



## 4x4 / LDV / SUV Air spring application

**Why use Firestone Airstroke™ Actuators**  
(rather than air or hydraulic cylinder) for Actuation?

### Low Cost

Generally, initial cost is one-half or less than conventional pneumatic or hydraulic cylinders of the same force capabilities. This initial cost advantage is many times greater in the larger sizes.

### Wide Size Range

Airstroke actuators are available in sizes ranging from 2.2 inches (56mm) to 37 inches (940mm) in diameter. The force capability is 100,000 pounds (45 Tons). Strokes of up to 14 inches (360mm) are possible.

### Durable for Long Life

Airstroke actuators are a further application of Firestone's time proven Airide springs for truck and bus suspensions. The long life and durability necessary for millions of miles of heavy duty suspension use under adverse environmental conditions are also important factors in machine design.

### No Maintenance or Lubrication required

### No Internal Rod or Piston

Airstroke actuators have no internal rod, piston, or sliding seals as do conventional cylinders. This allows for the design of Airstroke actuators into applications where dirt or grit would destroy the seals on conventional cylinders.

### Friction Free for Immediate Response

Since Airstroke actuators have no sliding seals, there is no breakaway friction as with conventional cylinders.

### Flexible Media

An Airstroke actuator can do its work with either a liquid or gas (Please see page 14 for acceptable media choices.)

### Angular Capability

An Airstroke possesses the unique capability of stroking through an arc without a clevis. Angular motion of up to 30 degrees is possible, along with the design advantage of generally less complex linkages.

### Side Loading Capability

Airstroke actuators, within certain limits, are not affected by side loads as are conventional cylinders. This misalignment capability eliminates potential rod bending, scoring, and excessive seal wear common to conventional cylinders.

### Compact Starting Height

Airstroke actuators have a low profile compared to conventional cylinders. Our smallest Airstroke actuator (2.2 inch/dia. = 56mm) collapses to just 1.1 inches in height, while our largest triple convoluted Airstroke (37 inch/dia. = 940mm) will collapse to a very compact 5.5 inches = 140mm.



## Factory Sealed and Tested

Most Airstroke actuators feature Firestone's proven concept of crimped end plates. The crimped design allows for pre shipment testing and quicker installation on equipment.

Firestone developed the air spring in the late 1930's as a more efficient spring (vibration isolator) for use in vehicle suspensions. Airide™ springs, as they were named, provided the means for a suspension to reduce the amount of road shock and vibration transmitted into the vehicle. Millions of kilometers of actual use have proven the dependability and effectiveness of the air suspension concept using Airide™ springs by Firestone. Airstroke™ actuators, Airmount™ isolators, and Airide™ springs are Firestone registered trademark names FOR ONE PRODUCT: the air spring. The use of the air spring (actuator, industrial isolator and vehicular isolator, respectively) determines which name is applied to it. All of the parts in this catalogue may be used as Airstroke actuators (except the 1X84D-1) or Airmount isolators, with two exceptions: Triple convoluted and reversible sleeve type air springs (except the 1M1A) should not be used as Airmount isolators without consulting Firestone. Individual Airstroke actuators and Airmount isolators are capable of generating a force or supporting a load of up to 450 kN and a stroke capability of up to 355 mm is possible. Included in this engineering manual are detailed operating characteristics for many of the standard Firestone air springs, along with technical details and procedures for using these products.

## Why use Firestone Airmount™ Isolators

rather than a Coil  
Spring or other type of Isolator?

### Unsurpassed Isolation Capability

Airmount isolators can provide the highest degree of isolation of any type vibration isolator. System natural frequencies as low as 1 hertz are available. The addition of an auxiliary reservoir can provide even lower system frequencies. In order to achieve similar results from a conventional coil spring isolator, a real deflection of 230 mm would be required.

### Constant Isolation Efficiency

Airmount isolators are unique in that the system's natural frequency does not change significantly with changes in load. This unique feature, combined with accurate height control, will allow the use of the same Airmount isolator at each mounting point of an unevenly loaded machine.

### Accurate Height Control

Airmount isolators provide accurate height control through regulation of internal air pressure. This feature eliminates the fatigue and permanent set found in the use of other types of vibration isolators.

### Wide Size Range

Airmount isolators are capable of isolating loads of 0.44 kN per mounting point to over 577 kN per mounting point.

### Compact Installed Height

Airmount isolators can carry the loads and provide the isolation described above at installed heights as low as 31 mm. Coil springs providing equal isolation would require a free height of 125 mm to 635 mm.



## Extended Equipment Life

Airmount isolators extend equipment life through their superior isolation capabilities.

## Effective Noise Reduction

Airmount isolators reduce structurally transmitted noise. Airmount isolators are also quiet in themselves, since there is no spring chatter as found in conventional coil springs.

## Versatile

Airmount isolators can be used not only to protect structural members from vibrating machinery, but are also widely used to protect delicate equipment from structurally transmitted vibration.

## Basic Parameters applicable to both Airstroke™ Actuators & Airmount™ Isolators

Air springs are designed for use with compressed air. Nitrogen is also acceptable. Air springs may be filled with water or waterglycol (automotive antifreeze) solutions. If water is to be used, rust inhibitors should be added to protect the end closures. Two reasons for liquid filling an air spring are:

1. To reduce the internal volume of air (and therefore, increase the natural frequency of the air spring) and,
2. To use a media which is incompressible. Accurate positioning would be one reason to do this.

Petroleum base fluids (most hydraulic oils fall into this category) are NOT RECOMMENDED. Moderately lubricated air will not harm the bellows.

## Pressure

1. 100 PSIG MAXIMUM FOR 2 PLY.
2. 175 PSIG MAXIMUM FOR HIGH STRENGTH.

We recommend that there be a minimum three times safety factor between maximum internal air pressure and burst pressure. So, as an example, if 100 psig is required, the burst should be at 300 psig or greater. For convoluted air springs, the burst pressure decreases as height increases. Therefore, the determining factors are twofold: What is the maximum height into extension and what is the internal pressure at that point? Please see the Airstroke Inflation Pressure Chart (for single, double, and triple convoluted air springs) on page 17 for specific pressure vs. height information. For AIRMOUNT applications (where the part is used at a height very close to the shaded area), it is best to stay within 100 psig maximum for a two ply, and 150 psig maximum for a four ply or high strength cord air spring.

## Temperature

1. STANDARD BELLOWS. Our standard industrial air springs should be limited to use in the range: - 35° F to + 135° F.
2. ALL NATURAL RUBBER (LOW TEMPERATURE COMPOUND).

A few of our industrial air springs are available in all natural rubber construction. This increases the acceptable cold or low end of the scale to - 65° F. The range then becomes - 65° F to +135° F.

3. EPICHLOROHYDRIN (HIGH TEMPERATURE COMPOUND).

Most convoluted parts are available in this material. The operating temperature range for it is: 0° F to 225° F. Additionally, Epichlorohydrin has very good oil resistance. ALL EPICHLOROHYDRIN APPLICATIONS MUST BE APPROVED BY FIRESTONE. For more information on Epichlorohydrin (also known as Herclor), ask for Technigram number 111.



## Contaminates

Shielding should be used to protect the bellows from exposure to hot metal, sand, petroleum base fluids, acids, etc. Please consult Firestone if you wish to know how the bellows will withstand a specific contaminant (For liquids such as acids, it is important to know both concentration and temperature).

## Storage

The best storage environment is a dark, dry area at normal room temperature.