 16-1, and 16-2 gas springs have M6 threads.
- SUSPA's 16-4 gas springs have M8 threads.
- Brackets not recommended for gas spring forces over 100lbs.
- Brackets mounting holes are .20"

**13MM BALL STUD**



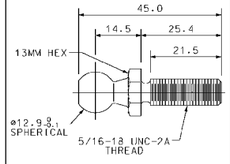

P67-00075
ZINC-PLATED STEEL (YELLOW)

**13MM BALL STUD**



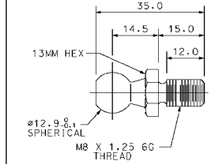

P67-00002
ZINC-PLATED STEEL

**13MM BALL STUD**




P67-00006
ZINC-PLATED STEEL

**13MM BALL STUD**




P67-00116
ZINC-PLATED STEEL (YELLOW)

# Storage, Disposal Guidelines

The proper storage of SUSPA gas springs contributes to their performance and life expectancy. This includes protecting them from moisture, spray and salt water, dirt and mechanical damage.

Horizontal or vertical storage is acceptable for up to three months. Beyond this time, gas springs should be stored vertically with the piston rod pointing downward.

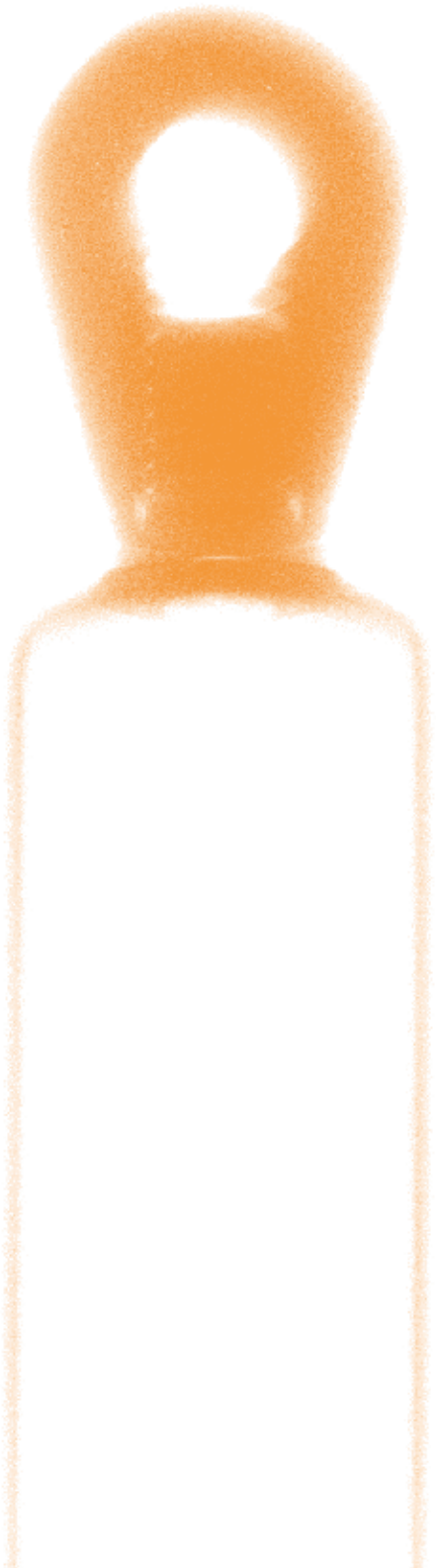
Maximum storage without actuation should be limited to six months. An increased release force at first actuation after storage is possible.

Temperatures during storage should not range beyond -10° C (14° F) to +60° C (140° F). The range may be extended during a short period (transportation), but condensation can damage the cylinders.

Optimal relative humidity is approximately 50%.

Use the original packaging from the SUSPA factory for the best storage environment.

All SUSPA gas springs are nearly 100% recyclable. They must be decompressed, with the remaining oil drained, before reprocessing.



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