Firestone

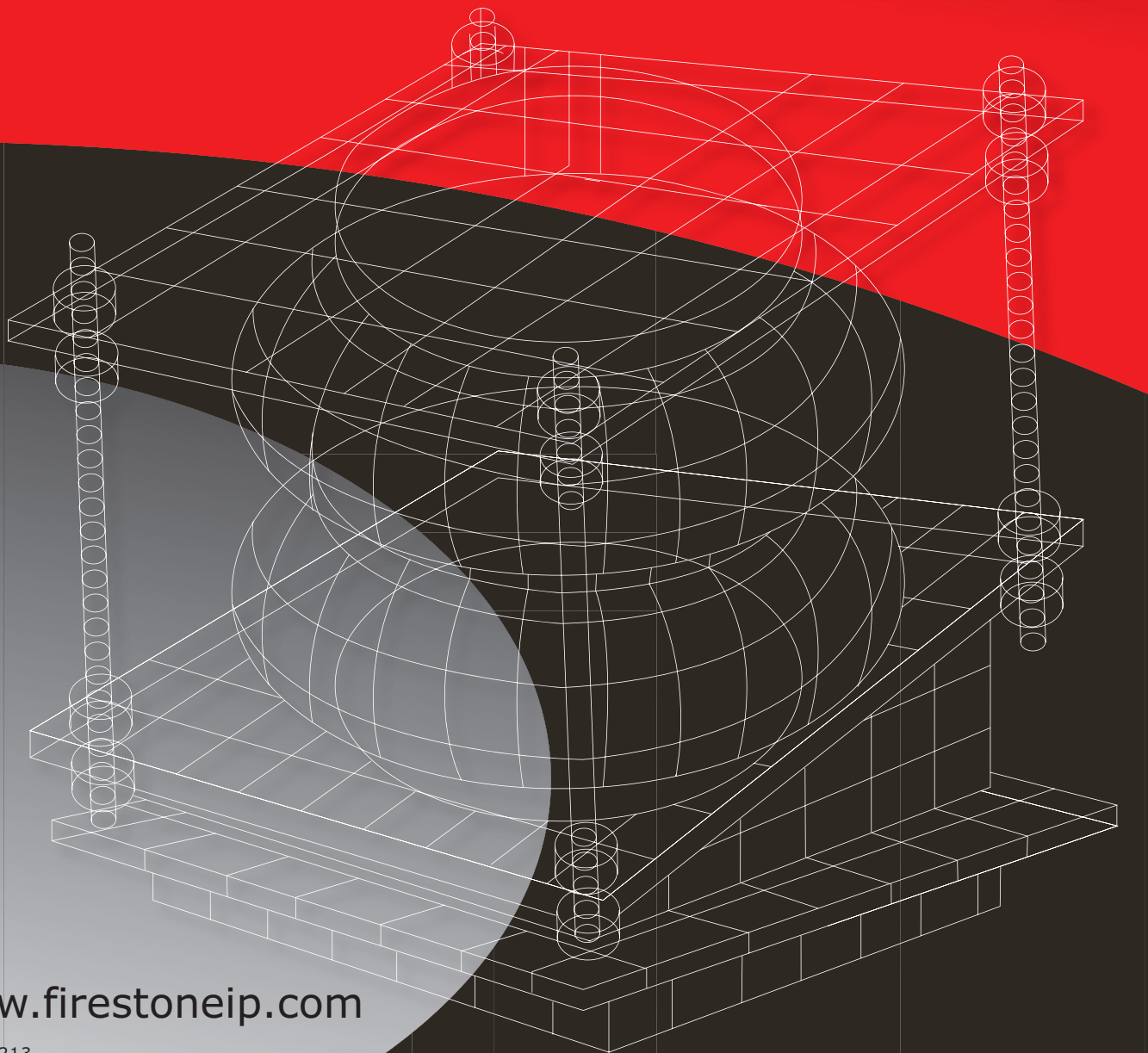
World's Number 1 Air Spring.

FIRESTONE INDUSTRIAL PRODUCTS COMPANY

AIRSTROKE™ ACTUATORS

AIRMOUNT™ ISOLATORS

Engineering Manual & Design Guide



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INTRODUCTION

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 miles 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 2M1A) or Airmount isolators, with two exceptions: Triple convoluted and reversible sleeve type air springs (except the 1M1A-0) should not be used as Airmount isolators without consulting Firestone.

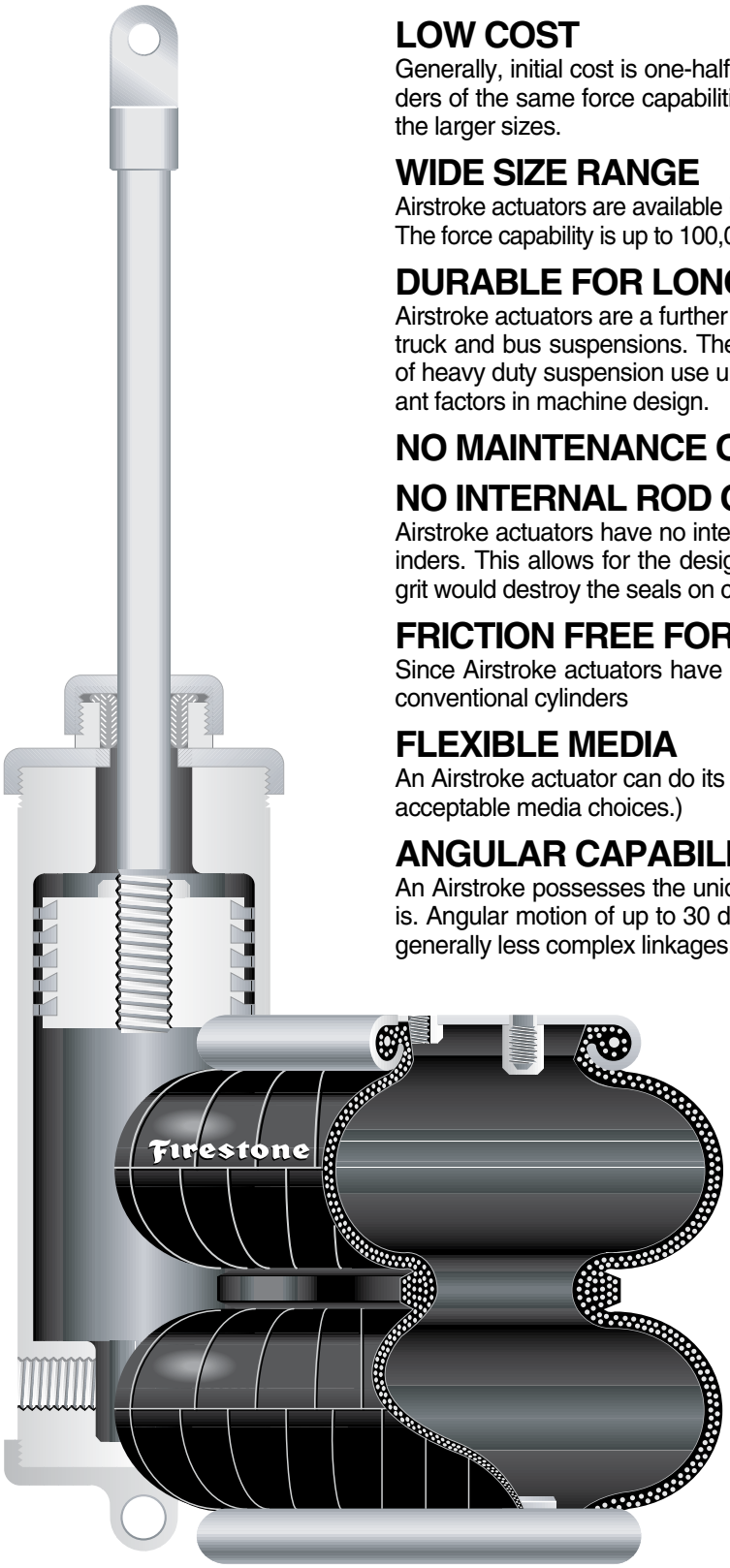
Individual Airstroke actuators and Airmount isolators are capable of generating a force or supporting a load of up to 100,000 pounds, and a stroke capability of up to 14 inches is possible. Included in this engineering manual are detailed operating characteristics for many of the standard Firestone air springs, along with technical details and procedures for using these products.

PLEASE NOTE:

The information contained in this publication is intended to provide a general guide to the characteristics and applications of these products. The material, herein, was developed through engineering design and development, testing and actual applications and is believed to be reliable and accurate. Firestone, however, makes no warranty, expressed or implied, of this information. Anyone making use of this material does so at his own risk and assumes all liability resulting from such use. It is suggested that competent professional assistance be employed for specific applications.

ADVANTAGES OF FIRESTONE AIRSTROKE™ ACTUATORS

Why use an Airstroke actuator (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 to 37 inches in diameter. The force capability is up to 100,000 pounds. Strokes of up to 14 inches 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.) collapses to just 1.1 inches in height, while our largest triple convoluted Airstroke (37 inch/dia.) will collapse to a very compact 5.5 inches.

FACTORY SEALED AND TESTED

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

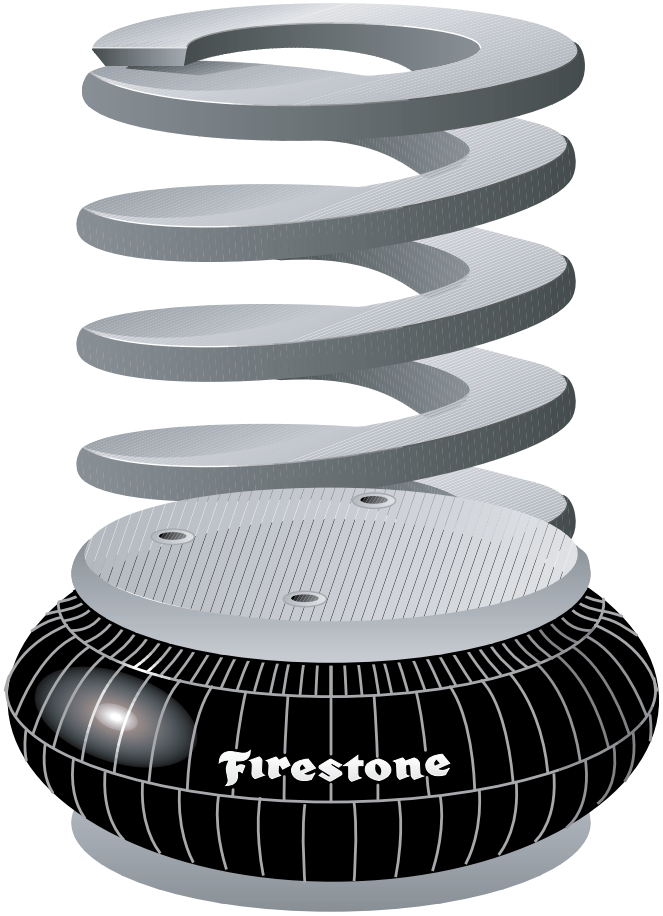
PLEASE REFER TO PAGE 15 FOR A THOROUGH DISCUSSION OF ACTUATION.

ADVANTAGES OF FIRESTONE AIRMOUNT™ ISOLATORS

Why use an Airmount isolator 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 60 cycles per minute (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 9 inches 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 100 pounds per mounting point to over 100,000 pounds per mounting point.

COMPACT INSTALLED HEIGHT

Airmount isolators can carry the loads and provide the isolation described above at installed heights as low as 2.5 inches. Coil springs providing equal isolation would require a free height of 5 to 25 inches.

EXTENDED EQUIPMENT LIFE

Airmount isolators extend equipment life through their superior isolation capabilities.

EFFECTIVE NOISE REDUCTION

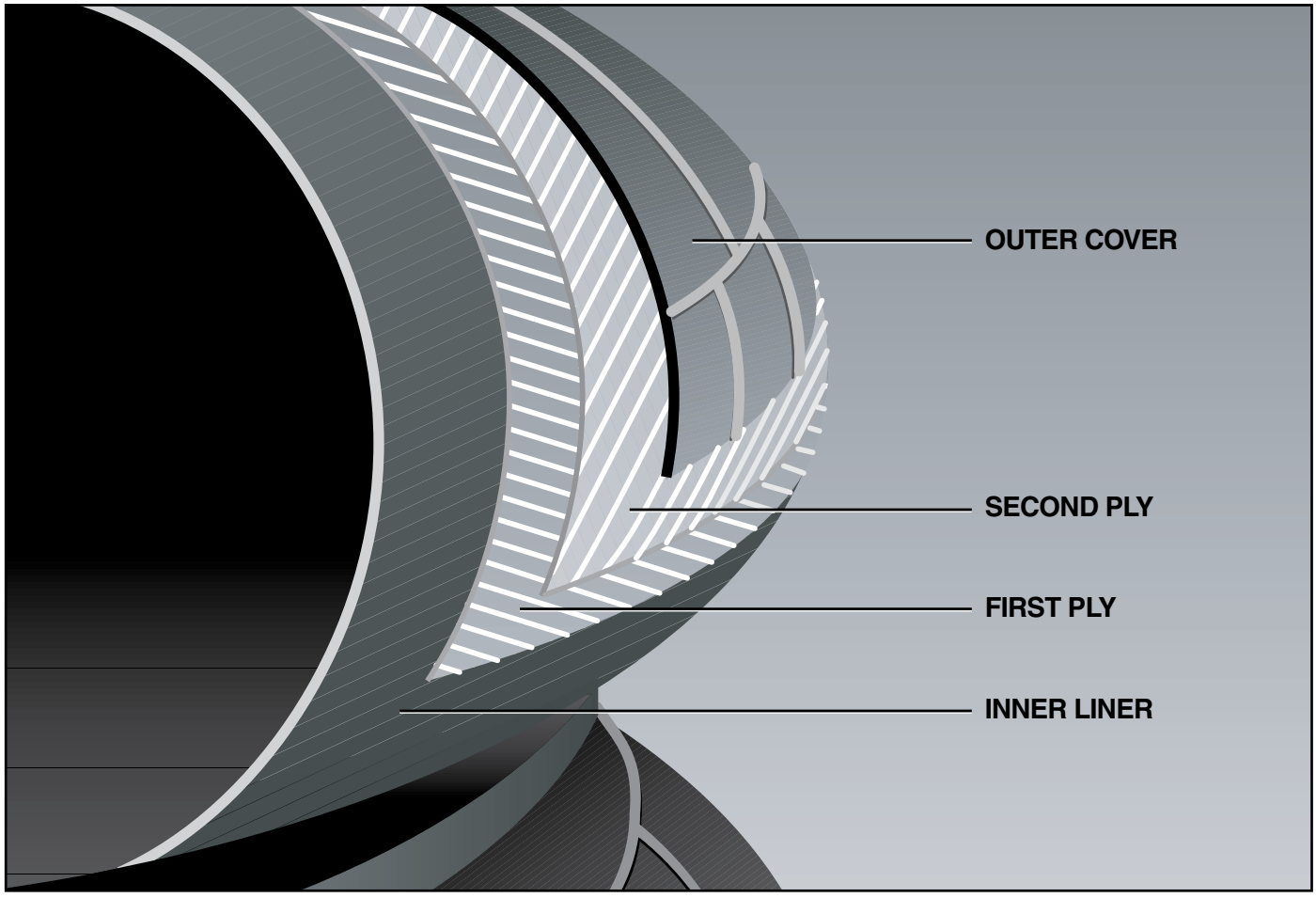
Airmount isolators reduce structurally transmitted noise. Airmount isolators are also quiet in themselves, since there is no spring chatter as found in conventional coil springs.

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.

PLEASE REFER TO PAGE 21 FOR A THOROUGH DISCUSSION OF VIBRATION ISOLATION.

AIR SPRING BELLOWS CONSTRUCTION



An air spring is a carefully designed rubber/fabric bellows which contains a column of compressed air. The rubber bellows itself does not provide force or support load. This is done by the column of air.

Firestone air springs are highly engineered elastomeric bellows with specially designed metal end closures. Our standard two ply air spring bellows is actually made up of four layers:

a. An inner liner of calendered rubber.

b. One ply of fabric reinforced rubber.

c. A second ply of fabric-reinforced rubber (with the cords at a specific bias angle to the first ply).

d. An outer cover of calendered rubber.

Many of our air springs are also available in high strength construction for higher pressures (see page 14 for more detailed information). In this case, there are four plies of fabric-reinforced rubber, with an inner liner and outer cover.

The two ply air spring is standard. Where high strength construction is available, it is so noted in the selection guide (page 32), on the individual Data sheets, and in the index (page 109). If the high strength style number is omitted, then it is not currently available in that particular part.

Each air spring bellows is identified by a style number. This style number is molded into the bellows during the curing (or vulcanization) process. Examples would be 16, 22, 313, 1T15M-6, etc... This identifies *only* the rubber/fabric bellows and *not the complete assembly*. There are several different end closure options available for most air springs; therefore, please always specify both the style number and the complete **assembly order number (AON)**. An example would be: Style #22, assembly order number W01-358-7180. Both numbers are given on the individual data sheets.

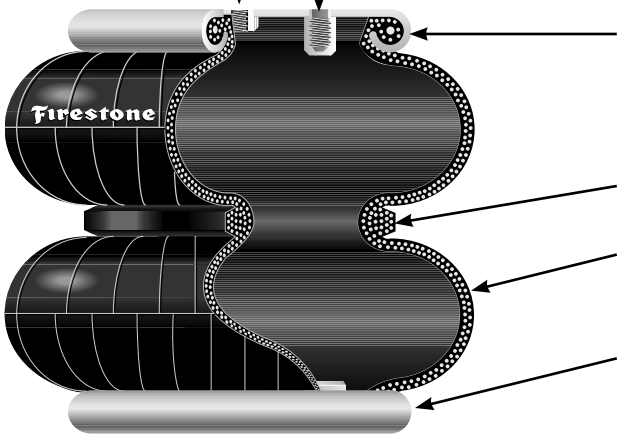
END CLOSURE OPTIONS

Each individual air spring data sheet shows a cross sectional view of the most popular end closure option for that part. For convoluted air springs 16 inches in diameter and less, and for the reversible sleeve air springs, *the Crimped Bead Plate attachment is shown.* For convoluted air springs 17 inches in diameter and larger, *a Bead Ring attachment is shown*. An air spring of each variety, with proper terminology for each, is shown on the following pages.

CRIMPED BEAD PLATES

CONVOLUTED AIR SPRINGS

(#22 is shown)



AIR INLET
1/4" NPT is standard. 3/4" NPT is also available for most parts. (See the data sheet order block on each specific part).

BLIND NUT
3/8-16 UNC thread x 5/8" deep (two or four per each plate depending on part size). Used for mounting the part.

UPPER BEAD PLATE
(9 gauge carbon steel, .149"). Permanently crimped to bellows to form an airtight assembly which allows for leak testing before the unit leaves the factory. Zinc/chromate plated for rust protection.

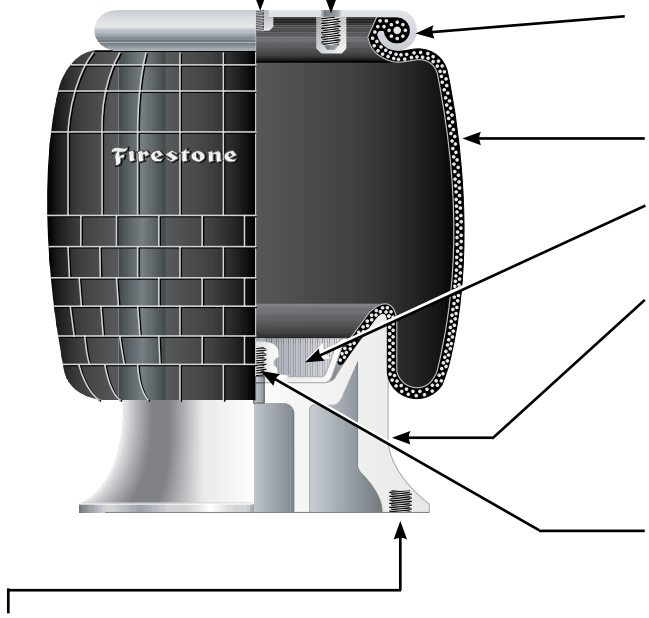
GIRDLE HOOP
Wire wound type shown, molded into the bellows.

BELLOWS
Wall gauge is approximately 1/4". See page 5 for detailed information.

LOWER BEAD PLATE
Usually the same as upper bead plate, except without air inlet.

REVERSIBLE SLEEVE AIR SPRINGS

(1T15M-6 is shown)



AIR INLET 1/4" NPT is standard. 3/4" NPT is also available for most parts. (See the data sheet order block on each specific part).

BLIND NUT 3/8-16 UNC thread x 5/8" deep (two or four per each plate depending on part size). Used for mounting the part.

BEAD PLATE (9 gauge carbon steel, .149"). Permanently crimped to bellows to form an airtight assembly which allows for leak testing before the unit leaves the factory. Zinc/chromate plated for rust protection.

BELLOWS Wall gauge is approximately 1/4". See page 5 for detailed information.

BELLOWS END CLOSURE—(steel) Permanently molded into the bellows (Except for styles 1T19L-7, 1T19L-11).

PISTON May be made of aluminum, steel, plastic or hard rubber. Held to the bellows by a bolt which screws into the bumper stud. For mounting, a long bolt may be used coming up through the mounting surface. Or, a short bolt may be used to attach the piston to the lower end closure and then use the threaded holes in the piston to secure the assembly to the mounting surface. (A piston long bolt is usually not included).

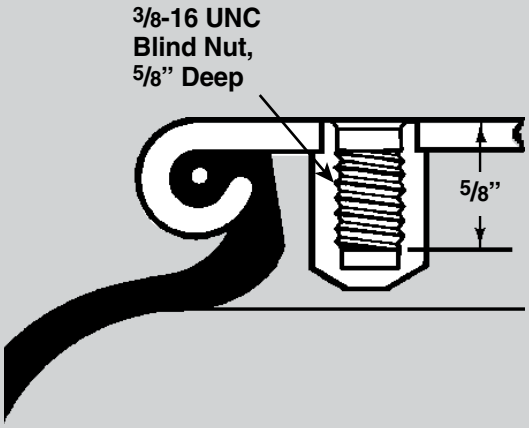
BUMPER STUD A permanent part of the bellows end closure (and bellows). It has two functions:

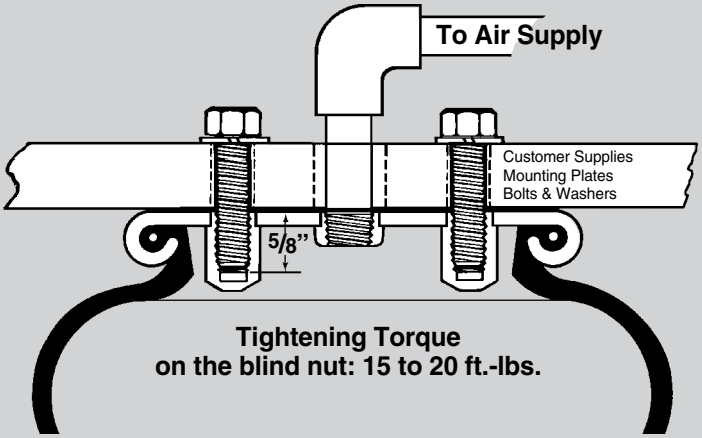
1. The optional rubber bumper snaps over the outside.
2. The inside is a threaded hole (see data sheets for thread dimension and depth) used to secure the piston to the bellows.

THREADED HOLE May be used for attachment to mounting surface. Not included in some pistons (See individual data sheets for specific part configuration.)

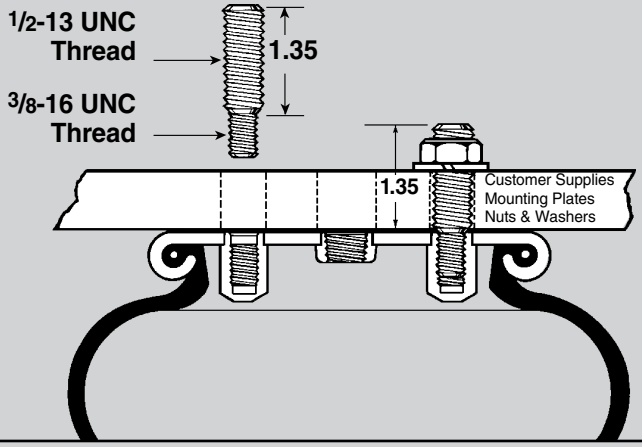
CRIMPED BEAD PLATE MOUNTING HARDWARE

CRIMPED BEAD PLATE AIR SPRINGS Use the blind nuts for attachment. This is accomplished by bringing bolts (two or four depending upon air spring size) through the customer supplied mounting plate and tightening into the blind nut. If this bolt is too long, it may fracture the bottom out of the blind nut.





STUD ADAPTER

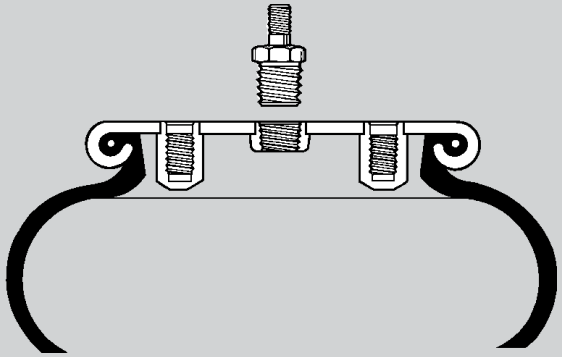


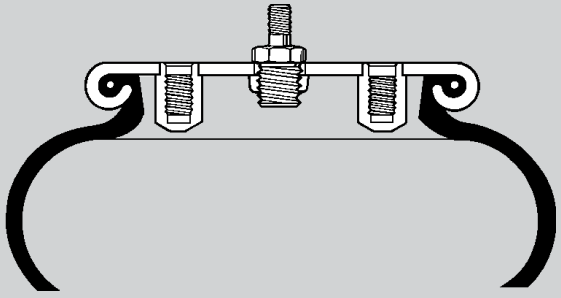
If a protruding bolt rather than a blind nut is preferred to attach the air spring, a STUD ADAPTER is available from Firestone:

Description	Order No.
Imperial Stud Adapter	WC1-358-0361
Metric Stud Adapter	WC1-358-0369

TANK VALVE One method for inflating air springs (primarily used in Airmount isolator applications) is with a tank valve: An air hose chuck is used (as inflating a tire with an air line). Care must be taken to periodically check the pressure within the air spring, because air will slowly permeate through the rubber/fabric bellows (See page 25).

Description	Order No.
Tank Valve	WC1-358-0009
Metric Tank Valve	WC1-M58-3889



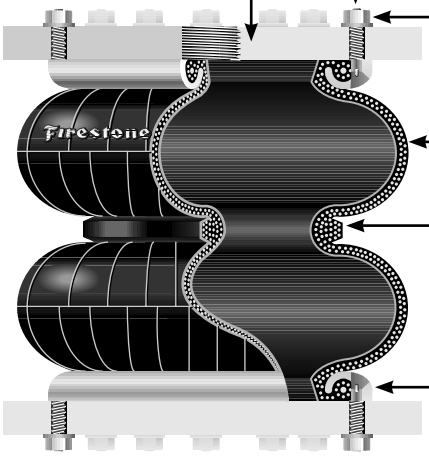


END CLOSURE OPTIONS

STEEL BEAD RINGS

CONVOLUTED AIR SPRINGS

(#22 is shown, with bead rings instead of crimped bead plates)



MOUNTING PLATE *is not included*. See page 10 for material, machining recommendations, and installation instructions.

BEAD RING BOLT May be one of three varieties. See page 10. Also refer to the data sheet order block on each individual part for bolt lengths.

NUTS AND LOCKWASHERS *are included* with the part. (Except for socket head type bead rings).

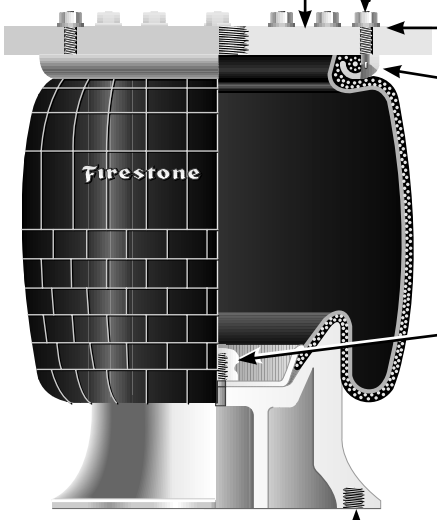
BELLOWS Wall gauge is approximately 1/4". See page 5 for detailed information.

GIRDLE HOOP Wire wound type shown, molded into the bellows.

BEAD RING, upper and lower. Countersunk steel type shown. See page 10. Also refer to the data sheet order block on each part for type and material. See the selection guide on page 32 for bolt circle diameter and number of bolts (each ring).

REVERSIBLE SLEEVE AIR SPRINGS

(1T15M-6 is shown, with a bead ring instead of a crimped bead plate)



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BEAD RING BOLT May be one of three varieties. See below. Also refer to the data sheet order block on each individual part for bolt lengths.

NUTS AND LOCKWASHERS *are included* with the part. (Except for socket head type bead rings).

BEAD RING Countersunk steel type shown. See the selection guide on page 32 for bolt circle diameter and number of bolts (each ring).

BUMPER STUD A permanent part of the bellows end closure (and bellows). It has two functions:

1. The optional rubber bumper snaps over the outside (of it).
2. The inside is a threaded hole (see data sheets for thread dimension and depth) used to secure the piston to the bellows.

THREADED HOLE May be used for attachment to mounting surface. Not included in some pistons (See individual data sheets for specific part configuration.)

END CLOSURE OPTIONS

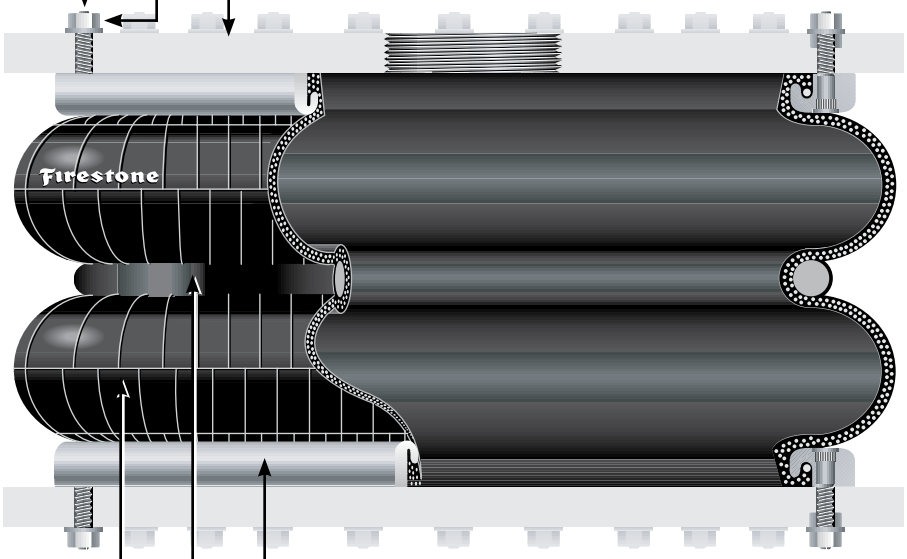
LARGE PARTS WITH ALUMINUM BEAD RINGS

All of the parts that are shown with crimped bead plates are also available with bead rings. (Bead plates are not suitable for some applications.) Typical examples of where bead rings are often used follow:

1. Where parts are stacked to increase stroke (See page 16).
2. Where the air spring is being used as a boot or flexible connector (See page 29).
3. When used as an Airmount isolator with an auxiliary reservoir (See page 24).
4. When air must move in or out of the unit at an extremely fast rate (and a 3/4" NPT air inlet is too small).
5. When used with an internal shaft, to either guide the part or to pull (rather than push) a load.

CONVOLUTED AIR SPRINGS

(#203 is shown)



BEAD RING BOLT May be one of three varieties. See page 10. Also refer to the data sheet order block on each individual part for bolt lengths.

NUTS AND LOCKWASHERS are included with the part. (Except for socket head type bead rings).

MOUNTING PLATE is not included. See page 10 for material, machining recommendations, and installation instructions.

BEAD RING, upper and lower. (Aluminum)

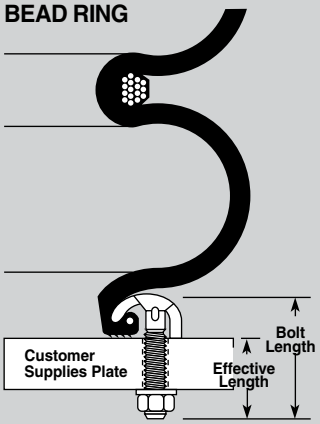
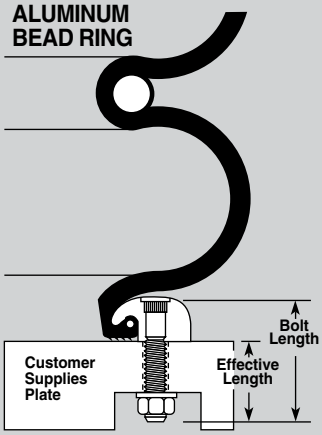
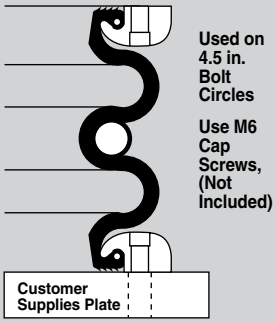
GIRDLE HOOP Solid steel type shown, molded into the bellows.

BELLOWS Wall gauge is approximately 1/4". See page 5 for detailed information.

For more Information Ask your Firestone Rep for Technigram 103.

END CLOSURE OPTIONS

THE THREE TYPES OF BEAD RINGS

COUNTERSUNK STEEL BEAD RING	RIBBED NECK ALUMINUM BEAD RING	SOCKET HEAD ALUMINUM BEAD RING*
		 Optional Shorter Length Ribbed Neck Bolt
Standard Bolt Length (in.) 1 3/4	**Standard Bolt Length (in.)** 1 7/8	
Standard Effective Length (in.) 1.22	**Standard Effective Length (in.)** 1.28	
Standard Order Number (bolt only) WC1-358-3625	**Standard Order Number (bolt only)** WC1-358-3620	
Thread 5/16-24 UNF	**Thread** 3/8-24 UNF	
Tightening Torque (ft.-lbs.) 17 to 22	**Tightening Torque (ft.-lbs.)** 28 to 32	

More bolt sizes available. Ask your Firestone Rep for availability.

BEAD RINGS CONTINUED

PLATE MACHINING REQUIREMENTS

When using bead rings, THE CUSTOMER WILL NEED TO FABRICATE HIS OWN MOUNTING PLATES. Hot or cold rolled steel provides satisfactory mounting surfaces, with specific finishes of 250 microns, if machined in a circular fashion, and 32 microns when ground. The thickness of mounting plates depends upon the application. The plates must be strong enough and backed by structural members to prevent bowing (of the plates) when subjected to the forces or loads involved. The rubber bellows provides its own seal; therefore, 'O' rings or other sealants are not needed when installing the part.

INSTALLATION

Follow this technique for assembling a bead ring style bellows to the mounting plate:

a. Insert the bolts into the bead ring (the bead rings have been previously attached to the bellows at the factory). The bolts will be pulled into place by the action of tightening the nuts.

b. Slip all of the bolts (which are protruding through the bead ring) into the mating holes of the mounting plate and attach the lockwashers and nuts. FINGER TIGHTEN all nuts to produce a uniform gap between the bead ring and mounting plate all the way around.

c. At this point, make certain that the bellows bead is properly seated under the bead ring.

PLEASE NOTE THAT UNIFORM SUCCESSIVE TIGHTENING OF THE NUTS IS IMPORTANT TO SEAT THE RUBBER BEAD PROPERLY TO THE MOUNTING PLATE FOR ITS FULL CIRCUMFERENCE.

Continue with the following sequence:

d. Tighten all nuts one turn each, moving around the circle until continuous contact is made between the bead ring and mounting plate.

e. Torque all nuts to the torque specifications shown on the page, going at least two complete turns around the bolt circle.

MATERIAL

Bead rings are supplied in either steel or aluminum. Both the bead ring material and type of ring are called out in the description section of the order block on each individual data page. Also, the bolt length (for the bolts supplied with that particular order number) is given.

WHERE A BEAD PLATE PART IS SHOWN AND THE BEAD RING ATTACHMENT IS PREFERRED, PLEASE REFER TO THE SELECTION GUIDE ON PAGE 32 FOR BOLT CIRCLE DIAMETERS AND NUMBER OF BOLTS (EACH RING).

*Available only on style #16, #268, and #267-1.5

END CLOSURE OPTIONS

LARGE PARTS WITH ROLLED PLATES

LARGE CONVOLUTED AIR SPRINGS

(#203 is shown, with rolled plates instead of bead rings)

The convoluted parts, with 17, 20, and 22 inch diameter, are shown with bead rings as standard. We have developed a method for permanently attaching plates to these larger sized Airstrokes (called rolled plate assembly). These parts may be an advantage over the bead ring parts in some cases, because installation is much easier (they attach the same way as the bead plate parts). When installing the rolled plate parts, a backup plate as large in diameter as the bead plate must be used. This plate should be a minimum of 1/2 inch thick.

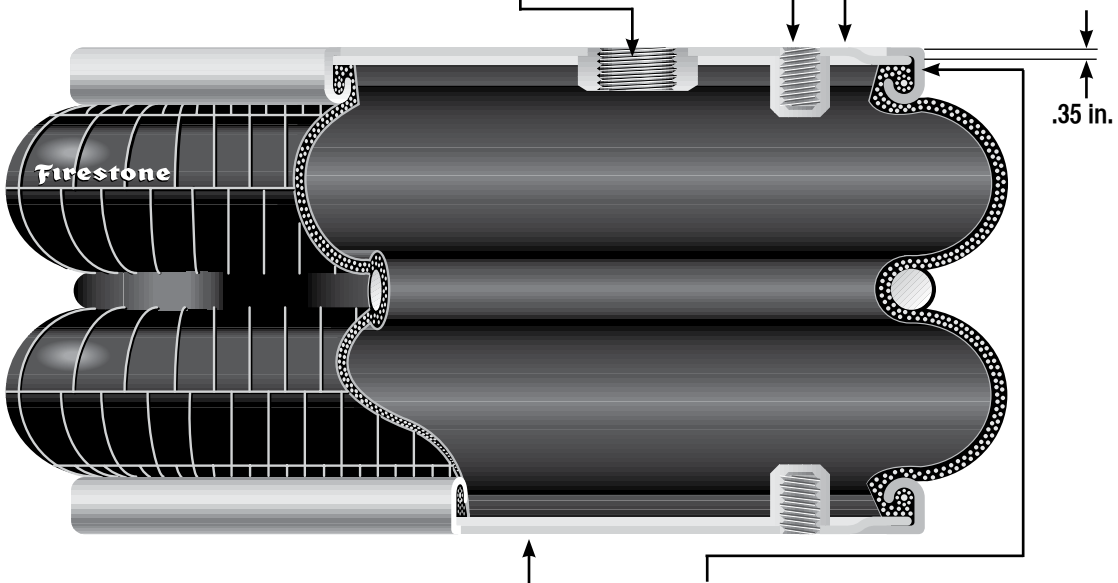
Again, for the blind nut and air entrance locations of rolled plate parts (bead rings are shown as standard on the data pages), please refer to the selection guide on page 32. The static data chart on each individual part may be used for the rolled plate version; but, two modifications must be made:

1. Increase the minimum height by .70 inch.
2. Add .70 inch to the height (bottom axis) before reading loads.

AIR INLET 3/4 NPT is standard. See the selection guide on page 32 for location (type 5). A centered 2" NPT air inlet is also available for some rolled plate parts. (Consult Firestone).

BLIND NUT 1/2-13 UNC thread x 3/4" deep (four each plate). Used for mounting the part. A stud adapter for this size blind nut is not available.

UPPER BEAD PLATE (6 gauge carbon steel, .149"). Permanently crimped to bellows to form an airtight assembly. Allows for leak testing before the unit leaves the factory. Zinc/chromate plated for rust protection.



CLAMP RING This ring is crimped up under the bellows bead to permanently attach the bead plate to the bellows. It is also zinc/chromate plated for rust protection.

LOWER BEAD PLATE Usually the same as upper bead plate, except without air inlet. See the selection guide on page 32 for diameter (type 5).

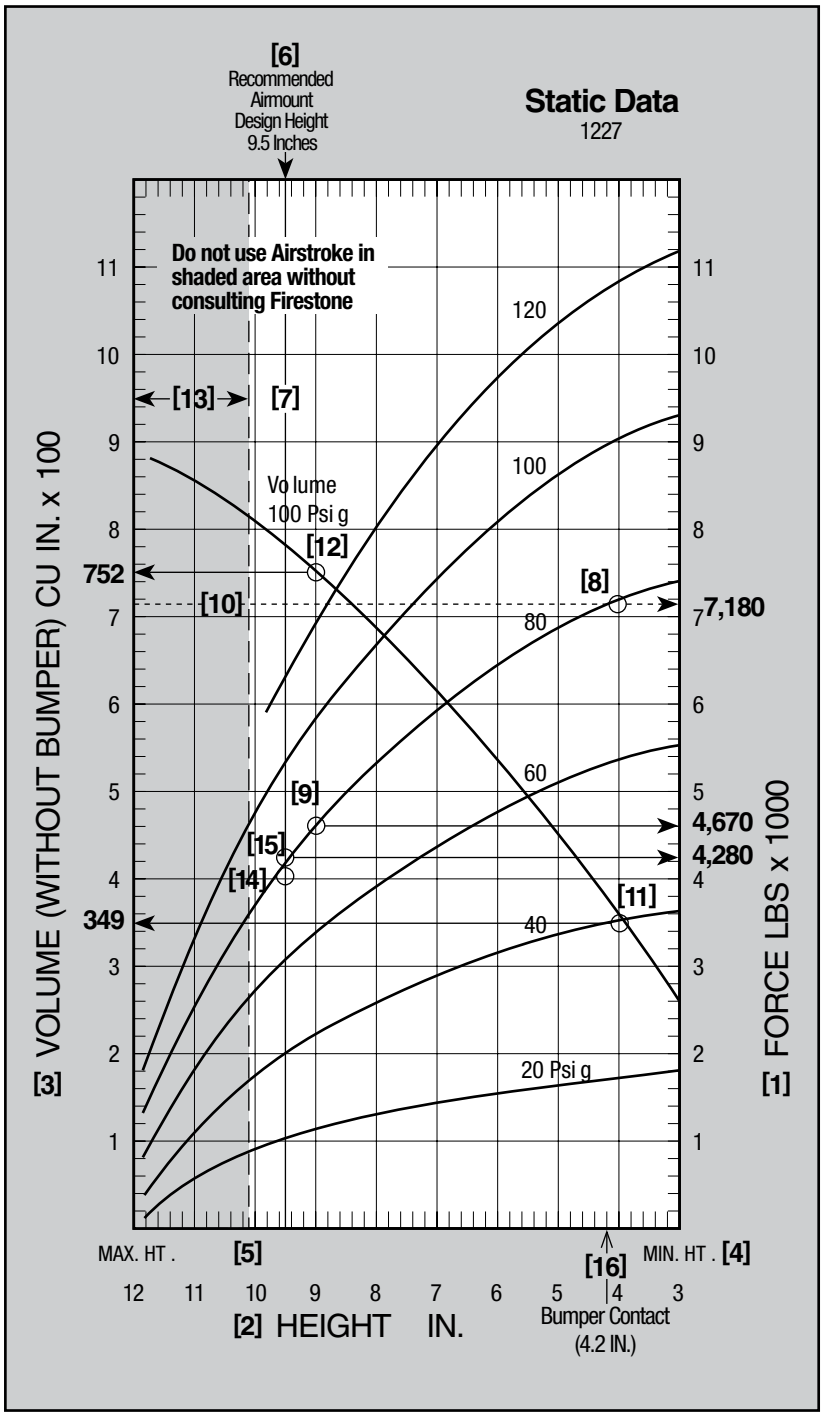
HOW TO USE THE STATIC DATA CHART

We also refer to this chart as the load/deflection (L/D) curve for an air spring. The force **[1]** is given on the right hand axis vs. the air spring height **[2]** as shown along the bottom axis; thus, load vs. deflection. The internal volume **[3]** is also given along the left hand axis, again vs. height **[2]**. It is called static data because the air spring is in a static, or non-moving, constant pressure condition. In almost all cases the static curves were run using a two ply bellows; however, *where a four ply bellows is available, use the two ply chart for it also.*

AIRSTROKE ACTUATION

The important considerations are minimum height **[4]** (3.0 inches) and maximum recommended height **[5]** (10.1 inches). Subtracting one from the other gives the stroke potential for this part (10.1 – 3.0 = 7.1 inches). As an actuator, the entire stroke may be used, *or any potion thereof. Ignore recommended airmount design height* [6] *and the corresponding darkened line* [7]. This height is important in using the air spring as an isolator (AIRMOUNT). It has nothing to do with the concern here of actuation. To determine the force at any given height, simply move up the height line to where it intersects any of the static pressure curves. Then move to the right and read from the force scale **[1]**.

EXAMPLE: At 80 psig, what is the force using a #22 from 4.0 to 9.0 inches, or 9.0 – 4.0 = 5.0 inch stroke? See **[8]** for force at 4.0 inches (7,180 #) and **[9]** for force at 9.0 inches (4,670 #). This example illustrates the primary difference between Firestone Airstrokes and conventional air cylinders. Air cylinders have a constant area for the pressure to work against, or constant effective area. *the effective area and force of an air spring changes as the height changes.(There is one exception: notice the plateau section of reversible sleeve 1T type curves.)*



In the example the effective area of a #22, at 4.0 inches using the 80 psi curve, is:

$$\frac{7{,}180 \text{ lbs.}}{80 \text{ lbs/in}^2} = 89.8 \text{ in}^2$$

at 9.0 inches in height it is:

$$\frac{4{,}670 \text{ lbs.}}{80 \text{ lbs/in}^2} = 58.4 \text{ in}^2$$

An air cylinder with 89.8 in^2 of area would have an 80 psi curve as shown by dotted line **[**10**]**.

The volume curve **[**3**]** may also be of importance:

a. If one needs to know the amount of free air (then compressed by the compressor) to perform a desired operation.

b. If the actuation must be completed quickly and calculations of flow through the air inlet (orifice) are required.

In each case above, the change in internal volume is required. Read up from the two heights involved to the intersecting point with the volume curve. Then move to the left and read from the volume scale. In the example at 4.0 a #22 (notice most volume curves are at 100 psig) has an internal volume of 349 in^3 **[**11**]** and at 9.0 the volume is 752 in^3 **[**12**]**. The change in volume is then 752 in^3 – 349 in^3, or 403 in^3. The volume at minimum height (349 in^3) would not be subtracted if exhausting the air spring to atmospheric pressure.

Notice the shaded area **[**13**]**. We do not recommend that an air spring be used at heights extending into this section. The "beginning of the shaded area" for a #22 is at 101 inches **[**5**]**.

SEE PAGE 15 FOR A MORE DETAILED DISCUSSION OF ACTUATION.

AIRMOUNT ISOLATION

Because of lateral stability considerations (see page 23 for more details) we recommend that each air spring be used at a *specific height* when used as an *isolator*. This specific height is called the "Airmount design height" **[**6**]**. The vertical line running through this height **[**7**]** is darkened so that it is easy to see where it intersects the static curves for load readings.

EXAMPLE: Support a 4,100 pound load with an air spring. Would a #22 be appropriate, and if so, at what height? The height isn't much of a problem, as this part SHOULD BE USED AT 9.5 INCHES. Simply move up the darkened line to where it intersects 4,100 lbs **[**14**]**. That point falls between the 80 and 60 psig curves. Exactly what pressure would be required? Use the formula:

$$\text{Effective Area} = \frac{\text{Load (lbs.)}}{\text{Pressure (lbs/in}^2\text{)}}$$

Determine the effective area at 9.5 inches (using the 80 psig curve, since 80 psig would be closer to our exact pressure than 60 psig), or:

$$\text{Effective Area} = \frac{4{,}280 \text{ lbs. } \textbf{[15]}}{80 \text{ lbs/in}^2} = 53.5 \text{ in}_2$$

Then divide the actual load by the effective area:

$$\frac{4{,}100 \text{ lbs.}}{53.5 \text{ in}^2} = 76.6 \text{ PSIG}$$

The pressure required to support 4,100 lbs. with a #22 at a design height of 9.5 inches is therefore 76.6 PSIG.

Please note that the static data can be converted to dynamic data (the air spring is in motion) by applying the formulas that are presented in the Airmount isolation section on page 22.

SEE PAGE 21 FOR A MORE DETAILED DISCUSSION OF VIBRATION ISOLATION.

INTERNAL RUBBER BUMPERS

Some parts are available with internal rubber bumpers. Where a bumper is available, it is shown as a dotted line in the cross sectional view of the air spring. Additionally, please note that:

1. the minimum height is increased to the "bumper contact" point **[**16**]** (this reduces the total available stroke somewhat, by 4.2 – 3.0 = 12 inches in our #22 example), and

2. the order block contains the proper ordering numbers for parts with bumpers.

BASIC PARAMETERS APPLICABLE TO BOTH AIRSTROKE™ ACTUATORS AND AIRMOUNT™ ISOLATORS

MEDIA

Air springs are designed for use with compressed air. Nitrogen is also acceptable. Air springs may be filled with water or water-glycol (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.

STORAGE

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

TEMPERATURE

1. **STANDARD ALL NATURAL RUBBER BELLOWS (LOW TEMPERATURE COMPOUND).** Our standard industrial air springs should be limited to use in the range:

   -65° F to +135° F

2. **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.

3. **NEOPRENE (HIGH TEMPERATURE COMPOUND).** Neoprene is more resistant to damage from oil. For this reason, Firestone Neoprene has been used as the inside layer in two configurations to reduce the hazard of having oil in the pneumatic plumbing system. The third configuration includes an outer layer of Firestone Neoprene for applications that expose the exterior of the air spring to an oil environment. In addition, Firestone Neoprene is able to withstand higher temperatures than natural rubber:

   -35° to +165° F

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).

WARNING

DO NOT INFLATE ASSEMBLY WHEN IT IS UNRESTRICTED. ASSEMBLY MUST BE RESTRICTED BY SUSPENSION OR OTHER ADEQUATE STRUCTURE. DO NOT INFLATE BEYOND PRESSURES RECOMMENDED IN DESIGN LITERATURE (CONTACT FIRESTONE FOR INFORMATION). IMPROPER USE OR OVERINFLATION MAY CAUSE ASSEMBLY TO BURST CAUSING PROPERTY DAMAGE OR SEVERE PERSONAL INJURY.

AIRSTROKE ACTUATION

SELECTION

1. Refer to the selection guide on page 32 for Airstroke force and stroke capabilities. After your list of possibilities has been reduced to one or two air springs, then turn to the individual data page for more detailed information on those parts.

2. STROKE: The maximum STROKE CAPABILITY is the difference between the height corresponding to the "start of the shaded area" minus the minimum height. This entire stroke, *or any portion thereof*, may be used. If an internal rubber bumper is required, please note that the minimum height is increased, and therefore, the total stroke is decreased.

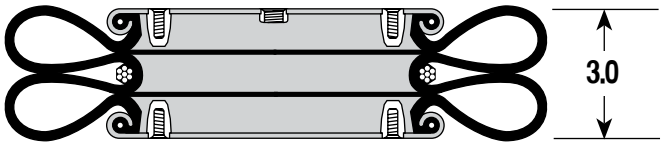
3. FORCE: Read the forces directly from the static data chart, or, use the force table located under the chart. Notice that the force generally decreases as height increases. This feature is discussed in detail on page 12 in the section entitled "How to Use the Static Data Chart."

4. SELECT THE END CLOSURES AND AIR INLET SIZE: Most Airstroke actuators are available with permanently attached plates or bead ring attachments. If an alternate end closure option is available, it is so stated under the cross sectional view of the part. Please refer to page 6 for a detailed discussion of end closure options.

DOWN AND UP STOPS

Positive stops in both directions (compression and extension) should always be used with Airstroke actuators .

1. In COMPRESSION, the minimum height shown for each air spring is at, or slightly above the PINCH POINT of the bellows. Here is a #22 shown in the collapsed or "pinch point" condition:



The bellows can be damaged if allowed to constantly bottom out as shown above; therefore, a downstop is required to prevent this. An external downstop can be something as simple as a steel block and should be sized at or slightly greater than the minimum height of the Airstroke. In our #22 example, the block would need to be at least 3.0 inches high. If an external downstop cannot be used, many parts are available with internal rubber bumpers (shown as a dotted line in the cross-sectional view of the air spring where available).

2. In EXTENSION, an upstop is required to prevent the air spring from overextending at heights into the shaded area of the graph. The reasons for this are twofold: **a)** the life of the bellows may be reduced and **b)** the crimp may open up, allowing the bellows bead to blow out of the metal end closure. There are many ways to design-in an upstop, including

a. a chain,

b. a cable,

c. contacting a metal stop, etc.

RETURN

An Airstroke actuator is a *single acting* device. To return the Airstroke to its minimum height (for another cycle or stroke), some return force must be used. Gravity acting on the load may be all that's required. The force to collapse the convoluted type Airstrokes to minimum height is given in the order block section for each part. If the load is not sufficient, then a second Airstroke or coil spring may be required.

GUIDING

An Airstroke follows the path of least resistance; therefore, the actuator should be guided in most instances. This is often easily accomplished in the mounting geometry.

ANGULAR CAPABILITY

An Airstroke actuator can stroke through an arc (without a clevis). Angular motion of up to 30 degrees is possible. When using an actuator with the mounting plates at an angle to each other, observe the following:

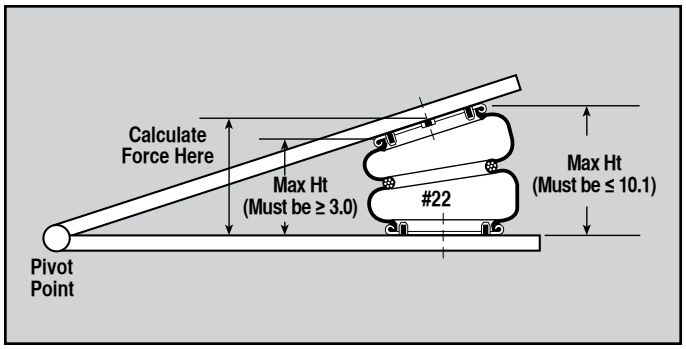
a. Measure force at the height between the plate centers.

b. Measure maximum height at the side separated the furthest.

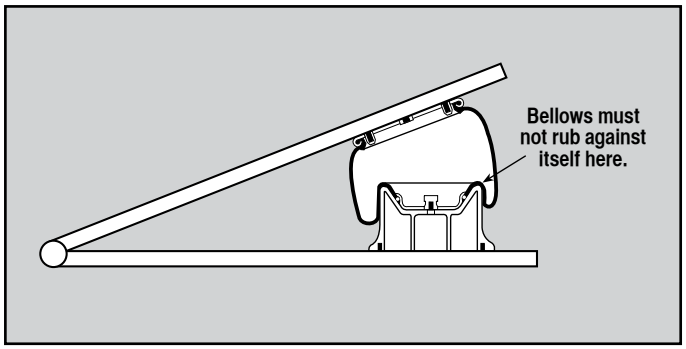
c. Measure minimum height at the side collapsed the most.

Angular Capability continued

These measurements must fall within the guide lines for that particular part. Consider style #22 in the following scissors arrangement:



Reversible sleeve Type 1T parts may also stroke through an arc. In this case, care must be taken to prevent the bellows from rubbing (internally) against itself where it rolls over the piston:



NOTE: The max and min height are not the vertical distance but the actual distance the bellows moves with the angle.

HORIZONTAL MISALIGNMENT

The upper and lower bead plate centers (or mounting plate centers in the case of a bead ring type attachment) may be out of line somewhat without injury to the bellows. Our "rule of thumb" for convoluted type Airstrokes is one inch misalignment allowed per convolution. So, a single convoluted air spring may be out of line by as much as 1 inch, a double by 2 inches, and a triple convoluted air spring by 3 inches.

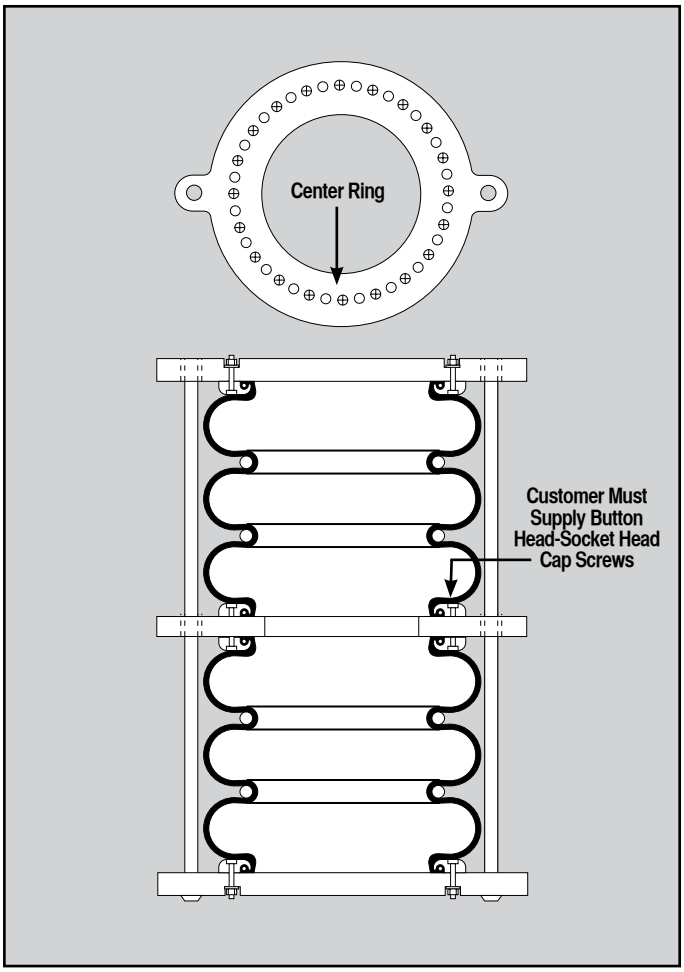
DESIGN ENVELOPE

Adequate clearance should be provided around the Airstroke to prevent puncturing or rubbing of the bellows. The maximum diameter @ 100 psig for each Airstroke (bellows) is located just above the cross-sectional view of the air spring.

STACKING

It is permissible to stack Airstrokes (one on top of another) to increase stroke; however, the center plate (or plates) connecting the two or more Airstrokes MUST BE GUIDED.

Please note that the air spring forces are *not* additive in this configuration. A method for guiding, which also illustrates one center ring concept for mounting the two parts together at the middle, is illustrated below:



FAIL SAFE DEVICES

Some applications require the use of fail safe mechanisms (such as a mechanical lock-out on a scissors lift) to prevent damage or injury in the event of an air system failure.

VACUUM

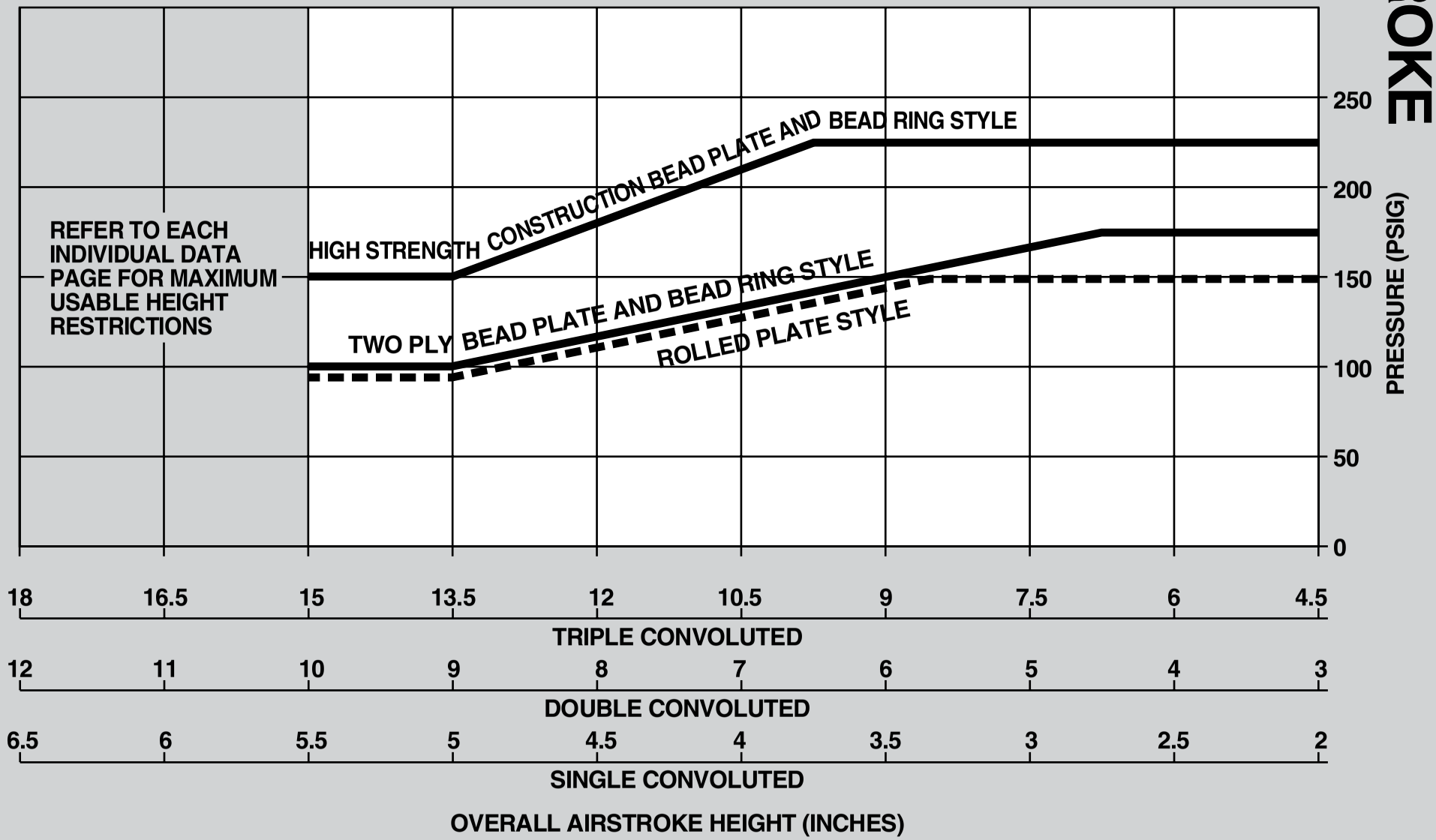
An Airstroke can withstand a small amount of vacuum without injury to the bellows. The maximum amount of acceptable vacuum is dependent upon the bellows' size, the height in use, and whether it is a two ply or high strength (fabric) air spring. (A high strength Airstroke bellows has a "stiffer" wall than a two ply; therefore, it is less susceptible to dimpling and deformation inward). **BEFORE USING THE AIRSTROKE WITH A VACUUM, PLEASE CONSULT YOUR FIRESTONE REPRESENTATIVE.**

An Airstroke Design Parameter Worksheet can be found on page 105.

INFLATION PRESSURE CHART

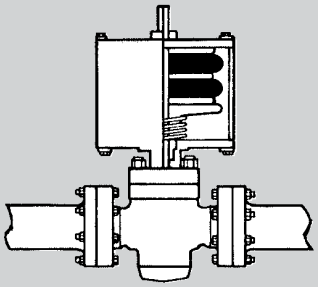
MAXIMUM RECOMMENDED INTERNAL PRESSURES FOR CONVOLUTED TYPE AIRSTROKE™ ACTUATOR APPLICATIONS

BASED ON APPROXIMATELY 1/3 NORMAL BURST VALUES
APPLICATIONS WHICH EXCEED THESE LIMITS SHOULD BE REVIEWED WITH FIRESTONE.

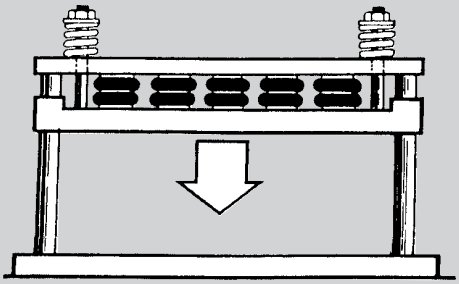


AIRSTROKE™ ACTUATOR PROBLEM SOLVERS

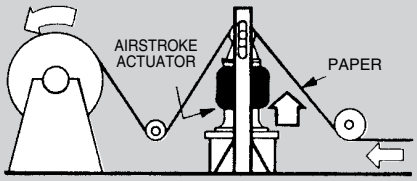
GATE VALVE OPERATOR



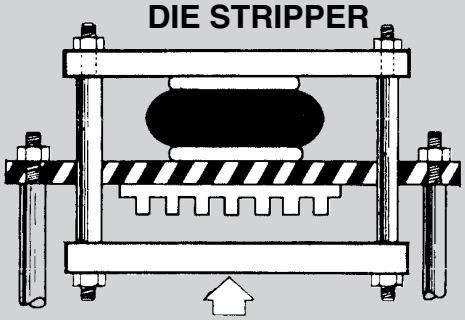
GLUING PRESS



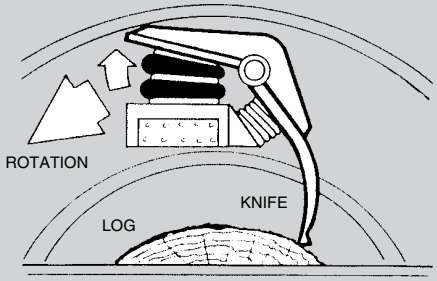
WEB TENSIONING DEVICE



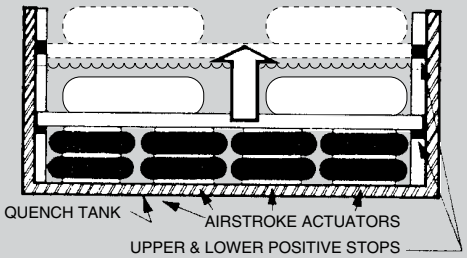
DIE STRIPPER



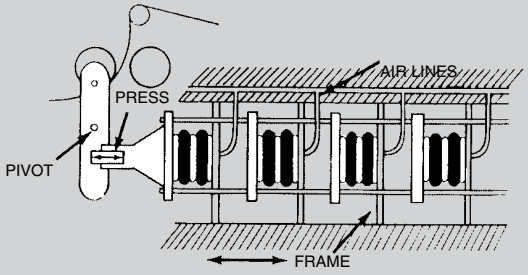
KNIFE SPRING ACTUATOR



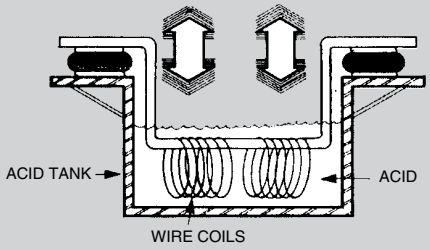
QUENCH TANK ACTUATOR



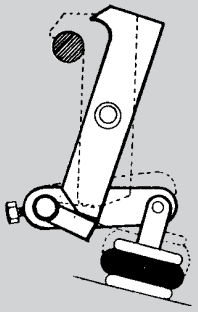
PAPER SIZING PRESS



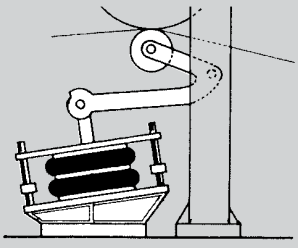
PICKLING TANK ACTUATOR



QUICK LOCK DEVICE

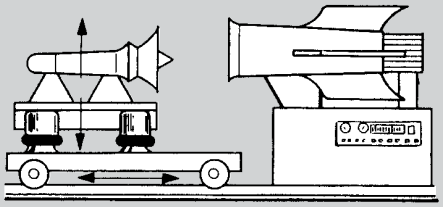


PRESSURE ROLL FOR CALENDER

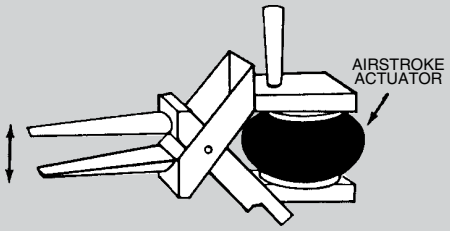


AIRSTROKE™ ACTUATOR PROBLEM SOLVERS

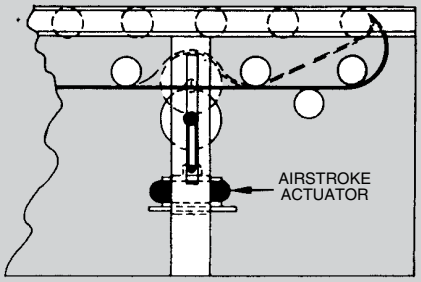
MISSILE ASSEMBLY FIXTURE



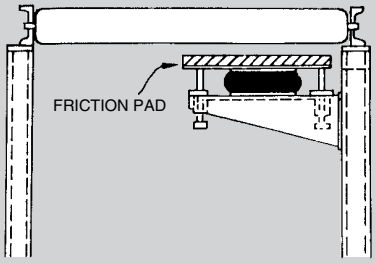
CORE STRAIGHTENER



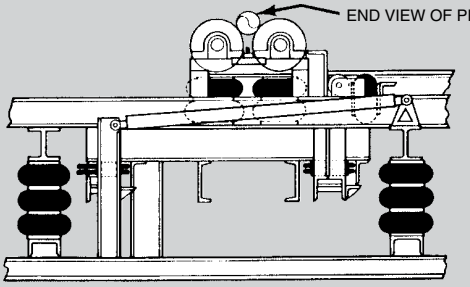
BELT TAKE UP



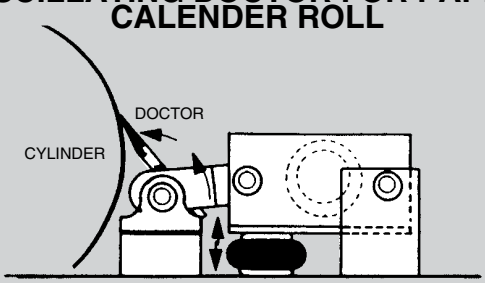
ROLLER FRICTION BRAKE



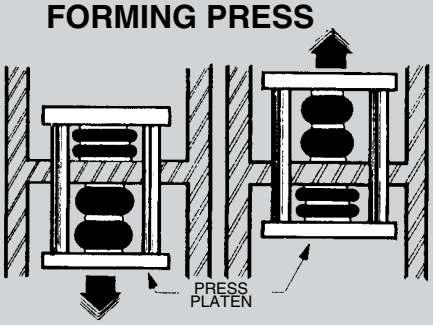
PIPE INDEXING THREADING



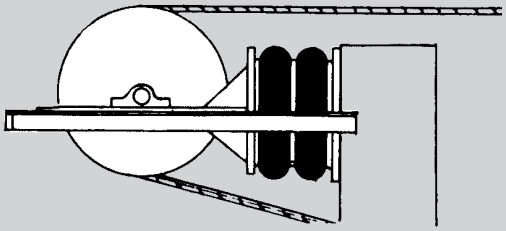
OSCILLATING DOCTOR FOR PAPER CALENDER ROLL



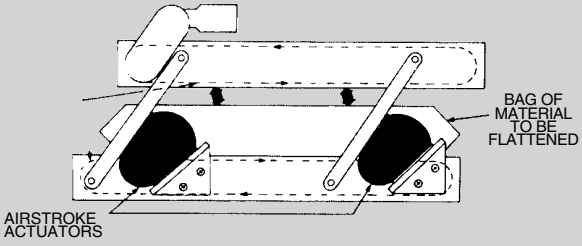
FORMING PRESS



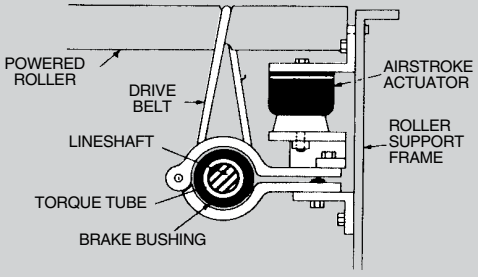
CABLE TENSIONING DEVICE



BAG FLATTENER

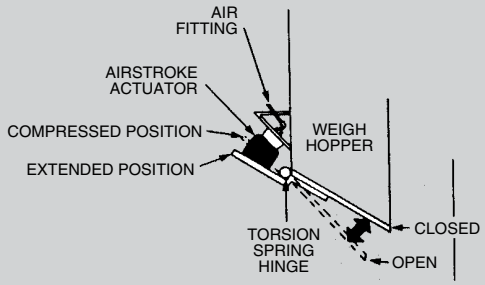


TORSIONAL FRICTION BRAKE

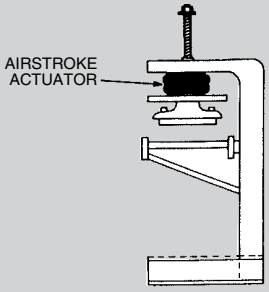


AIRSTROKE™ ACTUATOR PROBLEM SOLVERS

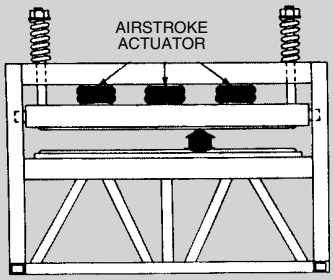
HINGED GATE



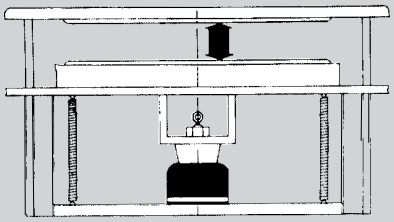
HOT FOIL STAMPING PRESS



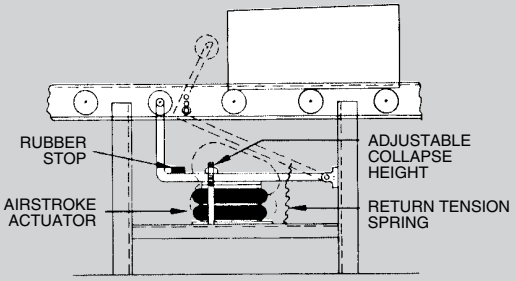
ACTUATED HEAVY DUTY SEALER



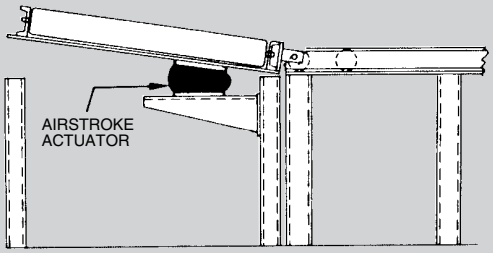
PIVOTED CLAMPING DEVICE



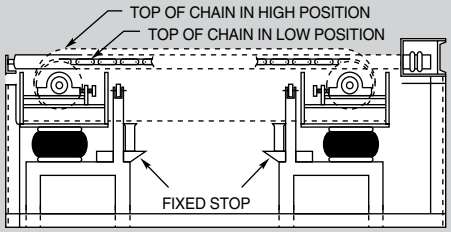
AIRSTROKE ACTUATED ROLLER STOP



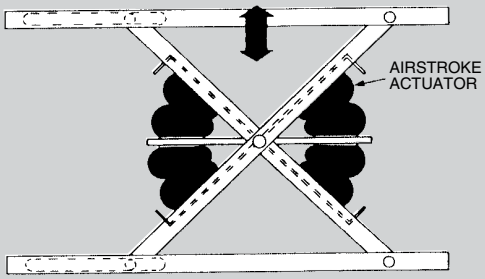
HINGED ACTUATED GRAVITY GATE



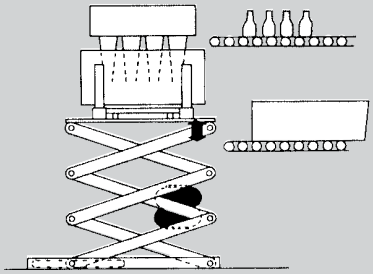
VERTICAL ACTUATED DRIVE TABLE



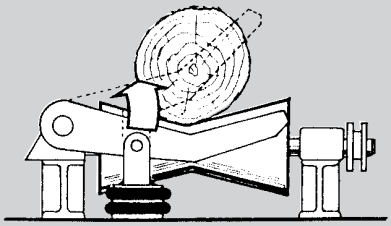
SCISSOR LIFT



CASE PACKER



CONVEYOR TRANSFER ACTUATOR



AIRMOUNT™ VIBRATION ISOLATION

SELECTION AND ISOLATION FORMULA

Refer to the selection guide on page 33 for Airmount load and isolation capabilities. Follow this procedure:

1. LOAD CAPACITY

Select one or two Airmounts that can support the load at each mounting point. It is normally best to design for pressures in the 60 to 80 psig range. Consider only the 1M1A-0 and the single and double convoluted types at first. Please notice that in the range of 210 to 63,890 pounds you will, in most cases, find both a single and double convoluted style part which will support the load.

2. DETERMINE ISOLATION EFFECTIVENESS

Select the disturbing frequency that is closest to the actual forced frequency (400, 800, or 1500 cpm). Then check the percentage of isolation for the parts that were selected in 1 above.

3. DETERMINE DESIGN HEIGHT

THE AIR SPRING SHOULD BE USED AT THE DESIGN HEIGHT GIVEN. The double convoluted part is used at a design height somewhat higher than its single convolution equivalent. Make sure that the design height falls within the height restrictions. Also, the double convoluted part will show a higher percentage of isolation (less transmitted vibration) than the single convoluted air spring. The reason for this is that the double convoluted part has a greater internal volume of air than the single convoluted version of the same size. At disturbing frequencies in the 400 to 800 cpm range, the double convoluted part is a significantly better vibration isolator than the single convoluted part. At disturbing frequencies of 800 to 1500 cpm, the gap closes considerably. At frequencies of 1500 cpm and above, the difference is negligible.

4. DETERMINE EXACT INTERNAL PRESSURE AND ISOLATION EFFECTIVENESS

The chances are that your specific vibration problem does not fall neatly into the load and disturbing frequency criteria as presented in the selection guide.

Therefore, once a preliminary part selection has been made, turn to the individual data page for that part in order to determine the specific internal pressure required and the percentage of isolation attainable.

CONSIDER THIS EXAMPLE:

Isolate a vibrating screen which weighs a total of 16,400 pounds, preferably with *one* isolator at each corner. The vibrating mechanism is rotating at a speed of 850 rpm (cpm) with a total stroke of $^{5}/_{16}$ inch.

a. Determine the load at each mounting point:

$$\frac{16{,}400}{4} = 4{,}100 \text{ lbs.}$$

Scan down the 80 psig load column in the selection guide. It appears that either a #19 or a #22 will support the load at a pressure between 60 and 80 psig.

b. Determine Isolation Effectiveness.

Read the % of Isolation at 800 cpm for the #19 and #22 (since 800 is closest to our machine speed of 850 cpm). A #19 is at 96.0% and a #22 is at 98.2%. Looking at isolation effectiveness in terms of % TRANSMISSION, the #19 will transmit 100 – 96.0, or 4.0% of the vibrations. A #22 will transmit 100 – 98.2, or 1.8% of the vibrations. So, even though there does not seem to be much difference between 96.0% and 98.2% isolation, the #22 is in fact a better isolator by approximately a factor of two when comparing transmitted vibration.

c. Determine Design Height.

Let's say we have chosen the #22 because 96.0% isolation for a #19 is considered to be too low. A #22 should be used at 9.5 inches as shown in the second column on page 33.

d. Determine Exact Internal Pressure and Isolation Percentage.

Turn to page 61 for detailed information on the #22.

a) What exact pressure will be required to support the load of 4,100 lbs? Refer to the information in the block entitled "Dynamic Characteristics at 9.5 in Design Height."

$$\frac{4{,}280 \text{ lbs.}}{80 \text{ lbs/in}^2} = 53.5 \text{ in}^2 = \text{effective area @ 9.5 inches @ 80 psig}$$

Divide the actual load by the effective area:

$$\frac{4{,}100 \text{ lbs.}}{53.5 \text{ in}^2} = \underline{76.6} \text{ psig required to support 4,100 lbs. at 9.5 inches}$$

b) What exact isolation will be attained?

Use the formula:

$$\% \text{ Transmission} = \frac{100}{\left(\frac{f_f}{f_n}\right)^2 - 1}$$

Where: f_f = Forced Frequency
f_n = Natural Frequency

The forced frequency is 850 cpm Read the natural frequency from the line at the load and pressure closest to the actual situation, or 106 CPM (@ 80 psig and 4,280 lbs.):

$$\% \text{ Transmission} = \frac{100}{\left(\frac{850}{106}\right)^2 - 1}$$

% Transmission = 1.6%
% Isolation = 100 – % Transmission
% Isolation = 100 – 1.6
% Isolation = 98.4%

Notice that the natural frequency of an Airmount changes only slightly with variations in pressure and load. Therefore, when working at pressures other than 40, 60, 80, or 100 psig, % isolation can be calculated quite accurately using the "closest" natural frequency and the formula above.

DYNAMIC SPRING RATE FORMULA

Spring rate is a different matter. Unlike most conventional springs, the rate of an Airmount is not constant. It is a function of the change in effective area, volume, and pressure from design height. To determine the rate of an Airmount, use the following formula:

$$K = \frac{\left[[P_g + 14.7]\left[A_c\left(\frac{V_1}{V_c}\right)^{1.38} - A_e\left(\frac{V_1}{V_e}\right)^{1.38}\right] - 14.7(A_c - A_e)\right]_{lbs}}{1\,inch}$$

WHERE:

K = Vertical Spring Rate in lbs./inch

P_g = Gauge Pressure at design height $\left(\frac{lbs}{in^2}\right)$

A_c = Effective Area at 1/2 inch below design height (in^2)

A_e = Effective Area at 1/2 inch above design height (in^2)

V_1 = Internal Volume at design height (in^3)

V_c = Internal Volume at 1/2 inch below design height (in^3)

V_e = Internal Volume at 1/2 inch above design height (in^3)

Consider the same #22 example: What is the vertical spring rate with a load of 4,100 pounds at a design height of 9.5 inches? Refer to the static data chart on page 62. Again, our "closest" pressure is 80 psig, so we'll need to read the appropriate data from the 80 psig curve.

The 80 psig information at 1/2 inch above design height would fall at the 10.0 inch height line, and 1/2 inch below design height would fall at the 9.0 inch height line. (In this example, we can read loads from the force table). The information at design height is located in the "Dynamic Characteristics Block." So,

K = Unknown

P_g = 76.6 psig (see page 13)

$$A_c = 58.4\ in^2 = \left(\frac{4{,}670\ lbs.}{80\ lbs/in^2}\right)$$

$$A_e = 47.6\ in^2 = \left(\frac{3{,}810\ lbs.}{80\ lbs/in^2}\right)$$

V_1 = 782 in^3

V_c = 752 in^3

V_e = 809 in^3

$$K = \frac{\left[[P_g + 14.7]\left[A_c\left(\frac{V_1}{V_c}\right)^{1.38} - A_e\left(\frac{V_1}{V_e}\right)^{1.38}\right] - 14.7(A_c - A_e)\right]_{lbs}}{1\,inch}$$

$$K = \frac{\left[[76.6+14.7]\left[58.4\left(\frac{782}{752}\right)^{1.38} - 47.6\left(\frac{782}{809}\right)^{1.38}\right] - \frac{14.7}{(58.4-47.6)}\right]_{lbs}}{1\,inch}$$

K = 1,324 lbs/inch

NATURAL FREQUENCY FORMULA

Once the spring rate is determined, calculate the Airmount natural frequency (for an *undamped* system) as follows:

$$f_n = 188\sqrt{\frac{K}{L}}$$

Where:

f_n = Natural Frequency in cycles per minute (cpm)

K = Rate (lbs/inch)

L = Load (pounds)

in our example:

$$f_n = 188\sqrt{\frac{1{,}324}{4{,}100}}$$

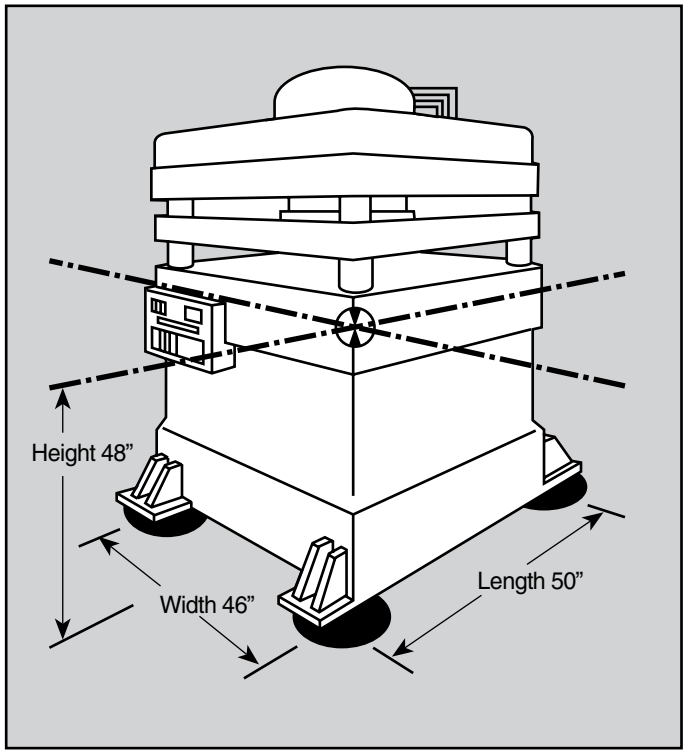
f_n = 106.8 cpm

AIRMOUNT™ VIBRATION ISOLATION

Up to this point, only the weight and disturbing frequency have been discussed. THERE ARE MANY OTHER IMPORTANT CONSIDERATIONS:

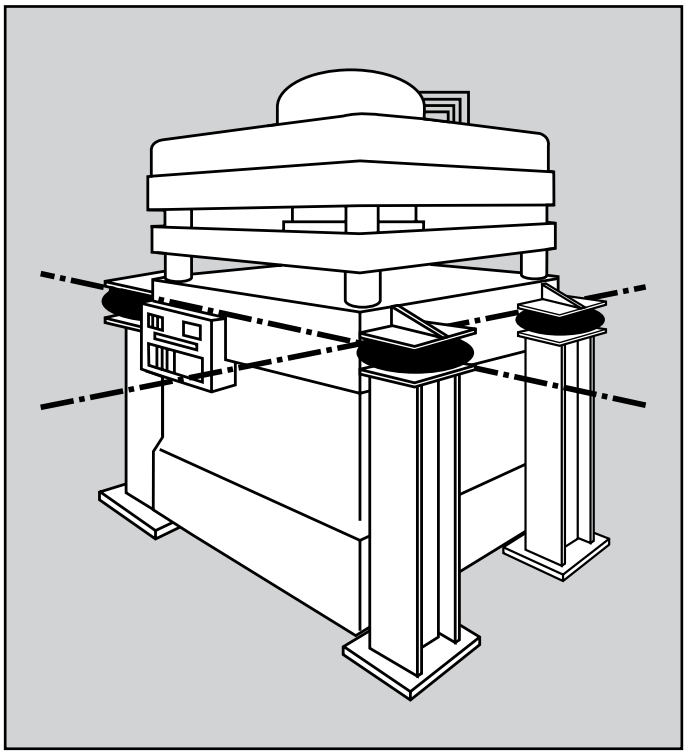
CENTER OF GRAVITY

An Airmount isolation system is inherently soft (easily deflected); therefore, precautions must be taken to insure that the system is stable. First, consider the location of the center of gravity (c.g.). Ideally, the Airmounts should be located on the same plane (parallel to the ground) as the center of gravity. Where this is not possible, follow this guideline: The distance between the most narrow mounting points should be at least twice the height of the center of gravity.



In the above example, the most narrow distance between two Airmounts is 46 inches The height to the c.g. is 48 inches; therefore, this system does not meet our guideline. Two possible solutions would be:

1. Increase the base dimensions to meet our guideline by increasing both the width and length to at least 48 x 2 or 96 inches.
2. Locate the Airmounts at the c.g. as shown above (in the next column).



LATERAL RATES AND STABILITY

Single and double convoluted air springs SHOULD BE USED AT THE DESIGN HEIGHTS GIVEN, because that is the point of maximum lateral rate or stability. The lateral rate *decreases* as the Airmount height *decreases*. Consider a #22 again at 80 psig:

Height	Lateral Rate	Vertical Rate
9.5 inch (design height)	325 lbs/in	1,373 lb/in
8.5 inch	212 lbs	—
7.5 inch	Unstable	—

Notice that the #22 becomes unstable in the horizontal or lateral direction when moving down only two inches from design height.

AIRMOUNT™ VIBRATION ISOLATION

At design height and without an auxiliary reservoir, the single and double convoluted parts follow this pattern; i.e., the lateral rate varies from 1/5 to 1/2 of the vertical rate (only the larger high strength parts get as high as 1/2). Notice the #22 is approximately 1/4($\frac{325}{1,373}$). Going back to the original example of a vibrating screen which weighs 16,400 lbs. mounted on four #22's (@ 9.5 inches), a side load of 1,300 pounds (325 x 4) would deflect the entire suspended mass by one inch.

TRIPLE CONVOLUTED AND REVERSIBLE SLEEVE TYPE PARTS

Both of these types are unstable laterally (except for the 1M1A). Due to low natural frequencies, both can be excellent isolators; however, do not use these two types as Airmount isolators without consulting Firestone (for special guidelines and precautions).

DESIGN ENVELOPE

Adequate clearance should be provided around the Airmount to prevent puncturing or rubbing of the bellows. The maximum diameter @ 100 psig for each Airmount (bellows) is shown just above the cross sectional view of the air spring.

SAFETY STOPS

It is normally recommended that positive stops be installed *in all directions*; i.e., into compression, extension, and laterally. Positioning of the vertical stops depends upon the amplitude of movement, both during normal operation and startup and shutdown. A good "rule of thumb" is ± 1/2 inch from design height for vertical stops and also ± 1/2 inch (horizontally) for lateral stops.

INITIAL INSTALLATION

NEVER use Airmounts to lift equipment into place, due to the lateral instability at lower air spring heights as discussed previously. Equipment should be rested on stops set *slightly* below design height and raised into position for isolation.

STARTUP AND SHUTDOWN / RESONANCE AND AMPLIFICATION

Resonance is the condition where the forced frequency of the vibrating system is at the natural frequency of the suspension. When this happens, AMPLIFICATION of movement occurs. Going back to our vibrating screen example again, if the normal stroke is 5/16 of an inch, during startup and shutdown (as the machine goes through resonance), the amplitude of movement will be multiplied somewhat. So, while the machine is building up to speed and slowing down, the stroke may be amplified in the range of 1/2 to 1 1/2 inches. The longer the machine takes to go through resonance (to build up to, or slow down from full operating speed), the larger the amplitude of movement.

ISOLATING AN UNBALANCED MASS

The primary concern in this case is the amplitude of movement. It is dependent on:

1) The ratio of the unbalanced moving mass to the total suspended mass, and

2) The ratio of the speed of the unbalanced moving mass (forced frequency) to the natural frequency of the Airmounts.

The addition of damping to the isolation system (shock absorbers) will reduce the large amplitude of movement experienced during resonance.

If the amplitude of movement is too great, one possible solution would be to add an inertia base in order to increase the ratio of the total suspended mass to the moving unbalanced mass. A good "rule of thumb" is 10:1, respectively.

LOW PRESSURE OPERATION

The lateral rate of a single and double convoluted style Airmount *decreases* with decreasing internal air pressure (becomes unstable). Consult Firestone if you plan on operating an Airmount at less than 40 psig.

EFFECT OF AN AUXILIARY RESERVOIR

There is a direct relationship between natural frequency and isolation effectiveness. Generally, the lower the natural frequency, the better the isolator (or higher percentage of isolation). As previously mentioned, a double convoluted Airmount has a lower natural frequency than a single convoluted type (of the same size) because it has more internal air volume. We can use this principle to lower the natural frequency of an air spring by adding an auxiliary reservoir (pressure vessel) externally to the Airmount. This effectively increases the air spring volume and reduces its natural frequency.

In order for the reservoir to work properly, there must be a free flow of air between the Airmount and reservoir. Therefore, it should be mounted as close as possible to the Airmount. Additionally, a bead ring attachment is the best end closure choice as the hole in the upper mounting plate can be sized as large as the inside diameter of the bellows (at the top). A 3/4" NPT air inlet will restrict the flow of air somewhat, but can be used as long as it is understood that there is some throttling effect.

Going back to the #22 example, an auxiliary reservoir of three times the internal volume of the air spring at design height (approximately 10 gallons) will reduce the natural frequency from 106.8 cpm to 90.2 cpm. The spring rate also decreases, from 1,324 lbs./inch to 944 lbs./inch.

AIRMOUNT™ VIBRATION ISOLATION

DAMPING

Damping is defined as the ratio: $\frac{C}{C_c}$

WHERE: C = System Damping

C_c = Critical Damping

The damping ratio inherent in an Airmount is in the order of .03. This damping number is so small that the formulas presented in this section assume it to be zero.

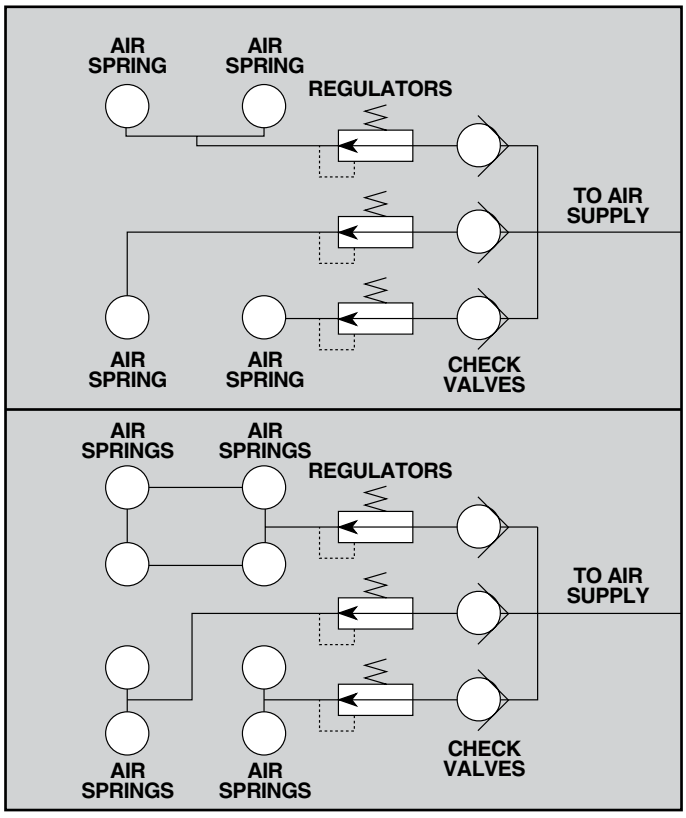
PLUMBING SYSTEMS

There are three basic ways of controlling an air suspended isolation system:

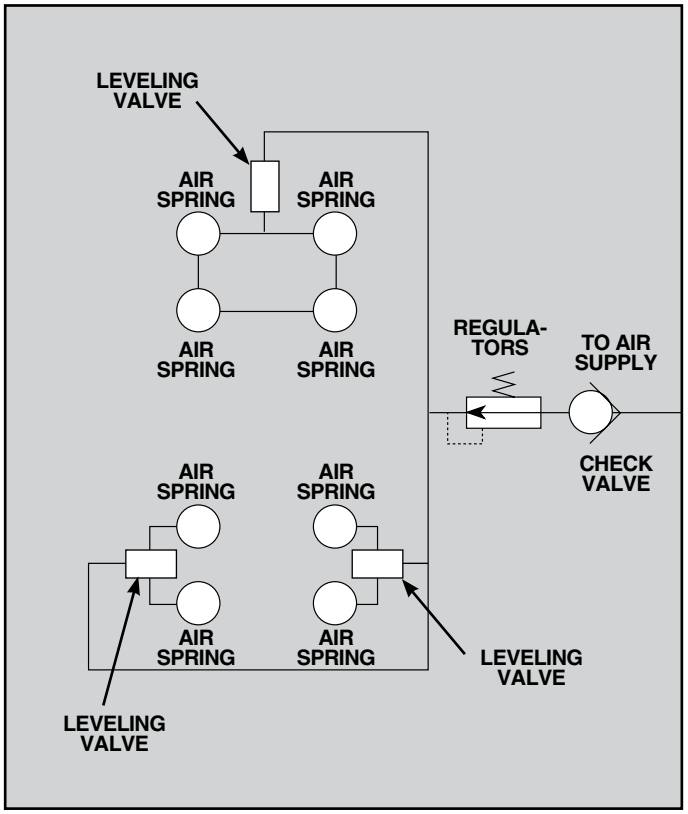
1. **Tank Valve System** With a tank valve in each Airmount, each air spring is then inflated individually. The pressure in each must be checked periodically, because air will permeate through the bellows.

For an idea of the permeation rate, a #116 will lose approximately 30 psig over a period of one year (from 100 psig to 70 psig). Please see page 7 for a picture of a 1/4" NPT tank valve.

2. **Three Point Regulated System** The Airmounts can be connected directly to the factory compressed air system using pressure regulating valves. This eliminates the need for periodic inspections. The air springs should always be connected in clusters so the mass is supported with only THREE REGULATORS. This is illustrated below (in the previous column) for both a four and eight Airmount system:



3. **Three Point Leveled System** Height control can be provided by adding height control valves to the system. Again, there should be only THREE POINTS OF CONTROL, or in this case, three leveling valves. Attempting to use more than three control points often results in the valves hunting or fighting one another. There are sensing systems available to control heights within ±.001 inch. Truck type leveling valves can provide accuracy to ±1/16 inch. A three point, eight air spring, leveled system is illustrated below:



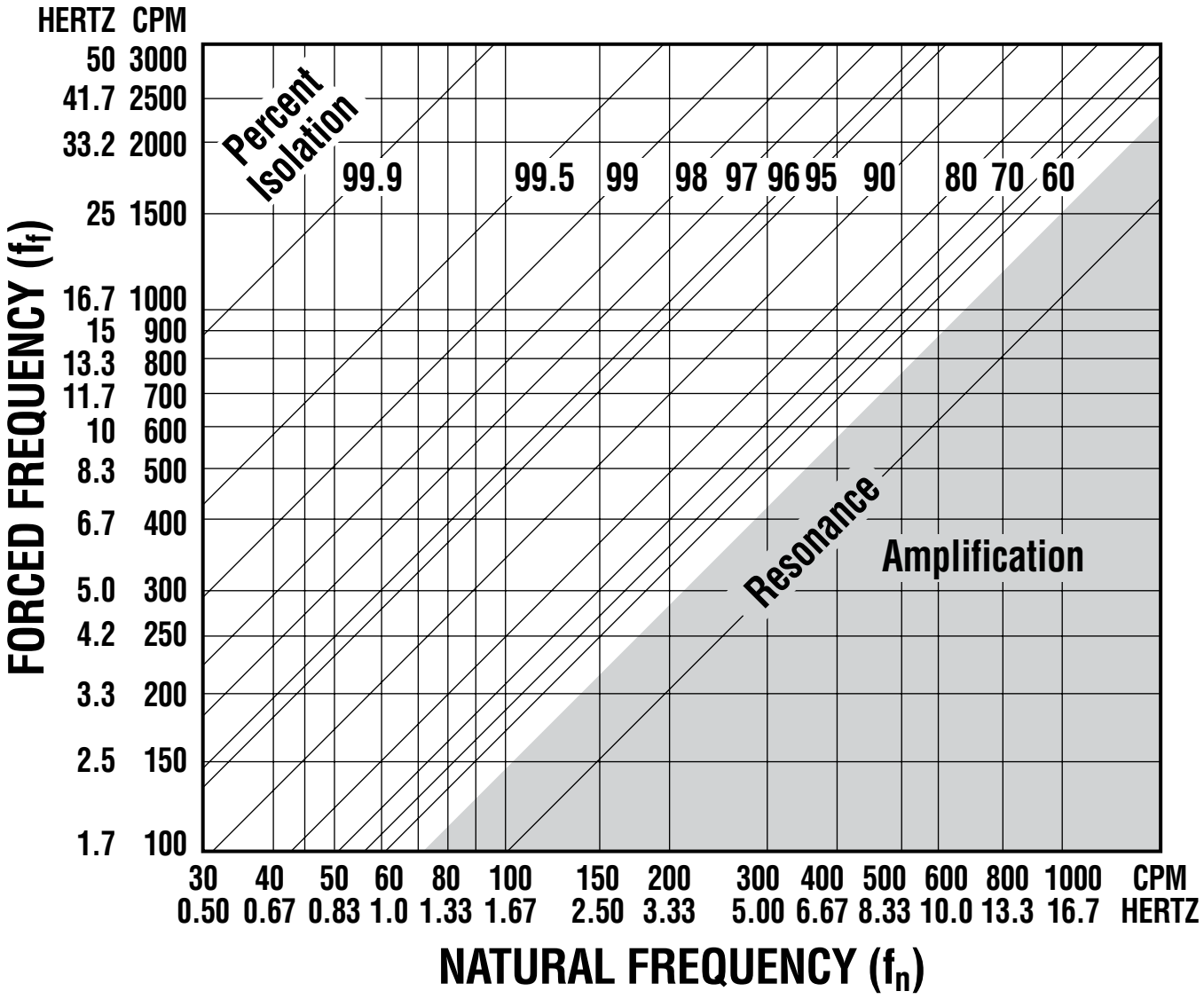
Description	Order No.
Height Control Valve	WC1-358-3592

An Airmount Design Parameter Worksheet can be found on page 107.

For More information ask your Firestone Rep for Technigram 107.

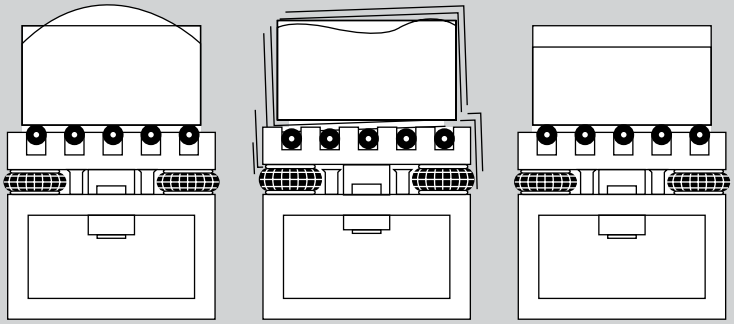
AIRMOUNT™ VIBRATION ISOLATION

ISOLATION CHART

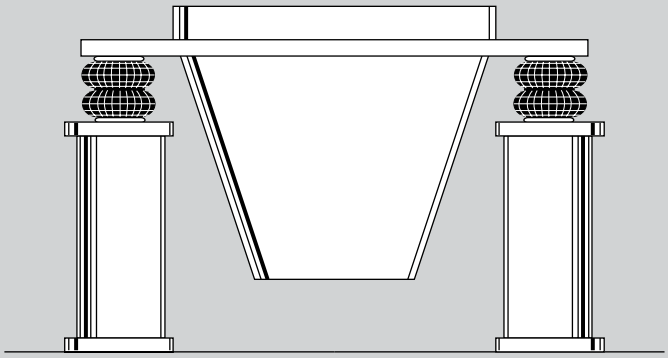


AIRMOUNT™ ISOLATION PROBLEM SOLVERS

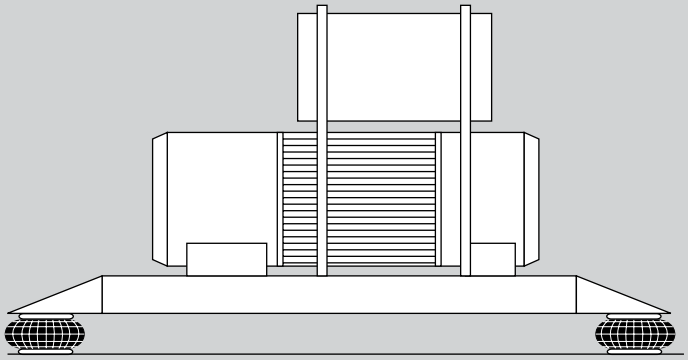
VIBRATING PACKER



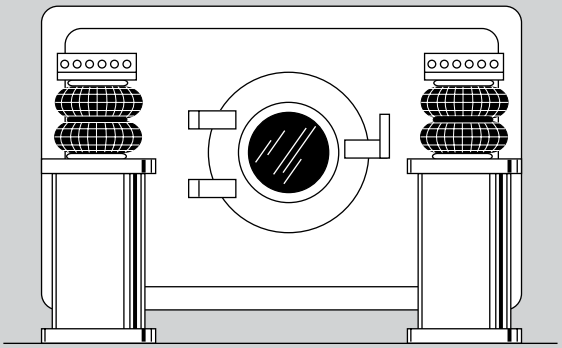
BIN HOPPER



COMPRESSOR

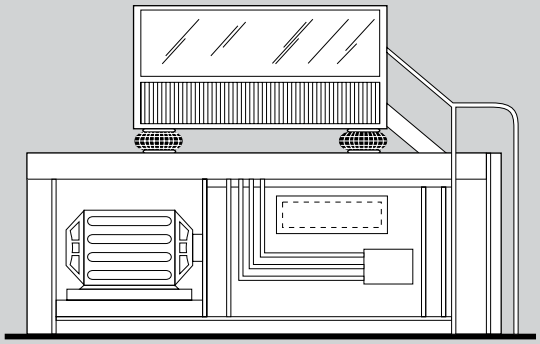


COMMERCIAL LAUNDRY MACHINE

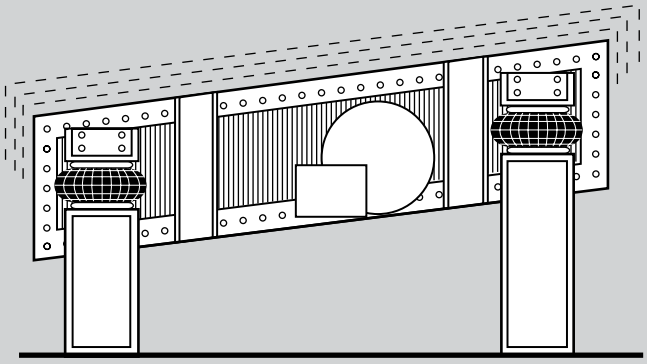


AIRMOUNT™ ISOLATION PROBLEM SOLVERS

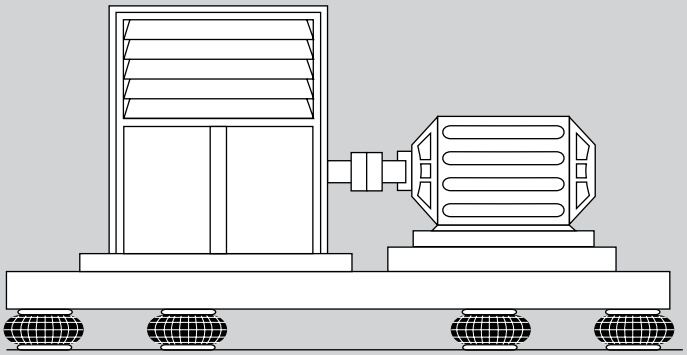
CONTROL BOOTH



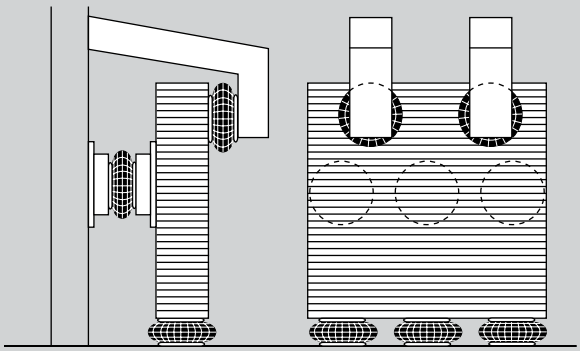
VIBRATING SCREEN



BLOWER AND MOTOR



CONTROL PANEL

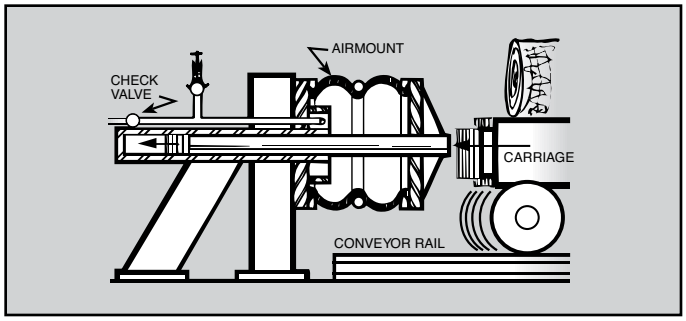


MISCELLANEOUS APPLICATIONS

The air spring provides a unique solution for many actuation and isolation applications the world over. Besides the common applications, there are many that are not readily recognized because of the air spring's unique construction. Listed below are some miscellaneous applications.

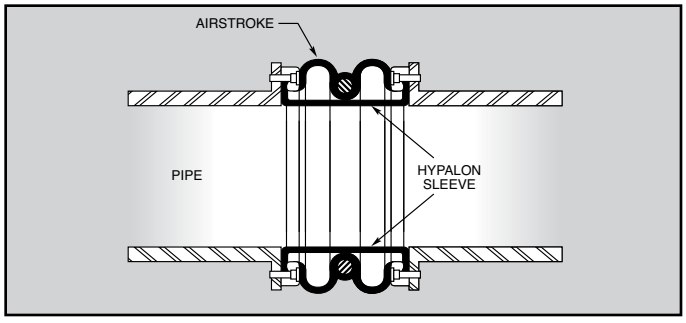
SHOCK IMPACT ISOLATION

The air spring is frequently used in shock impact isolation applications. This air spring application is commonly found in saw mills as the means to both absorb the shock of a falling log, and then by actuating the air spring, to lift and transfer a log onto a conveyor. Because of the properties of both air and rubber, the air spring is an ideal solution to this problem. Without it, the mechanism and surrounding structure would suffer fatigue and fail prematurely due to the intensity of the shock from the falling log. Refer to the problem solver section on the following pages for miscellaneous applications.



PROTECTIVE BOOT AND FLEXIBLE CONNECTOR

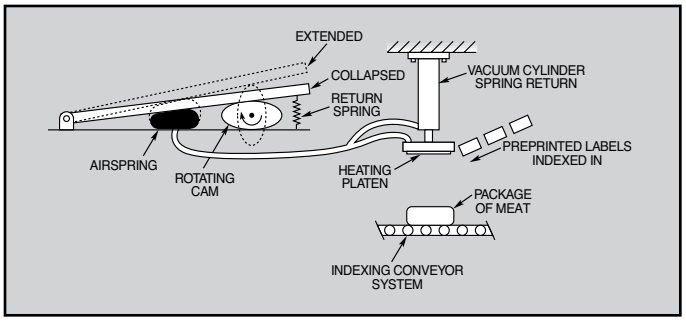
An air spring bellows, with a bead ring type attachment, can be used as a protective boot or flexible connector. Due to the flexible construction of the air spring and the ability to handle both misalignment and angular movement, the air spring is a suitable solution to this problem. To protect the inner surface from the flow of material, an inner sleeve may be required. Refer to the problem solver section on the following pages for miscellaneous applications.



For more information, call your local stocking distributor or the Firestone applications engineer at the phone number on the back cover of this design guide.

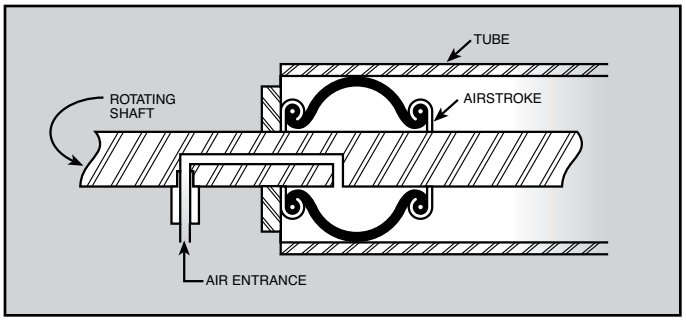
VACUUM PUMP

It is possible to drive an air spring mechanically in order to create a vacuum. The air spring can withstand a small amount of acceptable vacuum without injury to the bellows. The maximum amount of tolerable vacuum is dependent upon the bellows' size, height and whether it is a 2 ply or high strength air spring. It is generally best to use only the single convoluted air spring for this purpose. Refer to the problem solver section on the following pages for miscellaneous applications.



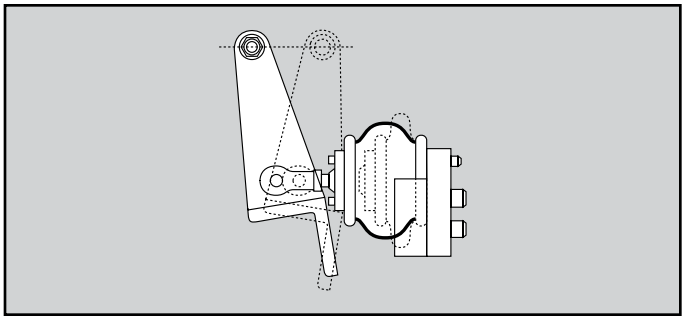
INFLATABLE CHUCK

By restricting the height internally of a bead ring style air spring, the rubber walls will extend in an outward fashion. In this arrangement the air spring can be used as an inflatable chuck. The air will need to be introduced via the same mechanism that restrains the air spring's height. Refer to the problem solver section on the following pages for miscellaneous applications.



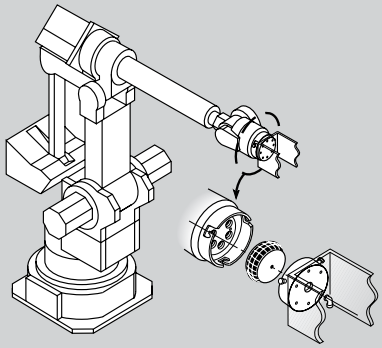
CAM FOLLOWER

The introduction of an air spring as the cam follower can extend the life of the cam greatly. Surface wear is reduced by removing the rigidity and friction of typical cam followers. With this reduction of wear comes continually smooth operations and overall minimization of fatigue. Refer to the problem solver section on the following pages for miscellaneous applications.

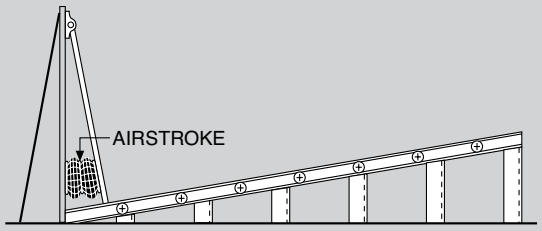


MISCELLANEOUS PROBLEM SOLVERS

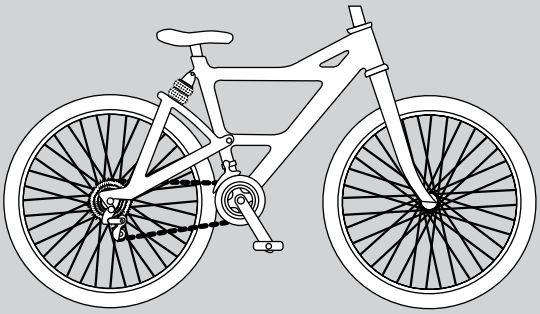
ROBOTIC COUPLING



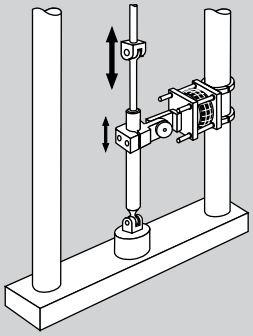
CONVEYOR END STOP



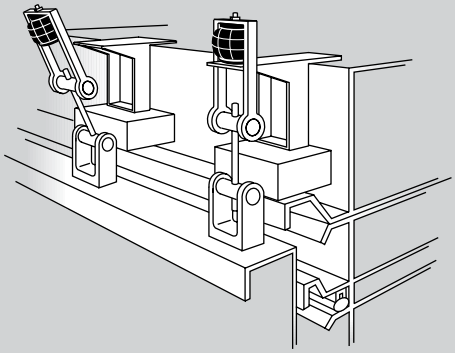
MOUNTAIN/TRAIL BIKE



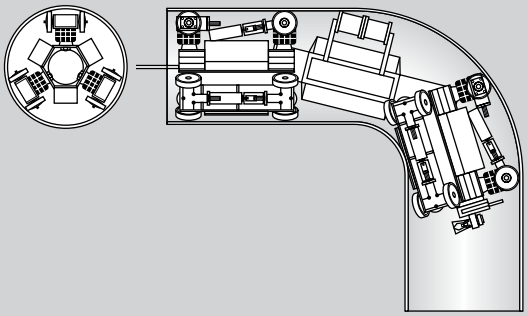
SHOCK ABSORBER TEST SYSTEM



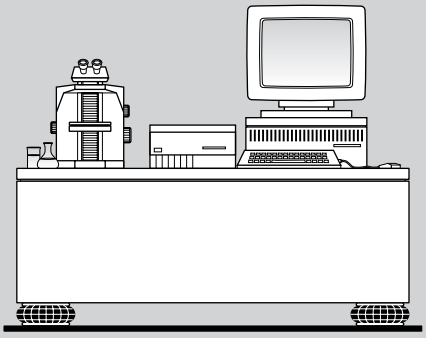
SCREENING MACHINE COVER CLAMP



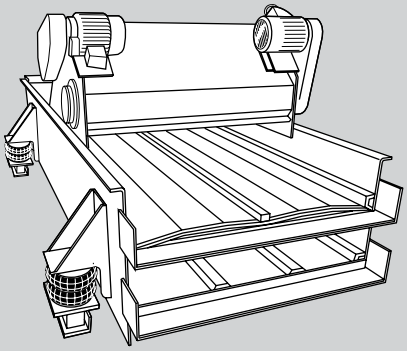
PIPE CRAWLER



DELICATE ELECTRONIC EQUIPMENT

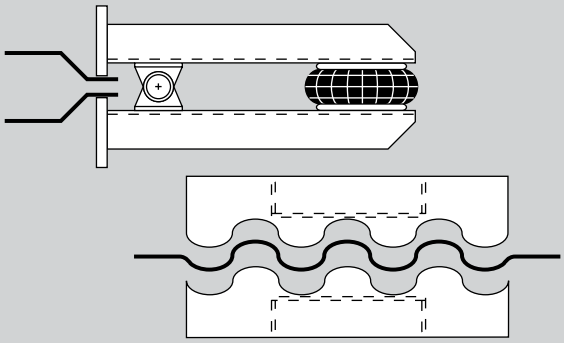


VIBRATING SCREEN

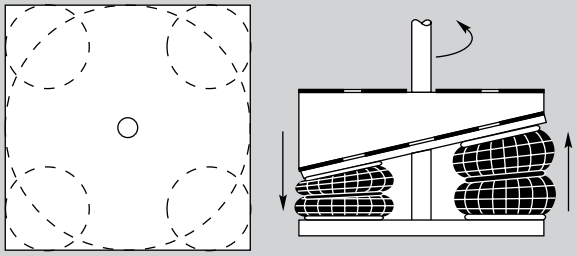


MISCELLANEOUS PROBLEM SOLVERS

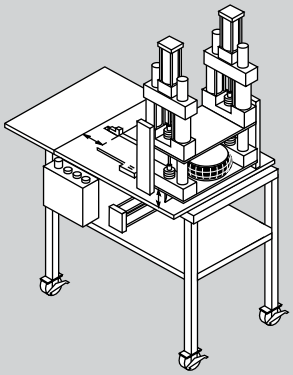
SHEET WELDING CLAMP



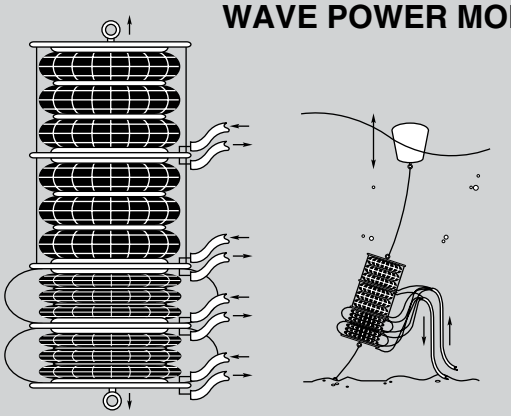
SWASH PLATE MOTOR



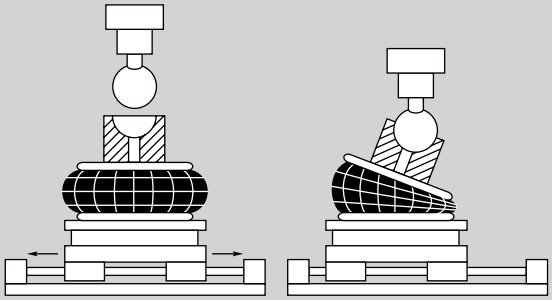
PERFECT BOUND MAGAZINE CUTTER



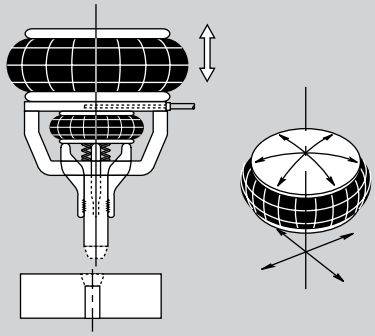
WAVE POWER MODULE



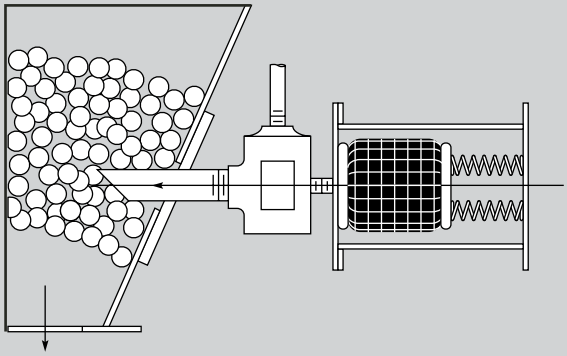
CHECK VALVE LAPPING



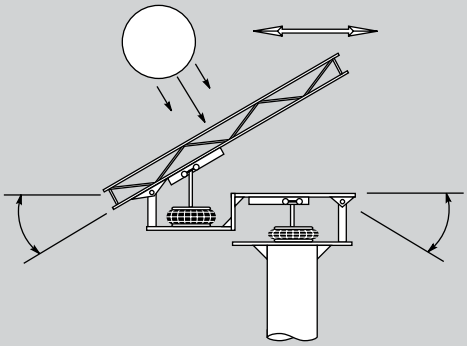
SELF ALIGNING DEVICE



AIR BLAST GENERATOR



SOLAR TRACKER



Firestone AIRSTROKE™ ACTUATORS

END CLOSURE OPTIONS

Style Number	Maximum Diameter at 100 PSIG (inches)	Minimum Height (inches)	Maximum Stroke (inches)	Maximum Usable Height (inches)	100* PSI Force† at Stroke of			High Strength Style Number	Pg. No.
					1 Inch (pounds)	3 Inches (pounds)	Maximum Stroke (pounds)		
POLYACTUATOR									
50-P-10	1.97	0.45	0.4	0.85			37		34
70-P-13	2.75	0.55	0.5	1.05	125		115		35
SHAPED SLEEVE									
1M1A-0	3.4	1.5	1.4	2.9	563		500		36
1M1A-1	3.45	1.5	2.0	3.5	613		469		37
2M1A	3.5	2.5	3.4	5.9	588	513	450		38
2M2A	2.3	1.2	1.0	2.2	175		175		39
SINGLE CONVOLUTION									
16	6.0	1.9	1.4	3.3	1,163		725		40
131	6.5	2.0	2.1	4.1	2,063		1,063		41
160	7.2	2.1	4.3	6.4	2,338	1,875	1,425		42
110	8.3	2.1	3.0	5.1	2,613	1,288	1,175		43
116	9.1	2.0	3.1	5.1	3,363	1,713	1,625	117	44
116-1	9.6	2.0	4.2	6.2	3,725	2,800	1,825		45
115	10.1	2.2	2.9	5.1	4,388	2,600	2,275	124	46
19	12.9	2.0	3.5	5.5	8,400	4,663	3,288		47
19-.75	13.5	2.2	3.7	5.9	8,800	6,250	4,063		48
113	15.2	2.0	3.5	5.5	12,775	8,075	6,188	128	49
113-1	15.9	2.1	4.5	6.6	13,575	11,000	6,875	128-1	50
153-2	18.1	2.5	4.8	7.3	16,419	13,255	8,028		51
119§	17.4	2.0	4.2	6.2	17,538	14,313	9,813		52
121§	20.3	2.1	3.5	5.6	24,500	18,063	14,188		53
126§	22.4	2.0	3.5	5.5	32,450	23,063	18,625		54
138-1.5	27.9	2.1	4.9	7.0	52,413	44,475	30,400		55
148-1	37.4	2.5	4.8	7.3	97,875	84,988	65,625		56
DOUBLE CONVOLUTION									
268	6.4	3.0	3.1	6.1	1,813	1,100	1,025		57
267-1.5	6.5	3.0	4.0	7.0	2,082	1,667	895		58
224	8.0	3.0	2.8	7.7	2,888	2,125	1,213		59
26	8.6	3.0	2.8	8.7	3,438	3,288	1,188		60
274	9.9	3.1	6.0	9.1	4,925	3,524	810	202	61
20-2	10.4	3.0	8.0	11.0	5,156	4,691	2,653		62
22	12.9	3.2	6.9	10.1	8,975	8,088	4,625	210	63
22-1.5	13.7	3.0	8.1	11.1	9,600	8,738	4,788		64
21	15.1	3.2	6.9	10.1	12,875	11,638	7,088	205	65
21-2	16.0	3.0	8.7	11.7	14,163	13,338	7,313		66
233-2	15.5	3.0	10.4	13.4	13,708	13,205	7,375		67
28§	17.4	3.4	6.7	10.1	18,750	16,500	10,663	201	68
203§	20.0	3.5	7.0	10.5	26,750	24,000	16,138	218	69
29§	22.7	3.3	7.5	10.8	33,625	30,500	21,600	207	70
200	26.0	3.5	7.1	10.6	44,625	41,625	31,563		71
215	27.9	3.5	8.6	12.1	53,125	50,000	35,200		72
248-2	37.4	4.2	9.1	13.3	97,750	92,625	67,488		73
TRIPLE CONVOLUTION									
352	13.1	4.8	10.9	15.7	10,038	9,175	5,100		74
313	15.1	4.5	10.7	15.2	13,313	12,125	6,825	39	75
333	15.2	4.5	12.0	16.5	24,901	12,541	7,250		76
312§	18.2	4.5	10.4	14.9	19,625	17,750	10,925	314	77
323§	20.5	4.6	10.8	15.4	27,513	25,250	16,650	324	78
320§	22.4	4.5	11.8	16.3	33,500	30,850	19,250	328	79
321	27.9	4.5	13.5	18.0	52,500	49,625	30,975	321	80
348-3	37.4	5.5	13.8	19.3	96,250	92,500	67,000		81
REVERSIBLE SLEEVE									
4004	3.1	3.6	3.6	7.2	350	388	388		82
7002	4.2	3.5	2.5	6.0	888	825	825		83
7010	4.0	5.75	4.25	10.0	713	750	800		84
7012	5.0	5.0	4.5	9.5	863	938	950		85
110/70	5.7	4.5	4.9	9.4	1,213	1,138	1,113		86
1T14C-1	9.1	5.0	7.7	12.7	3,488	3,213	2,150		87
1T14C-3	9.0	5.8	8.2	14.0	3,663	3,188	1,863		88
1T14C-7	9.0	8.0	9.4	17.4	3,800	3,263	2,038		89
1T15T-1	11.2	4.0	6.7	10.7	6,263	5,463	3,638		90
1T15LP-3	11.1	6.0	10.0	16.0	6,338	5,525	3,538		91
1T15L-4	11.7	6.0	9.9	15.9	7,113	6,875	4,600		92
1T15M-0	12.8	4.3	7.0	11.3	7,125	6,938	4,800		93
1T15M-2	12.6	5.0	8.3	13.3	7,600	7,413	5,075		94
1T15M-4	12.6	6.0	10.5	16.5	7,838	7,163	5,025		95
1T15M-6	12.6	7.0	12.2	19.2	7,850	7,163	4,938		96
1T15M-9	12.7	8.5	15.1	23.6	8,063	7,313	5,263		97
1T19L-7	14.2	6.5	12.8	18.8	11,000	9,125	5,875		98
1T19L-11	14.2	8.0	15.4	23.4	10,750	9,125	6,375		99

Bead Plate Type	Dim. A (blind nut centers) (inches)	Dim. B (inches)	Bead Ring Type	Dim. C (bolt circle diameter) (inches)	Number of Bolts (each ring)
SEE INDIVIDUAL DATA PAGE					
1	1.75		4	4.50	6
1	1.75		4	4.50	6
1	1.75		4	4.50	6
1	1.75		4	4.50	6
1	2.75		4	5.31	6
1	2.75		4	5.31	6
3	3.50	1.75•	4	6.31	8
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
2	6.25		4	11.31	12
2	6.25		4	11.31	12
2	6.25		N/A	N/A	N/A
5	9.00	13.79	4	13.81	18
5	12.00	16.50	4	16.50	24
5	15.00	19.00	4	19.00	24
			4	23.50	32
			4	32.68	40
1	1.75		4	4.50	6
1	1.75		4	4.50	6
1	2.75		4	5.31	6
1	2.75		4	5.31	6
3	3.50	1.75•	4	6.31	8
3	3.50	1.75	4	6.31	8
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
2	6.25		4	11.31	12
2	6.25		4	11.31	12
2	6.25		4	11.31	12
5	9.00	13.79	4	13.81	18
5	12.00	16.50	4	16.50	24
5	15.00	19.00	4	19.00	24
			4	22.00	24
			4	23.50	32
			4	32.68	40
3	6.20	2.88	N/A	N/A	N/A
2	6.25		4	11.31	12
2	6.25		4	11.31	12
5	9.00	13.79	4	13.81	18
5	12.00	16.50	4	16.50	24
5	15.00	19.00	4	19.00	24
			4	23.50	32
			4	32.68	40
SEE INDIVIDUAL DATA PAGE					
3	3.50	1.75•	4	6.31	8
3	3.50	1.75•	4	6.31	8
3	3.50	1.75•	4	6.31	8
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
3	6.20	2.88	4	9.00	12
2	6.25		4	11.31	12
2	6.25		4	11.31	12

*Values for the Polyactuators are based out of the 50 psi curve. Do not use polyactuator at more than 50 psi.

† To determine Airstroke force at other pressures, divide force shown by 80 PSIG and multiply result by new pressure.

§ This is offered with a rolled plate. When using the rolled plate end closure option, add .7 inch to heights shown.

•On plates with a 3/4 inch NPT air inlet, B dimension is 1.50 inch.

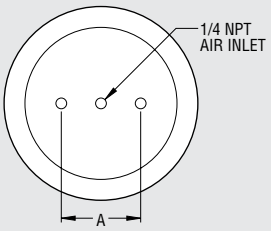
Firestone AIRMOUNT™ ISOLATORS

Style Number	Design Height	Load (at Design Height) at:			Natural Frequency	% of Isolation at Forced Frequency		
		**40 PSIG (pounds)	60 PSIG (pounds)	80 PSIG (pounds)	(@ 80 PSIG) f_n(cpm)	400 CPM %	800 CPM %	1500 CPM %
POLYACTUATOR								
50-P-10	DO NOT USE 50-P-10 AS AN AIRMOUNT ISOLATOR							
70-P-13	DO NOT USE 70-P-13 AS AN AIRMOUNT ISOLATOR							
SHAPED SLEEVE								
1M1A-0	2.5	210	330	450	220		91.8	97.8
1M1A-1	3.0	235	356	475	162	80.2	95.7	98.8
2M1A	DO NOT USE 2M1A AS AN AIRMOUNT ISOLATOR							
2M2A	2.0	95	140	184	210		92.6	98.0
SINGLE CONVOLUTION								
16	3.0	420	640	880	237		90.3	97.4
131	3.5	550	850	1,170	181	74.4	94.6	98.5
160	5.5	650	1,010	1,390	124	89.4	97.5	99.3
110	4.5	650	1,010	1,390	162	80.2	95.7	98.8
116	4.5	850	1,330	1,830	163	80.2	95.7	98.8
116-1	5.5	940	1,410	1,930	139	86.3	96.9	99.1
115	4.5	1,210	1,880	2,540	151	83.4	96.3	99.0
19	5.0	1,690	2,640	3,730	168	78.6	95.4	98.7
19-.75	5.5	1,890	2,950	4,080	156	82.0	96.0	98.9
113	5.0	3,010	4,610	6,460	152	83.1	96.3	99.0
113-1	5.5	3,820	5,900	7,990	133	87.7	97.2	99.2
153-2	6.0	4,564	7,048	9,682	121	89.9	97.7	99.3
119**	5.0	5,490	8,450	11,450	138	86.5	96.9	99.1
121**	5.0	6,450	10,300	14,450	142	85.5	96.7	99.1
126**	5.0	8,630	13,870	18,450	139	86.3	96.9	99.1
138-1.5	6.0	15,020	23,040	31,240	121	89.9	97.7	99.3
148-1	5.5	32,860	50,290	67,690	118	90.5	97.8	99.4
DOUBLE CONVOLUTION								
268	5.5	515	787	1,062	145	84.9	96.6	99.1
267-1.5	6.0	566	871	1,194	129	87.6	97.2	99.2
224	6.5	730	1,130	1,530	126	89.0	97.5	99.3
26	8.0	590	980	1,360	123	89.6	87.6	99.3
274	8.5	990	1,540	2,130	116	90.7	97.8	99.4
20-2	10.0	1,184	1,848	2,531	97	93.7	98.5	99.5
22	9.5	2,060	3,170	4,280	106	92.4	98.2	99.5
22-1.5	10.5	1,930	3,030	4,130	106	92.4	98.2	99.5
21	9.5	3,030	4,750	6,540	105	92.6	98.3	99.5
21-2	10.5	3,460	5,350	7,280	95	94.1	98.6	99 6
233-2	11.25	3,413	5,631	7,691	89	95.0	98.8	99.7
28**	9.5	4,590	7,010	9,590	101	93.2	98.4	99.5
203**	9.5	7,210	11,100	14,970	97	93.7	98.5	99.6
29**	9.5	9,780	14,860	20,060	92	94.4	98.7	99.6
200	9.5	13,290	20,390	27,330	93	94.2	98.6	99.6
211/215	10.5	15,840	24,140	32,550	86	95.1	98.8	99.7
248-2	11.0	30,830	47,720	63,890	83	95.5	98.9	99.7
TRIPLE CONVOLUTION								
352	13.5	2,319	3,631	5,017	77	95.9	99.0	99.7
313	13.0	3,310	5,120	7,020	82	95.6	98.9	99.7
333	14.7	3,282	5,167	7,000	77	96.1	99.1	99.7
312**	13.0	5,100	7,930	10,730	80	95.8	99.0	99.7
323**	13.0	8,010	12,030	16,270	78	96.0	99.0	99.7
320**	14.0	9,340	14,850	19,200	76	96.3	99.1	99.7
319/321	15.0	15,080	23,200	31,600	72	96.7	99.2	99.8
348-3	15.0	31,480	47,870	64,870	68	97.0	99.3	99.8
REVERSIBLE SLEEVE								
4004	5.5	150	220	290	105	92.7	98.3	99.5
7002	4.5	310	480	650	114	91.2	97.9	99.4
7010	8.0	280	440	600	83	95.5	98.9	99.7
7012	8.5	360	590	790	75	96.3	99.1	99.7
110/70	7.25	430	670	910	94	94.2	98.6	99.6
1T14C-1	9.0	1,190	1,890	2,570	86	95.1	98.8	99.7
1T14C-3	10.0	1,180	1,810	2,450	81	95.7	99.0	99.7
1T14C-7	13.0	1,250	1,920	2,610	64	97.4	99.4	99.8
1T15T-1	7.0	2,100	3,220	4,370	97	93.7	98.5	99.6
1T15LP-3	12.0	2,040	3,140	4,220	74	96.5	99.1	99.8
1T15L-4	11.0	2,650	4,080	5,510	82	95.6	98.9	99.7
1T15M-0	7.5	2,670	4,120	5,540	94	94.1	98.6	99.6
1T15M-2	9.5	2,850	4,370	5,900	86	95.2	98.8	99.7
1T15M-4	12.0	2,770	4,210	5,690	71	96.8	99.2	99.8
1T15M-6	14.0	2,730	4,130	5,590	67	97.1	99.3	99.8
1T15M-9	17.0	2,770	4,250	5,680	58	97.8	99.5	99.8
1T19L-7	13.0	3,480	5,290	7,100	70	96.8	99.2	99.8
1T19L-11	17.0	3,411	5,151	6,911	63	97.5	99.4	99.8

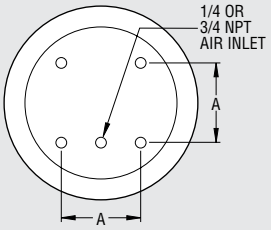
CONSULT FIRESTONE FOR USE AS AN AIRMOUNT†

END CLOSURES

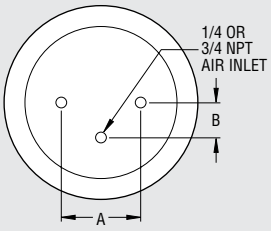
TYPE 1 bead plate



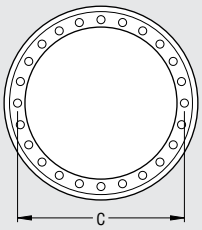
TYPE 2 bead plate



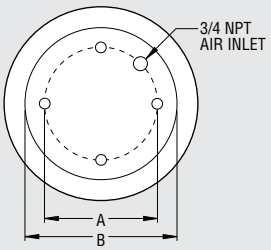
TYPE 3 bead plate



TYPE 4 bead ring



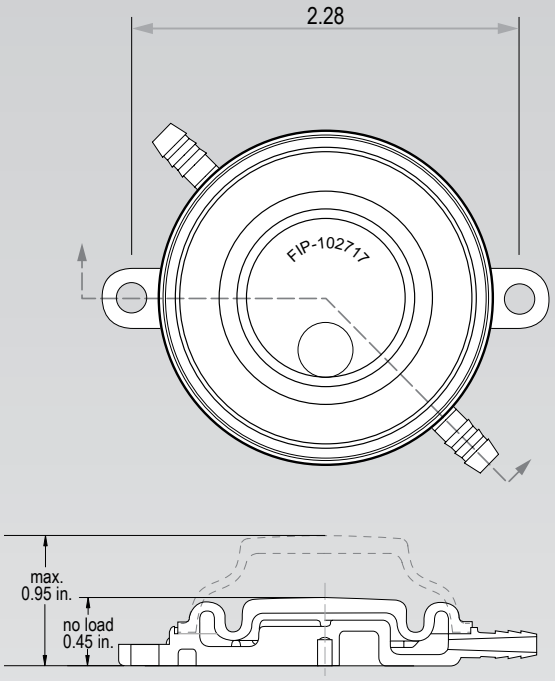
TYPE 5 rolled plate

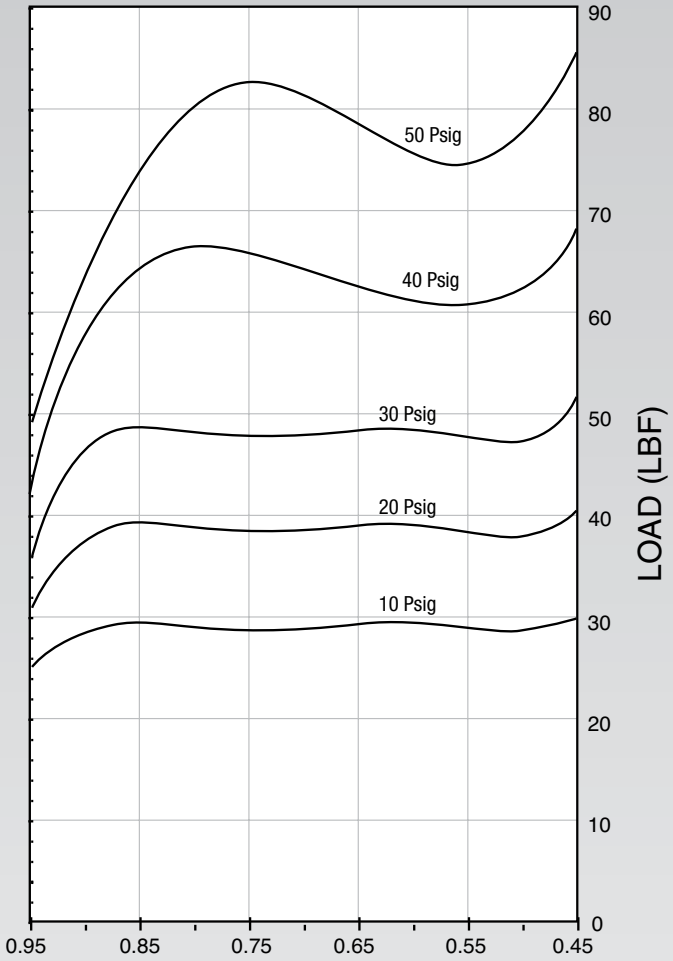


**Airmount isolator air pressures below 40 PSIG should be reviewed with Firestone.
†Except for 1M1A.

50-P-10 Firestone AIROMATIC POLYACTUATORS

Description	Assembly Order No.
50-P-10	WA1-358-5676





Use #8 or 4mm screws to mount through tabs.

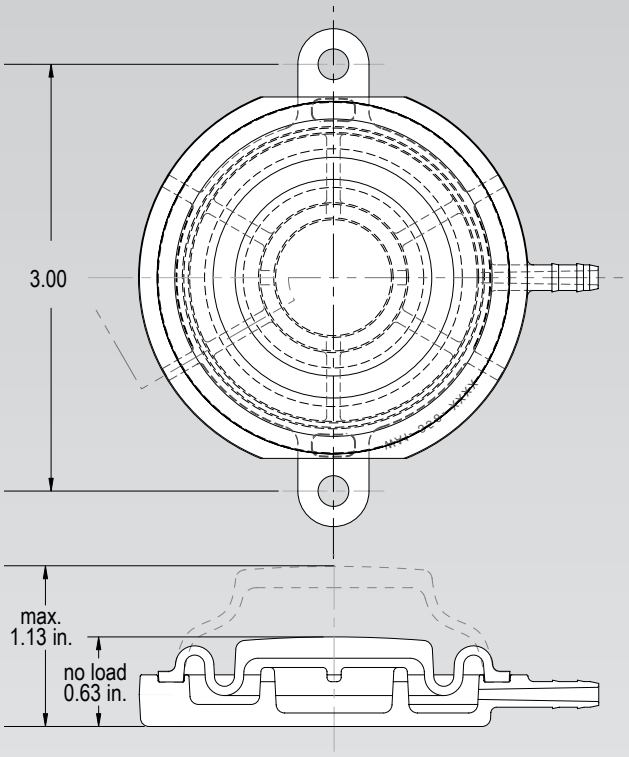
Use .18 [4.6] ID nylon or equivalent tubing.

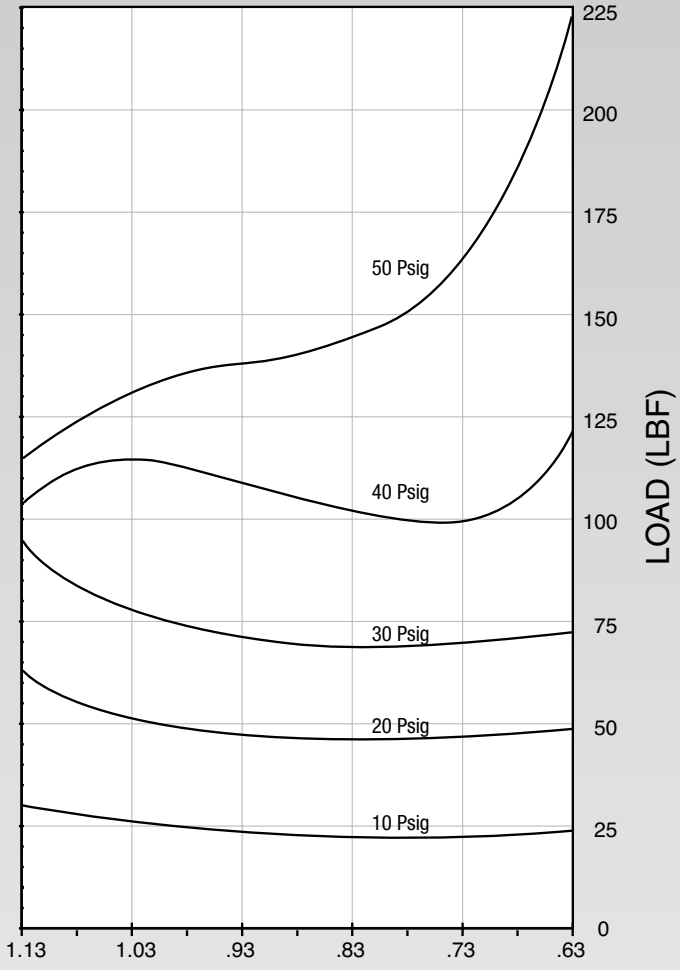
NOTE:
Do not use as an Airmount isolator.

Force Table (Use for Airstroke™ actuator design)

Assembly Height (in.)	Volume @ 60 PSIG (in^3)	Pounds Force				
		@10 PSIG	@20 PSIG	@30 PSIG	@40 PSIG	@50 PSIG
.45		14	27	41	62	85
.55		12	24	36	53	71
.65		13	25	38	56	76
.75		12	24	37	60	81
.85		13	25	38	58	69
.95		7	14	21	28	37

Description	Assembly Order No.
70-P-13	WA1-358-5674





Use #8 or 4mm screws to mount through tabs.

Use .18 [4.6] ID nylon or equivalent tubing.

NOTE:
Do not use as an Airmount isolator.

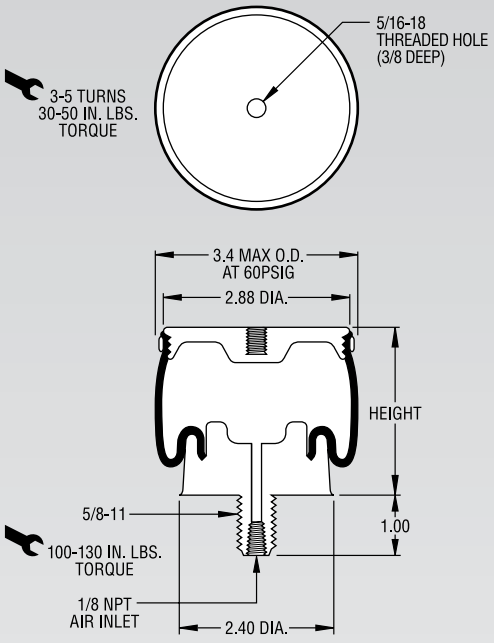
Force Table (Use for Airstroke™ actuator design)

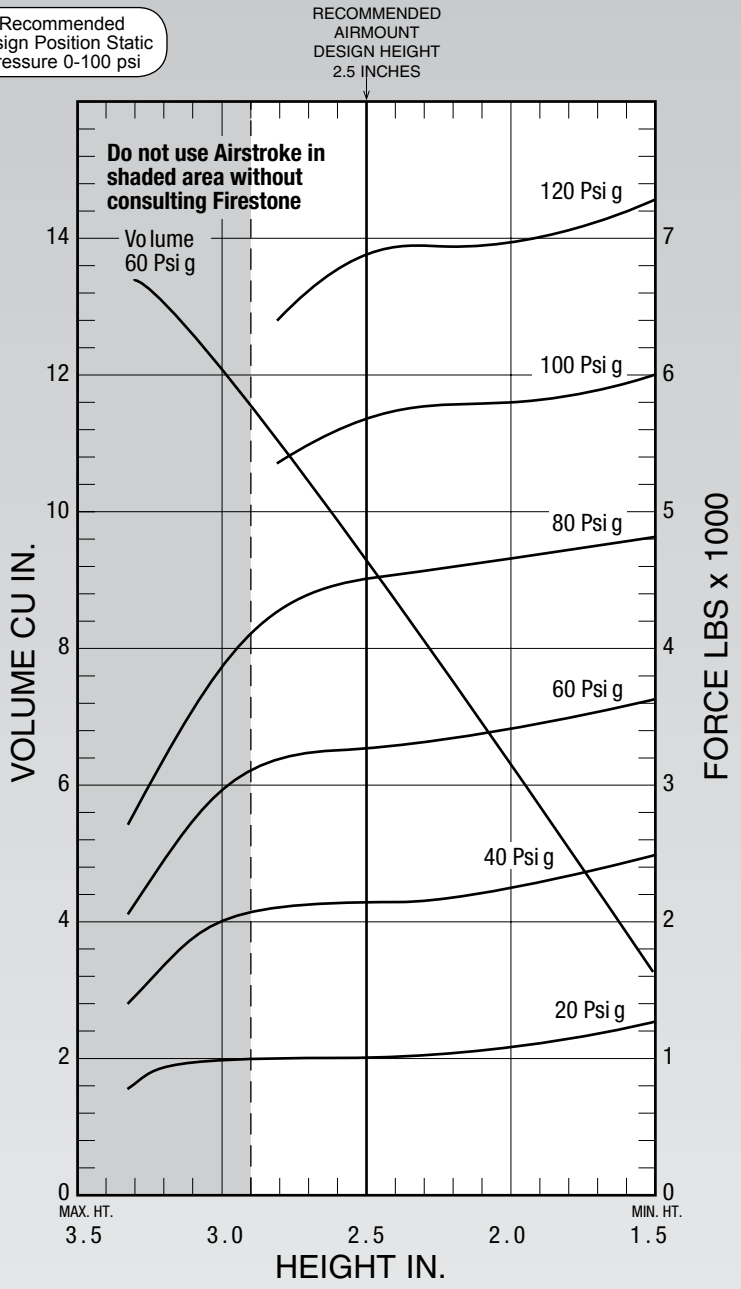
Assembly Height (in.)	Volume @ 60 PSIG (in^3)	Pounds Force				
		@10 PSIG	@20 PSIG	@30 PSIG	@40 PSIG	@50 PSIG
.63		24	49	73	129	247
.73		23	46	69	100	174
.83		23	47	70	102	146
.93		24	49	73	109	139
1.03		26	51	77	115	132
1.13		32	63	95	101	114

1M1A-0 Firestone

AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

Description		Assembly Order No.
Style 1M1A-0 Two Ply Bellows	Blind nut, 1/8 NPT, plastic stud	W02-358-3000
	Blind nut, 1/8 NPT, brass stud	W02-358-3001
	Blind nut, 1/8 NPT, brass stud, stainless steel ring	W02-358-3005
Assembly weight..... 0.5 lbs.		
Force to collapse to minimum height (@ 0 PSIG)..... 20 lbs.		



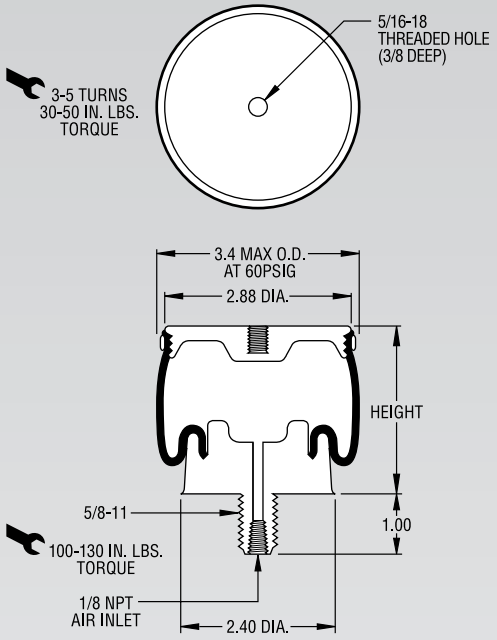


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 2.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 60 PSIG = 9.2 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	210	336	235	3.92
60	330	467	224	3.73
80	450	619	220	3.67
100	570	740	214	3.57

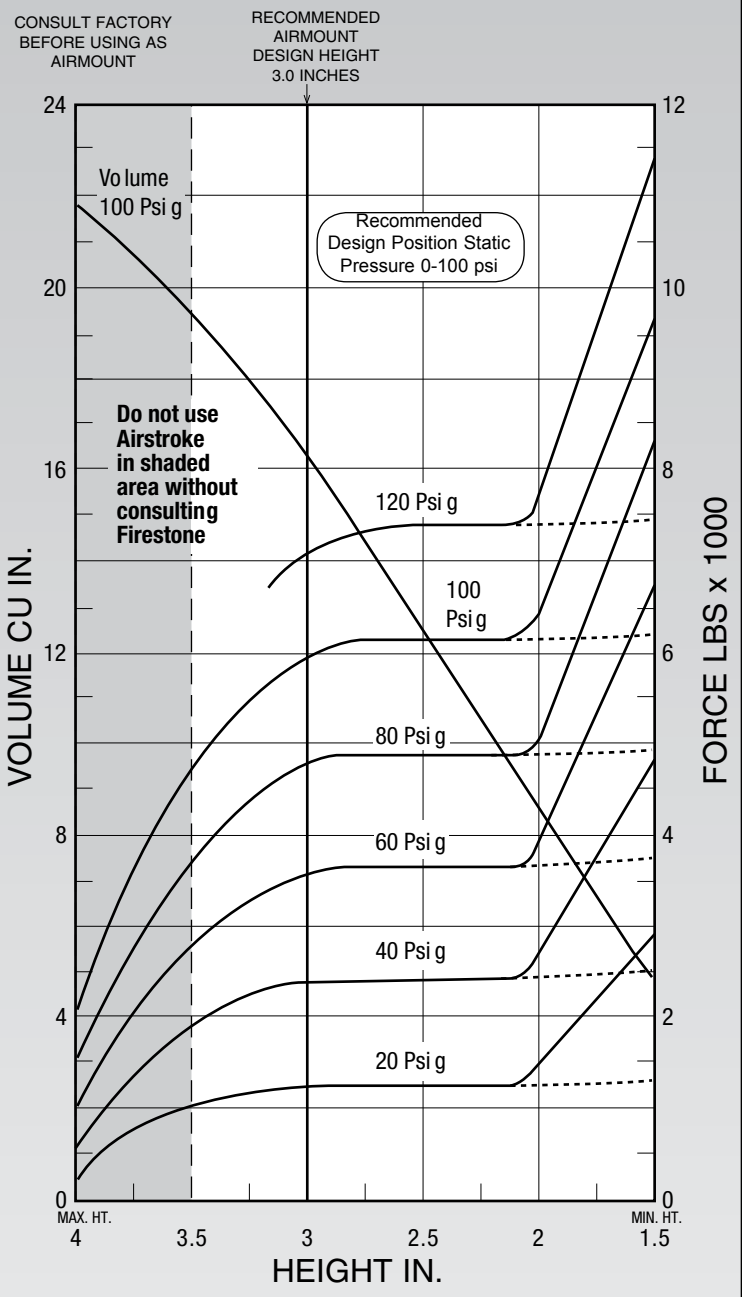
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 60 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
2.0	6	110	230	340	460	580

Description		Assembly Order No.
Style 1M1A-1 Two Ply Bellows	Blind nut, 1/8 NPT, brass stud	W02-358-3003
Assembly weight..... 0.5 lbs.		
Force to collapse to minimum height (@ 0 PSIG)..... 20 lbs.		



NOTE: The dotted line on the static data chart shows the force capabilities of the 1M1A-1 when attaching an additional 0.5 inch pedestal, provided by the customer, to the base of the air spring. If an additional pedestal is not used, the air spring will behave as the solid line depicts. Without a pedestal the rubber part will contact the ground at the height of 2.1 inches and could cause the rubber part to wear prematurely.

Dynamic Characteristics at 3.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 14 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	235	191	199.52	3.33
60	356	274	169.93	2.83
80	475	352	161.74	2.70
100	593	458	165.29	2.75

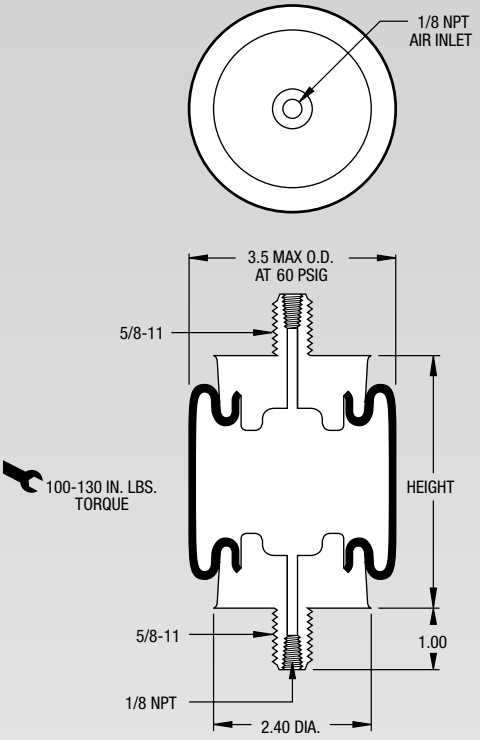


SEE PAGE 12 for instructions on how to use chart.

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
3.0	14	118	235	356	475	593

AIRSTROKE ACTUATOR ONLY

	Description	Assembly Order No.
Style 2M1A Two Ply Bellows	1/8 NPT, each end, plastic studs	W02-358-3002
	1/8 NPT, each end brass studs	W02-358-3004
Assembly weight..... 0.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 30 lbs.		



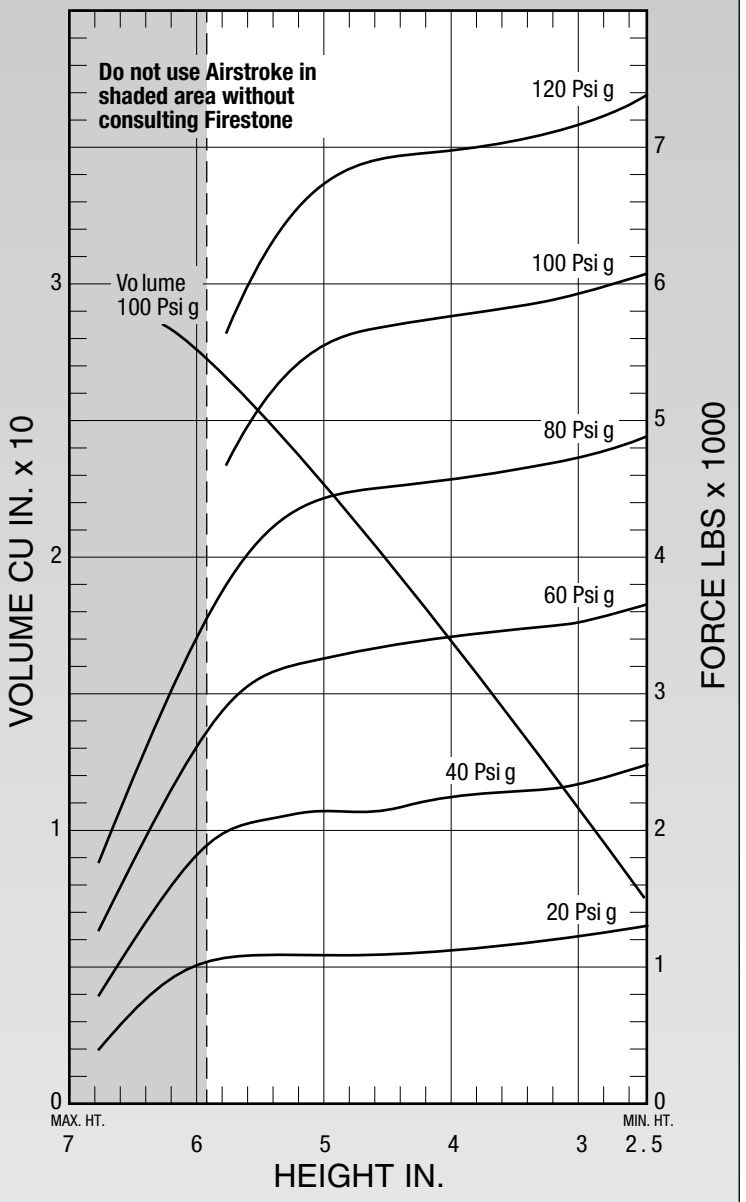
NOTE: This Airstroke actuator must be guided throughout the stroke.

NOTE: Do not use as an Airmount isolator.

NOTE: Plug off one end. (This part is single acting)

NOTE:
Do not use as an Airmount isolator.

Recommended Design Position Static Pressure 0-100 psi

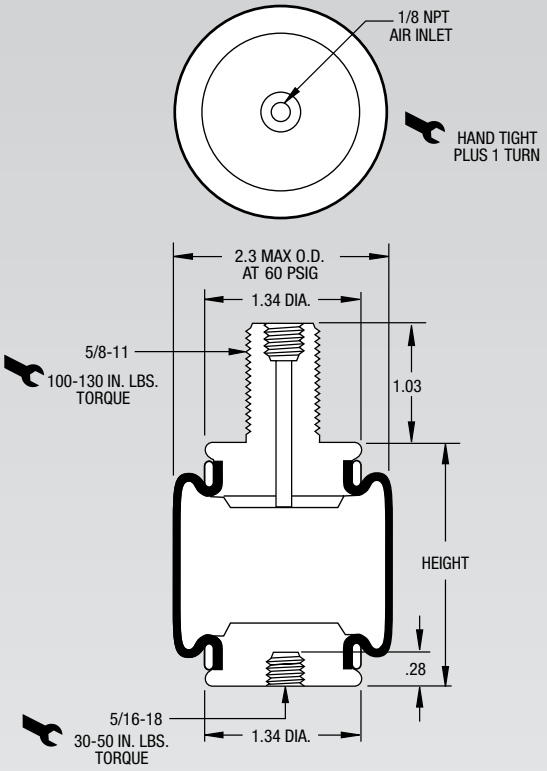


See page 12 for instructions on how to use chart.

Force Table (Use for Airstroke™ actuator design)

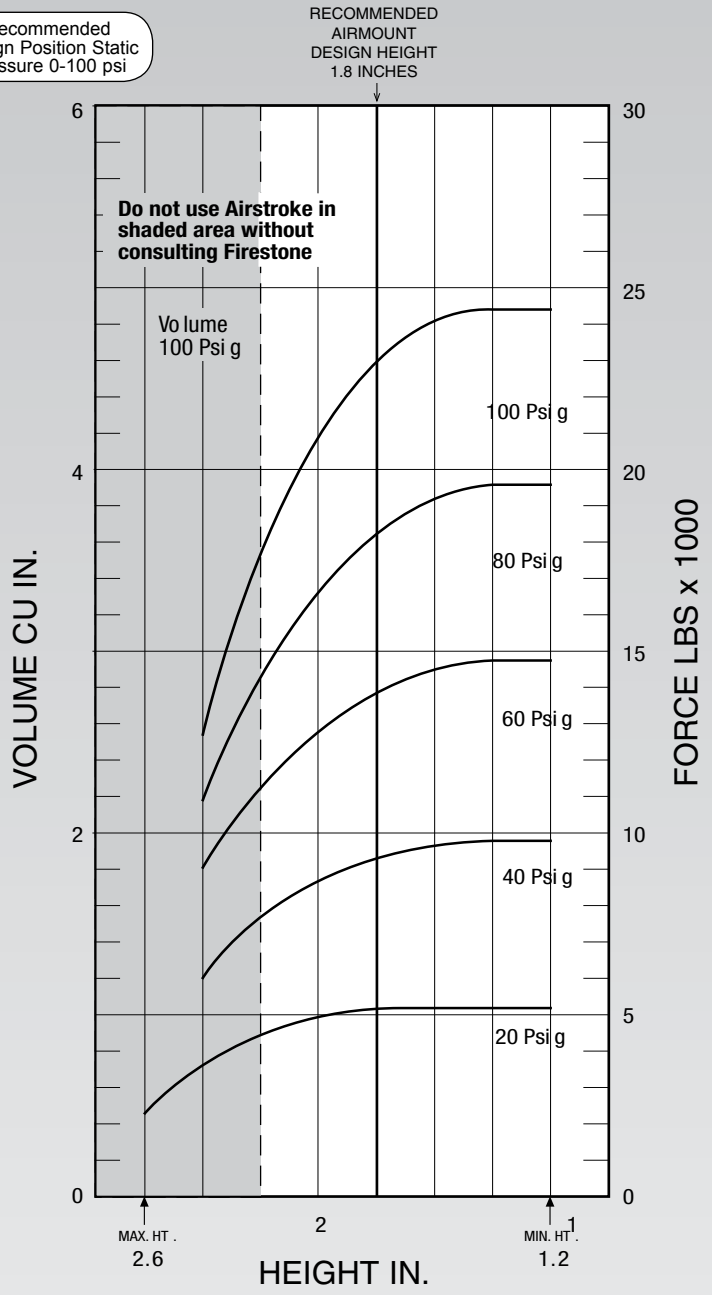
Assembly Height (in.)	Volume @ 60 PSIG (in^3)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6.0	28	100	180	270	350	430
5.0	23	110	210	330	440	560
4.0	17	120	230	340	460	580
3.0	11	120	240	350	480	600

Description		Assembly Order No.
Style 2M2A Two Ply Bellows	Blind nut,1/8 NPT, plastic studs	W02-358-3008
Assembly weight .....0.15 lbs.		
Force to collapse to minimum height (@ 0 PSIG).....5 lbs.		



NOTE: This Airstroke actuator must be guided throughout the stroke.

NOTE: The 2M2A is laterally unstable when used unsupported as an isolator. Contact Firestone for use in isolation applications.

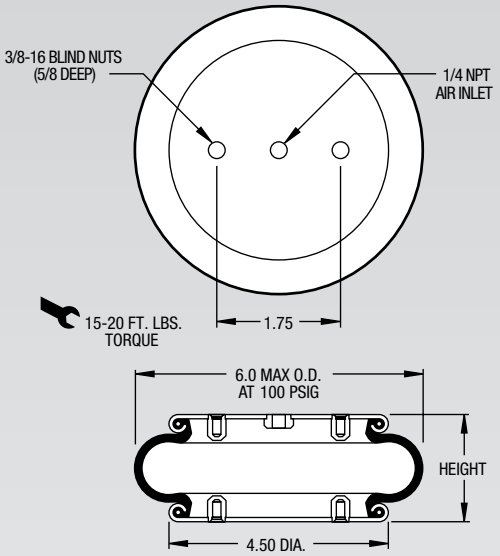


See page 12 for instructions on how to use chart.

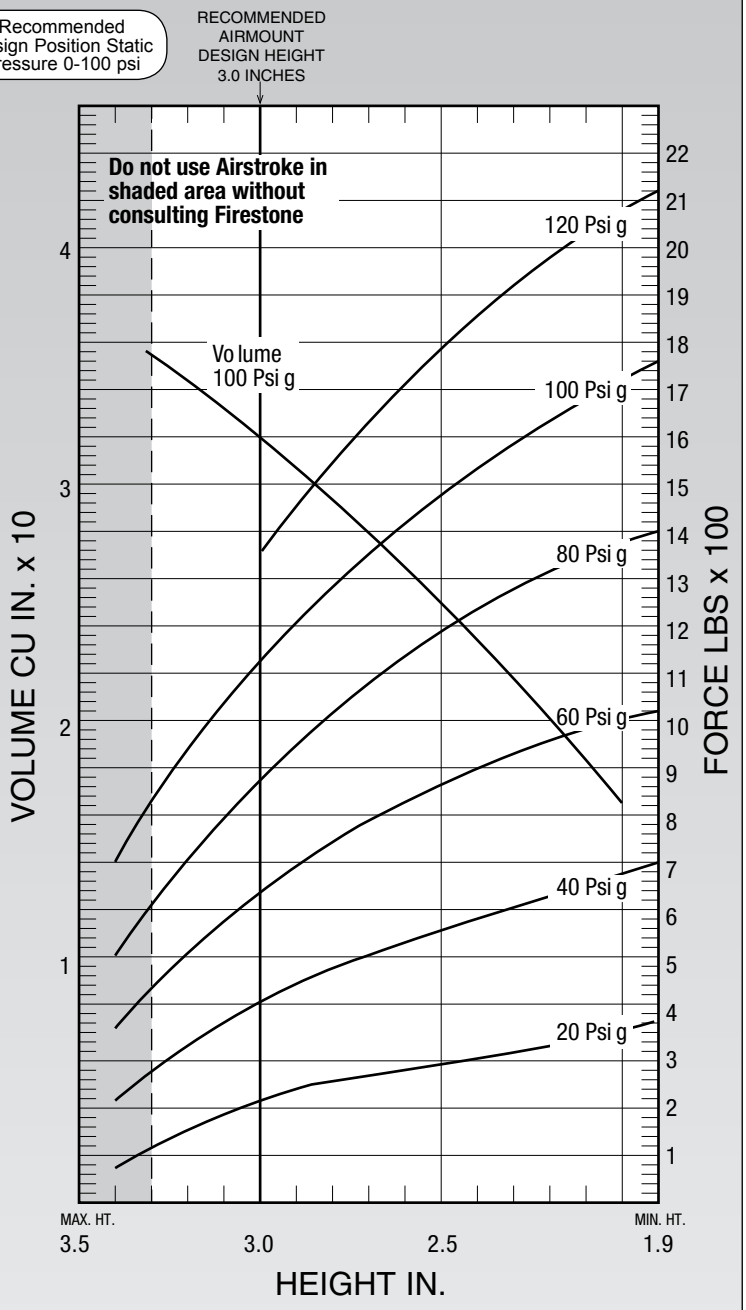
Dynamic Characteristics at 1.8 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 4.39 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	95	122	213	3.55
60	140	175	210	3.51
80	184	230	210	3.51
100	228	289	211	3.53

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 60 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
2.2	5.37	40	76	110	140	160
2.0	4.88	44	88	127	167	205
1.8	4.39	52	95	140	184	228
1.6	3.90	52	97	144	192	240
1.4	3.42	52	99	148	196	242
1.2	2.93	52	98	148	196	242

	Description	Assembly Order No.
Style 16 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7001
	Blind nuts, 3/4 NPT	W01-358-6996
	Socket head aluminum bead rings (bolts, nuts, washers not included-use 1/4 cap screws)	W01-358-0017
	3/4 NPT (only) upper plate, blind nuts lower plate	W01-358-0286
	Rubber bellows only	W01-358-0010
Assembly weight..... 2.5 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 30 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. Bolts are not included. See pages 8-10 for explanation.

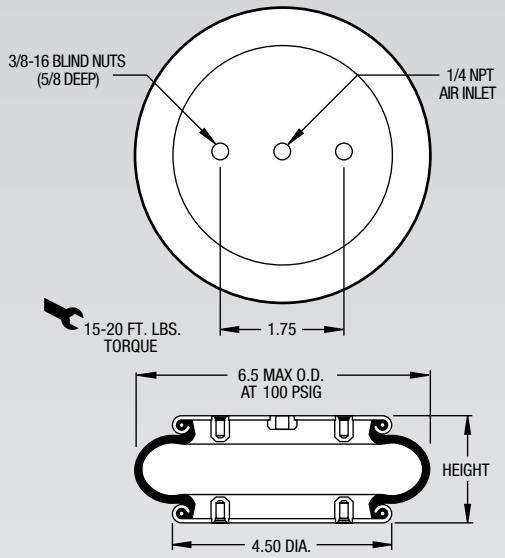


See page 12 for instructions on how to use chart.

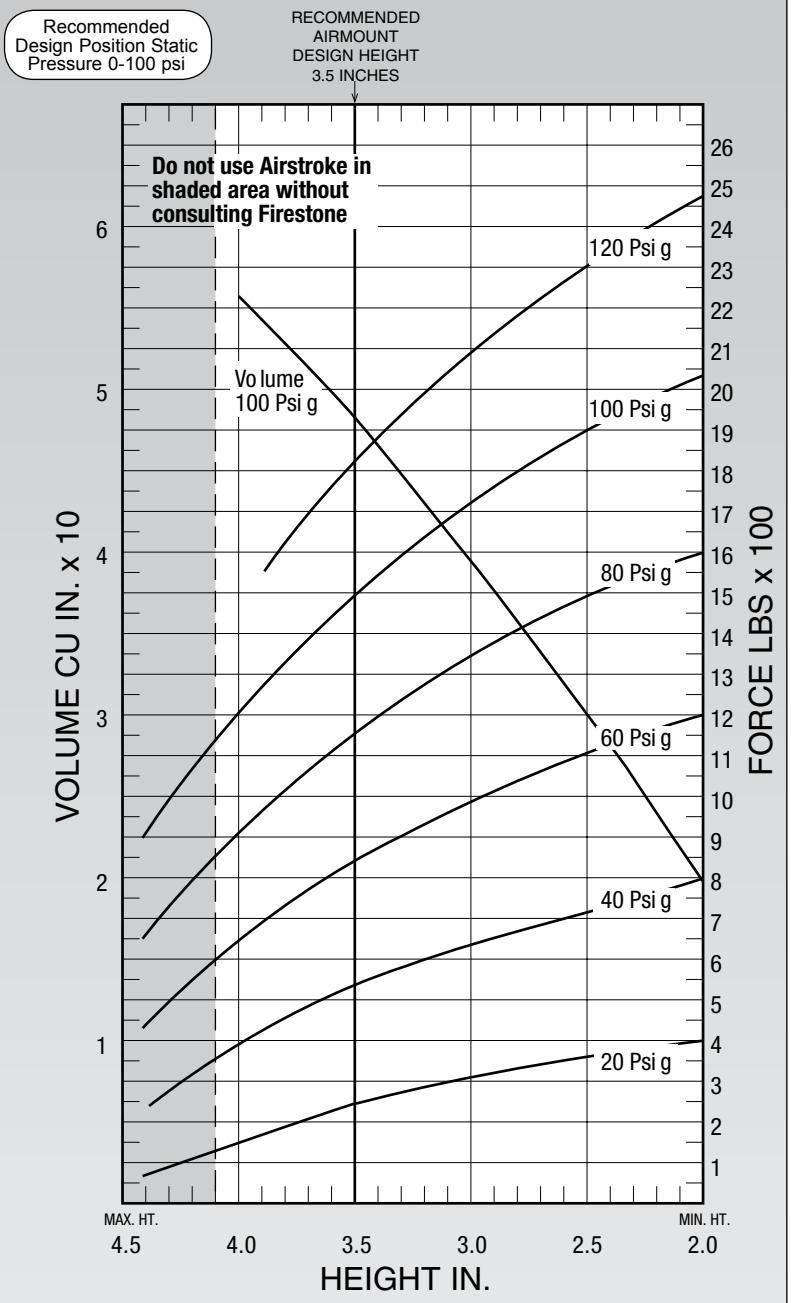
Dynamic Characteristics at 3.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 32 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	420	765	254	4.24
60	640	1,088	244	4.07
80	880	1,410	237	3.96
100	1,120	1,710	232	3.86

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
3.0	32	220	420	640	880	1,120
2.0	17	350	680	1,020	1,370	1,720

	Description	Assembly Order No.
Style 131 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7731
	Blind nuts, 3/4 NPT	W01-358-7742
	Socket head aluminum bead rings (bolts, nuts, washers not included-use 1/4 cap screws)	W01-358-0127
	3/4 NPT (only) upper plate, blind nuts lower plate	W01-358-7729
	Rubber bellows only	W01-358-0131
Assembly weight..... 2.8 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 32 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. Bolts are not included. See pages 8-10 for explanation.

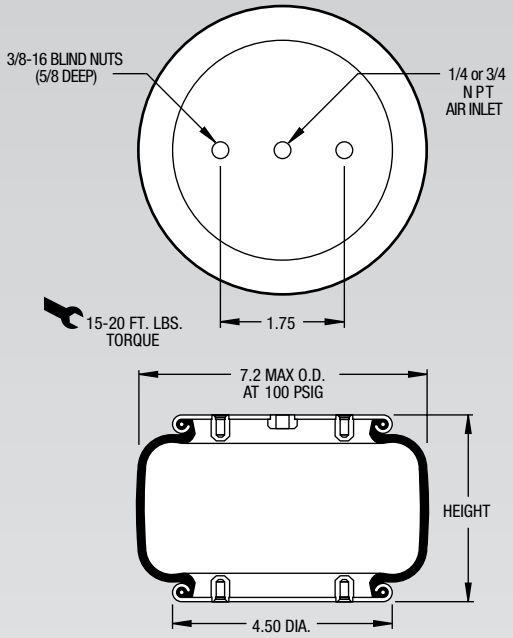


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 3.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 53 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	550	587	195	3.25
60	850	833	186	3.09
80	1,170	1,082	181	3.01
100	1,510	1,331	176	2.94

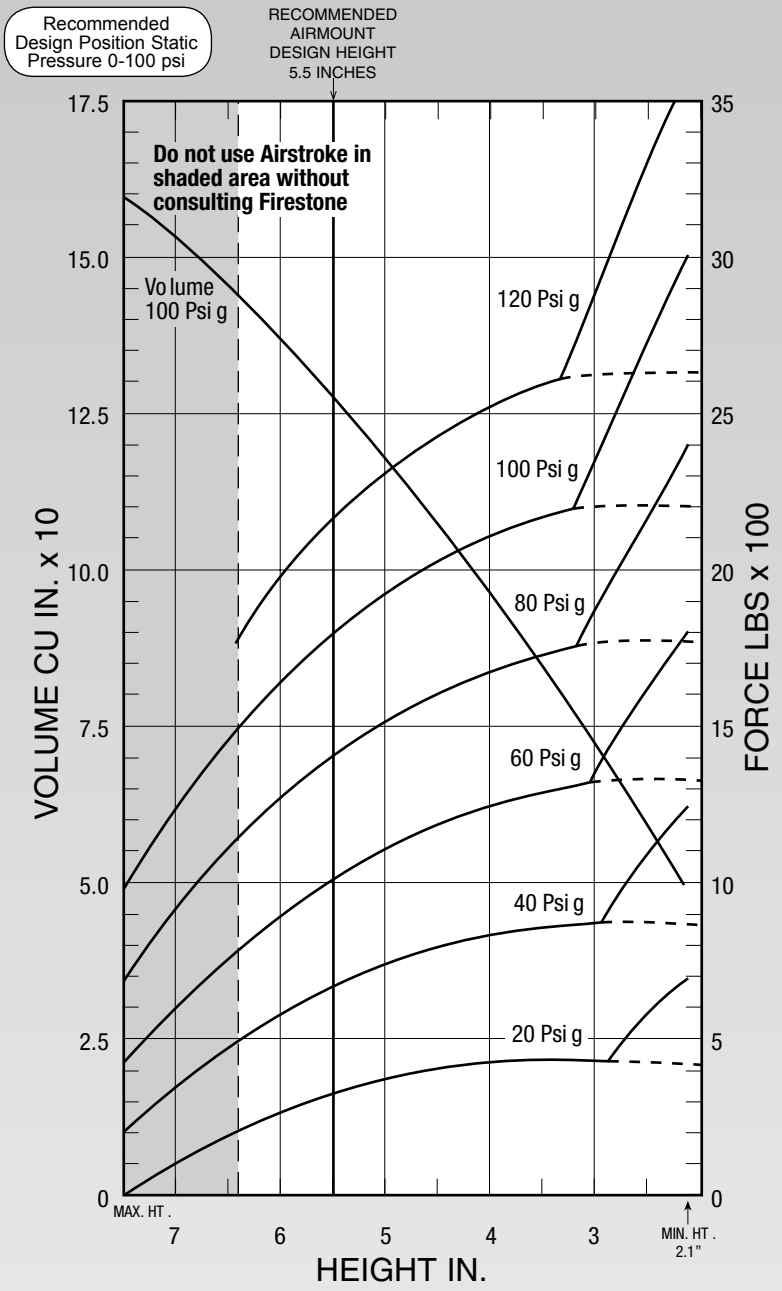
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
4.0	56	160	400	650	910	1,210
3.0	39	310	640	990	1,350	1,730
2.0	20	390	790	1,200	1,600	2,050

	Description	Order No.
Style 160 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7751
	Blind nuts, 3/4 NPT	W01-358-7752
	Socket head aluminum bead rings (bolts, nuts, washers not included-use 1/4 cap screws)	W01-358-7592
Assembly weight.....3.0 lbs.		
Force to collapse to minimum height (@ 0PSIG)... 140 lbs.		



NOTE: The dotted line on the static data chart shows the force capabilities of the 160 when attaching an additional 0.5" pedestal, provided by the customer, to both ends of the air spring. If an additional pedestal is not used, the air spring will behave as the solid line depicts. Without the pedestal the rubber part will contact the mounting surface at the height of 2.9". This could cause wear prematurely to the rubber part.

NOTE: A bead plate part is shown. This part is also available with bead rings. Bolts are not included. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

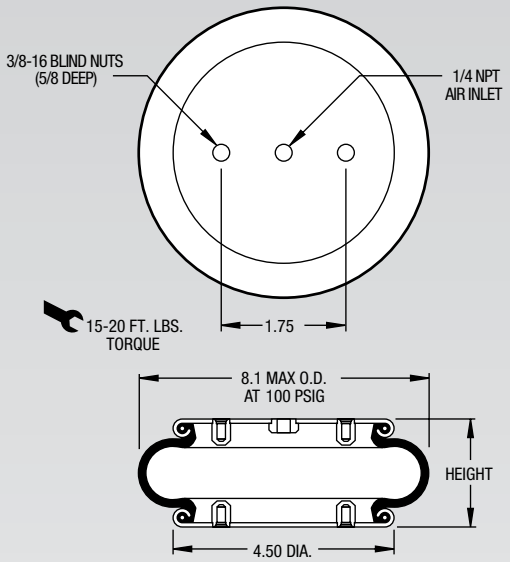
Dynamic Characteristics at 5.5 in. Design Heights
(Required for Airmount isolator design only)

Volume @ 100 PSIG = 128 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	650	327	133	2.22
60	1010	464	127	2.12
80	1390	601	124	2.07
100	1760	737	121	2.02

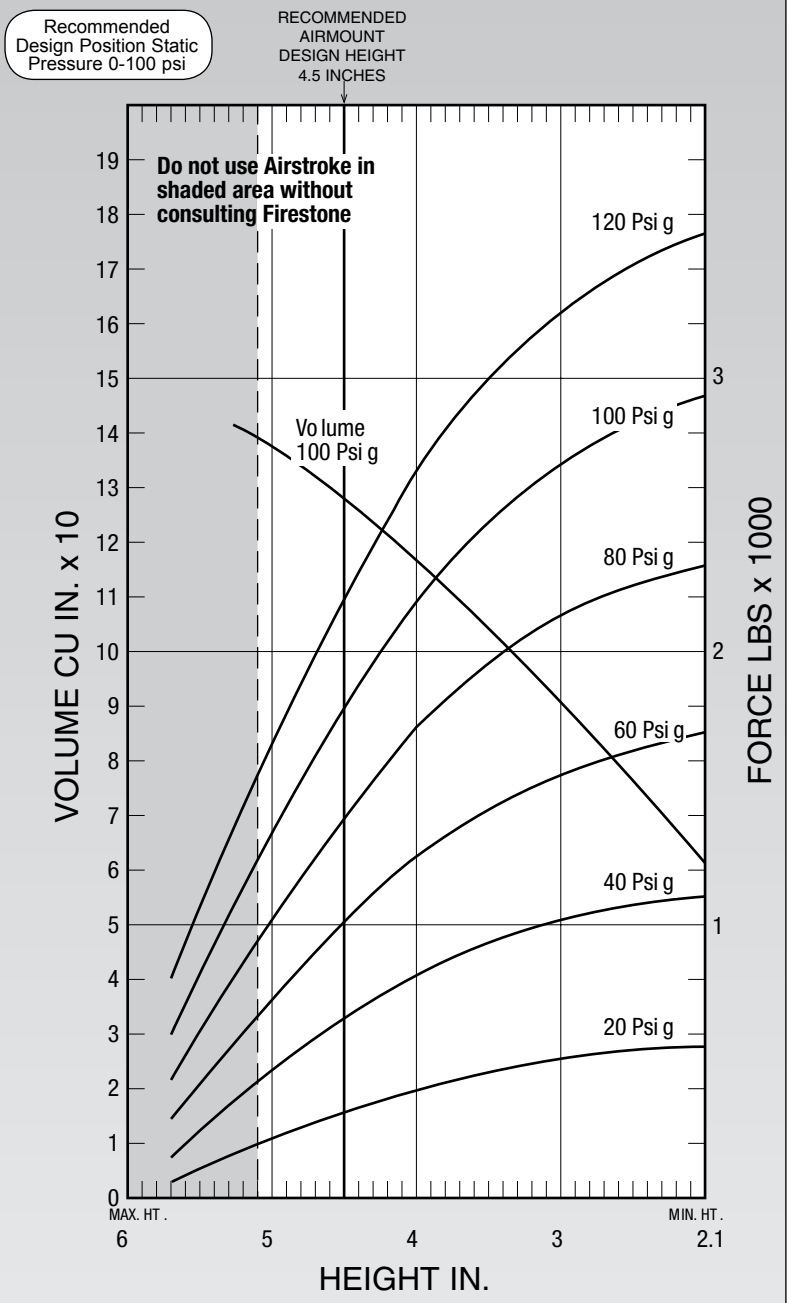
Force Table (Use for Airstroke™ actuator design)

Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6	137	240	560	900	1250	1620
5	118	340	710	1100	1500	1920
4	97	400	810	1240	1670	2110
3	73	440	870	1360	1870	2390

	Description	Assembly Order No.
Style 110 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7451
	Blind nuts, 3/4 NPT	W01-358-7484
	Socket head aluminum bead rings (bolts, nuts, washers not included-use 1/4 cap screws)	W01-358-0112
	Rubber bellows only	W01-358-0100
Assembly weight..... 3.0 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 8 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. Bolts are not included. See pages 8-10 for explanation.

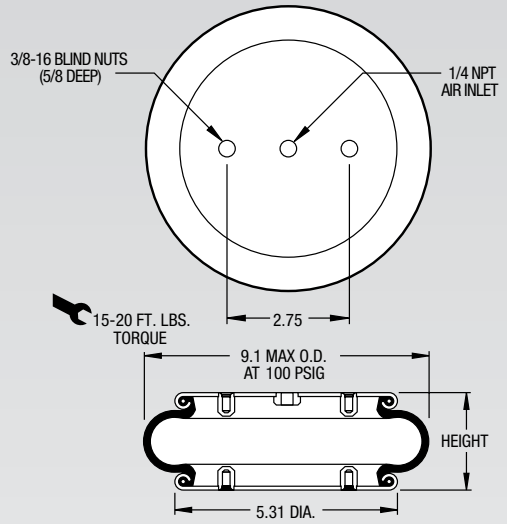


See page 12 for instructions on how to use chart.

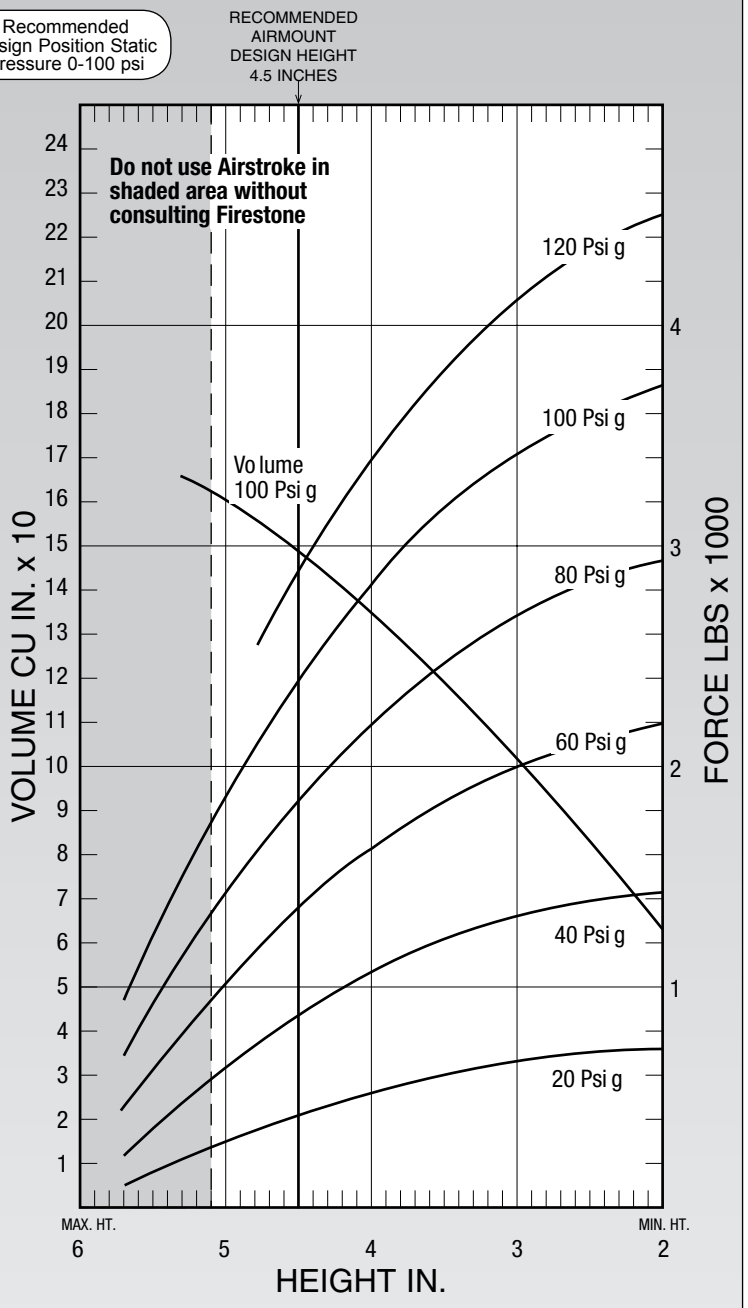
Dynamic Characteristics at 4.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 128 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	650	554	173	2.88
60	1,010	795	167	2.77
80	1,390	1,046	162	2.71
100	1,790	1,294	160	2.66

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
4.0	117	390	810	1,240	1,700	2,160
3.0	91	490	1,010	1,540	2,090	2,650

	Description	Assembly Order No.
Style 116 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7564
	Blind nuts, 3/4 NPT	W01-358-7561
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7568
	Blind nuts with installed 1/4 tank valve	W01-A72-7518
	Rubber bellows only	W01-358-0133
Assembly weight..... 4.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 8 lbs.		
Style 117 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-7600
	Blind nuts, 3/4 NPT	W01-358-7602
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7606



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

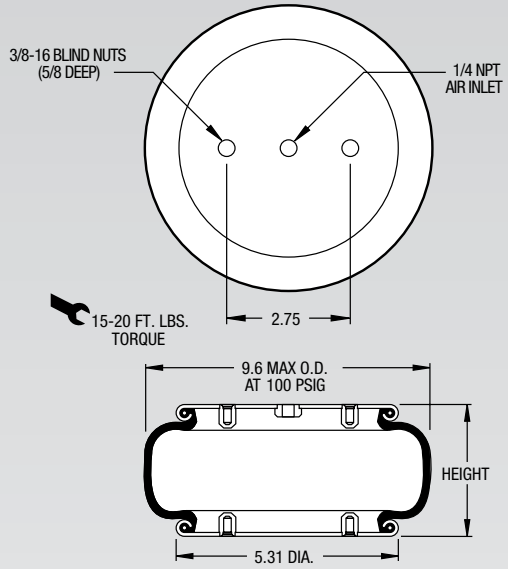


See page 12 for instructions on how to use chart.

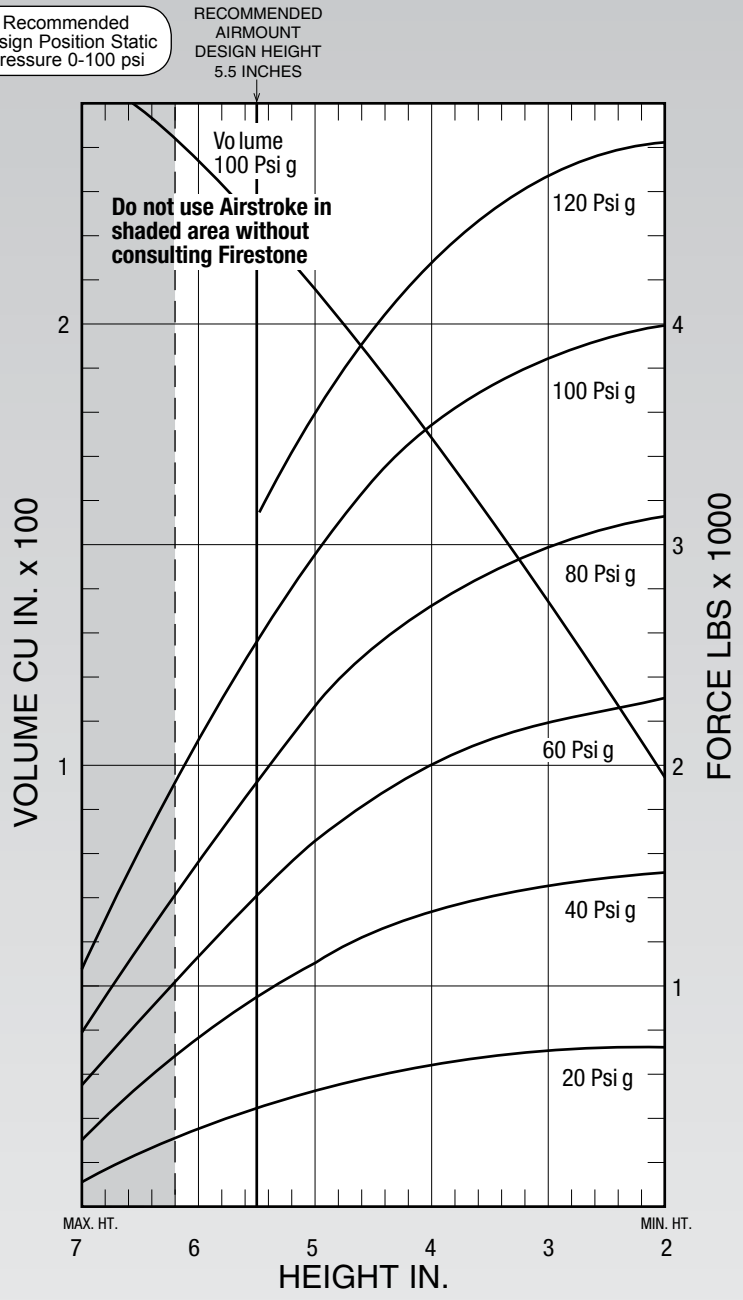
Dynamic Characteristics at 4.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 149 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	850	736	175	2.91
60	1,330	1,070	168	2.80
80	1,830	1,374	163	2.71
100	2,360	1,688	159	2.65

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	161	290	600	970	1,370	1,800
4.0	135	520	1,050	1,630	2,210	2,820
3.0	102	650	1,310	2,000	2,690	3,410

	Description	Assembly Order No.
Style 116-1 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7598
	Blind nuts, 3/4 NPT	W01-358-7605
Assembly weight..... 4.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 37 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



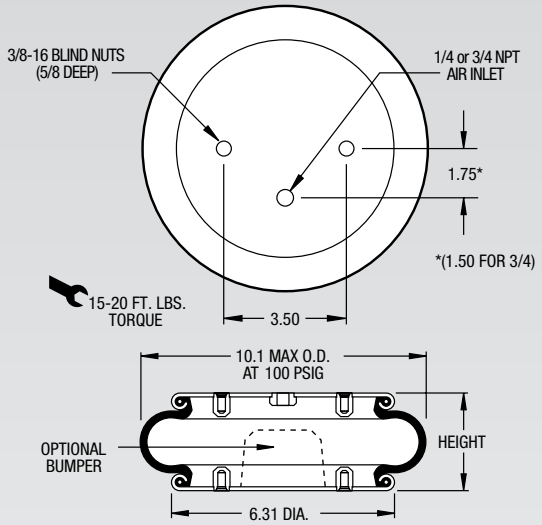
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 225 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	940	564	145	2.42
60	1,410	803	141	2.36
80	1,930	1,054	139	2.31
100	2,530	1,327	136	2.26

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6.0	237	360	750	1,150	1,580	2,090
5.0	210	540	1,100	1,650	2,240	2,920
4.0	178	650	1,330	2,000	2,710	3,490
3.0	139	710	1,450	2,200	2,980	3,810

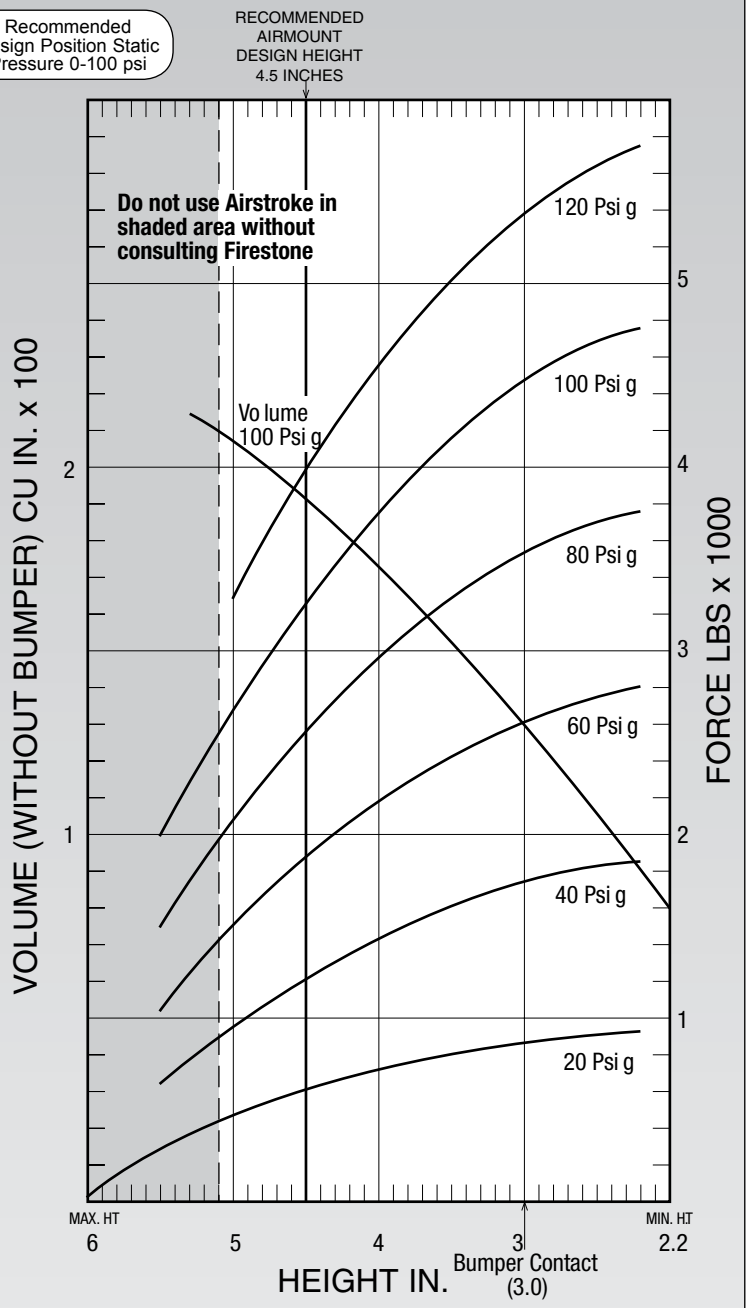
	Description	Assembly Order No.
Style 115 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7460
	Blind nuts, 1/4 NPT rubber bumper	W01-358-7459
	Blind nuts, 3/4 NPT	W01-358-7465
	Blind nuts, 3/4 NPT rubber bumper	W01-358-7458
	Countersunk steel bead rings, $1^5/_8$ bolts, nuts, washers	W01-358-7469
	Blind nuts, 3/4 NPT both ends (centered)	W01-606-7115
	Rubber bellows only	W01-358-0118
Assembly weight..... 5.7 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 8 lbs.		

Style 124 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-7650
	Blind nuts, 3/4 NPT	W01-358-7649



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

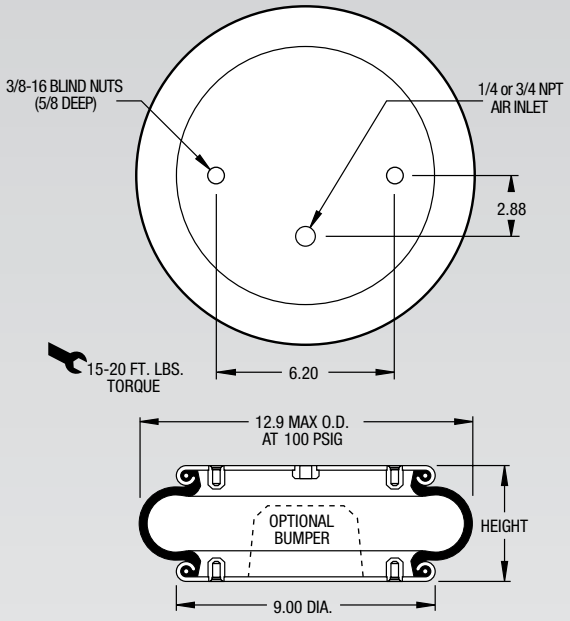
Dynamic Characteristics at 4.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 192 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,210	900	162	2.70
60	1,880	1,264	154	2.57
80	2,540	1,638	151	2.52
100	3,270	2,027	148	2.47



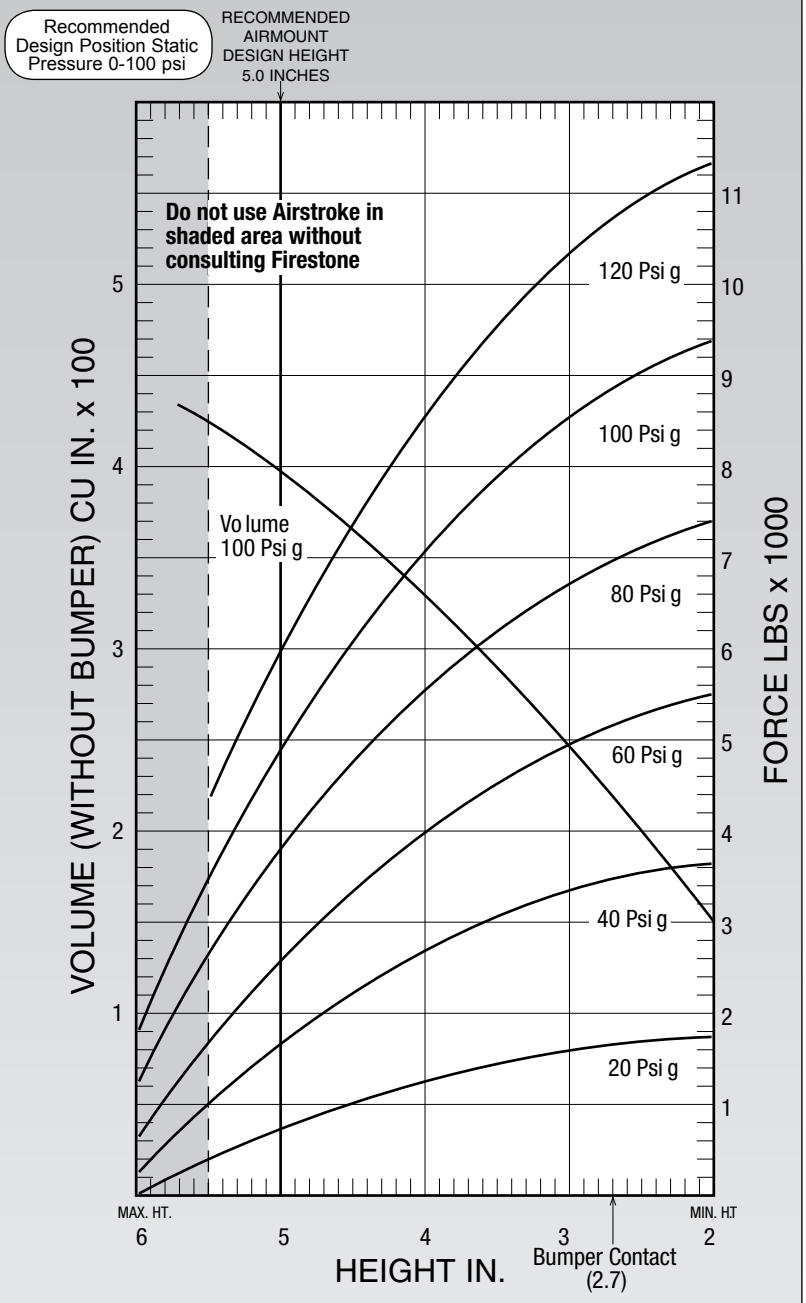
See page 12 for instructions on how to use chart.

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	209	470	960	1,520	2,080	2,690
4.0	174	700	1,430	2,180	2,940	3,750
3.0	130	820	1,720	2,630	3,510	4,440

	Description	Assembly Order No.
Style 19 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7008
	Blind nuts, 1/4 NPT, bumper	W01-358-7009
	Blind nuts, 3/4 NPT	W01-358-7011
	Blind nuts, 3/4 NPT, bumper	W01-358-7012
	Countersunk steel bead rings, $1^5/_8$ bolts, nuts, washers	W01-358-7023
	Rubber bellows only	W01-358-0134
Assembly weight..... 9.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG)..... 9 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

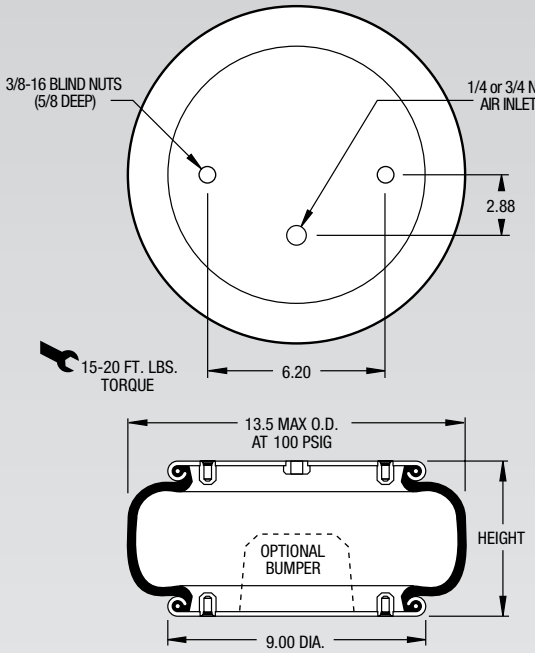


See page 12 for instructions on how to use chart.

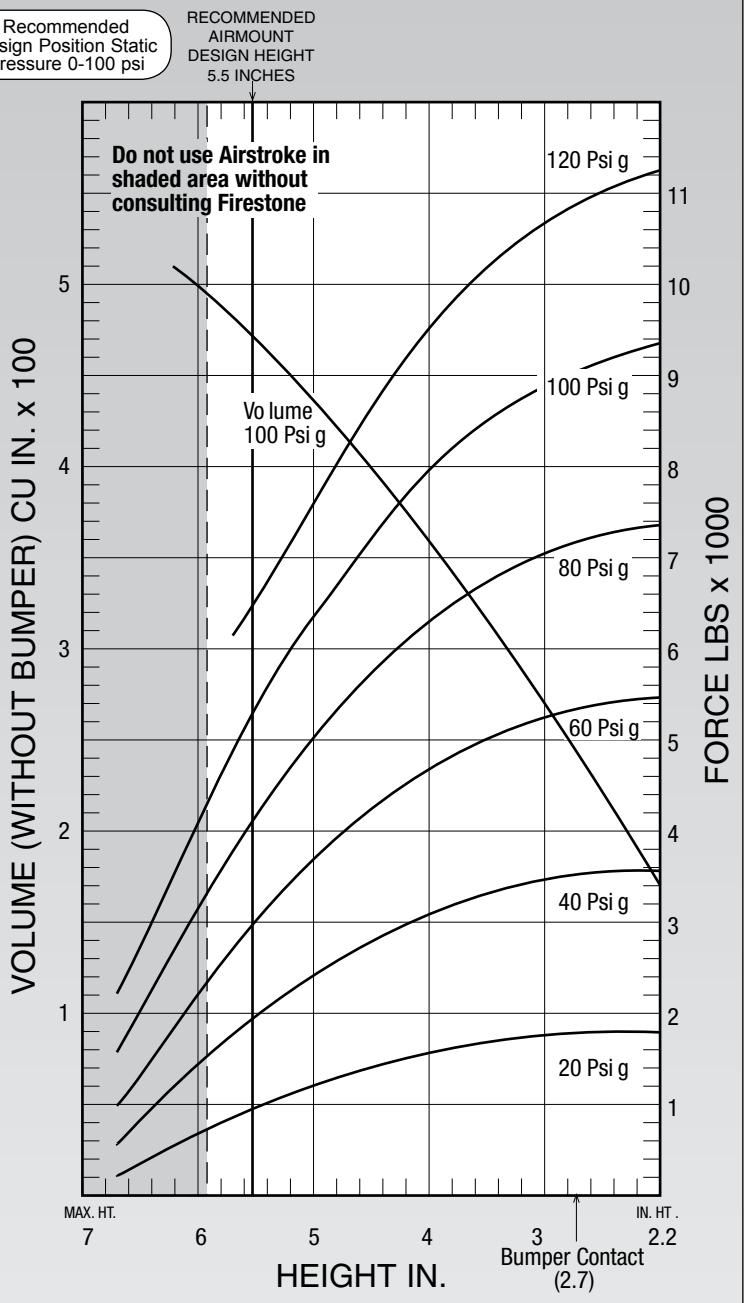
Dynamic Characteristics at 5.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 394 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,690	1,607	183	3.06
60	2,640	2,322	176	2.93
80	3,730	3,000	168	2.81
100	4,870	3,669	163	2.72

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	394	780	1,690	2,640	3,730	4,870
4.0	327	1,300	2,610	4,060	5,500	7,050
3.0	244	1,580	3,280	5,000	6,720	8,440

	Description	Assembly Order No.
Style 19-.75 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7040
	Blind nuts, 1/4 NPT rubber bumper	W01-358-7039
	Blind nuts, 3/4 NPT	W01-358-7042
	Blind nuts, 3/4 NPT rubber bumper	W01-358-7043
	Counter-sunk steel bead rings, 1 5/8 bolts, nuts, washers	W01-358-6896
Assembly weight..... 9.9 lbs.		
Force to collapse to minimum height (@ 0 PSIG)..... 15 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



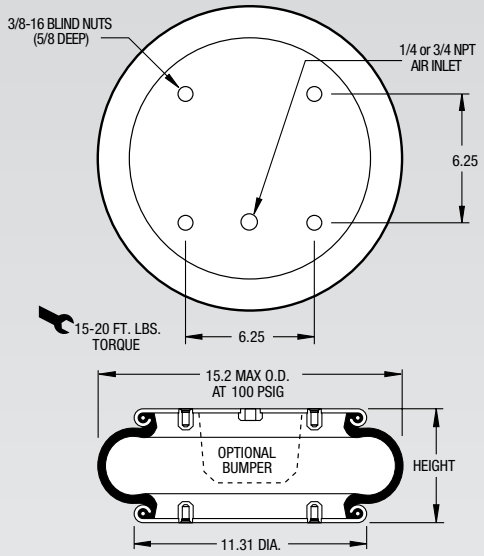
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 470 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,890	1,544	170	2.83
60	2,950	2,203	162	2.70
80	4,080	2,829	156	2.60
100	5,260	3,448	152	2.53

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	438	1,190	2,390	3,670	5,000	6,360
4.0	359	1,560	3,110	4,710	6,330	7,980
3.0	270	1,730	3,460	5,240	7,040	8,850

	Description	Assembly Order No.
Style 113 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7103
	Blind nuts, 1/4 NPT, bumper	W01-358-7104
	Blind nuts, 3/4 NPT	W01-358-7101
	Blind nuts, 3/4 NPT, bumper	W01-358-7109
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7110
	Blind nuts, 1/8 NPT	W01-753-7113
	Blind nuts, 1 1/4 NPT	W01-753-7114
	Rubber bellows only	W01-358-0135
Assembly weight..... 14.1 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 17 lbs.		

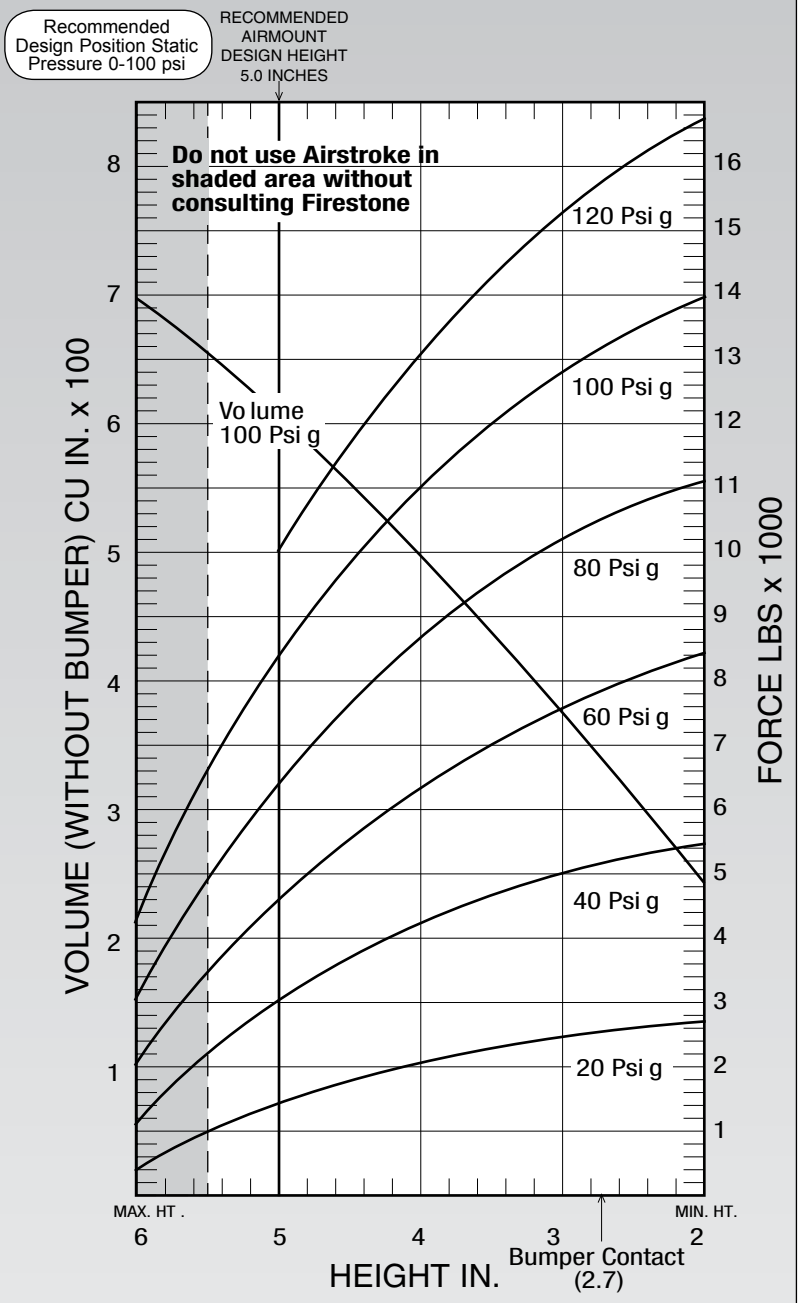
Style 128 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-8151
	Blind nuts, 1/4 NPT, rubber bumper	W01-358-8149
	Blind nuts, 3/4 NPT	W01-358-8152
	Blind nuts, 3/4 NPT, rubber bumper	W01-358-8150
	Rubber bellows only	W01-358-0231



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

Dynamic Characteristics at 5.0 in. Design Height
(Required for Airmount isolator design only)

Volume @ 100 PSIG = 601 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,010	2,322	165	2.75
60	4,610	3,288	158	2.64
80	6,460	4,247	152	2.54
100	8,320	5,176	148	2.47



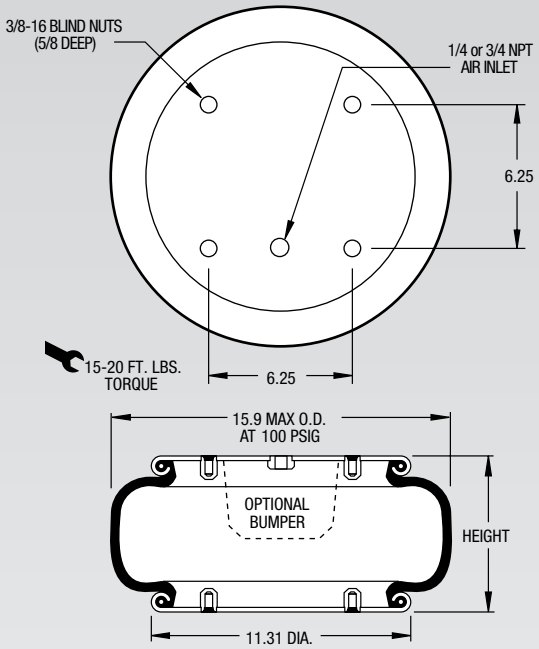
See page 12 for instructions on how to use chart.

Force Table (Use for Airstroke™ actuator design)

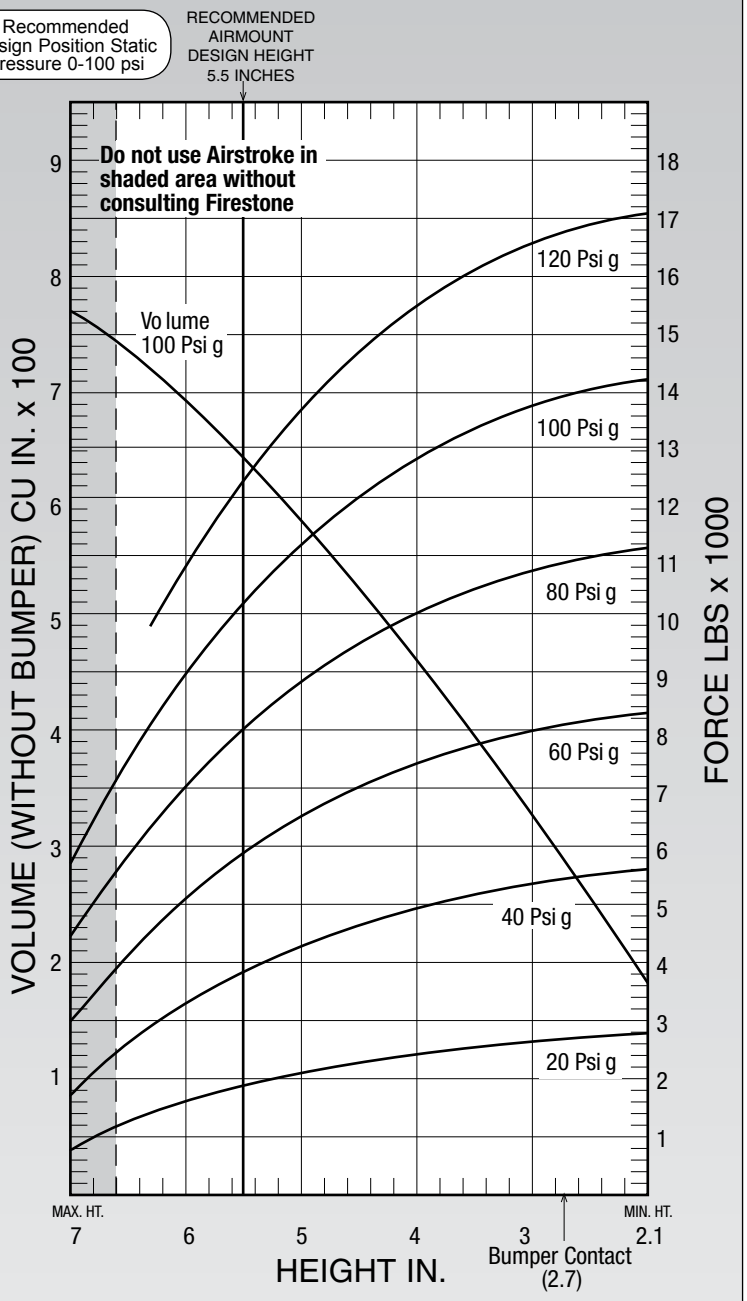
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	601	1,420	3,010	4,610	6,460	8,320
4.0	499	2,030	4,160	6,340	8,640	10,820
3.0	375	2,430	5,000	7,610	10,220	12,820

	Description	Assembly Order No.
Style 113-1 / Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7091
	Blind nuts, 3/4 NPT	W01-358-7092
	Blind nuts, 3/4 NPT, rubber bumper	W01-358-7094
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7277
	Rubber bellows only	W01-358-0150
Assembly weight..... 14.5 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 25 lbs.		

Style 128-1 / High Strength Bellows	Blind nuts, 3/4 NPT	W01-358-8160
	Blind nuts, 3/4 NPT, rubber bumper	W01-358-8162



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

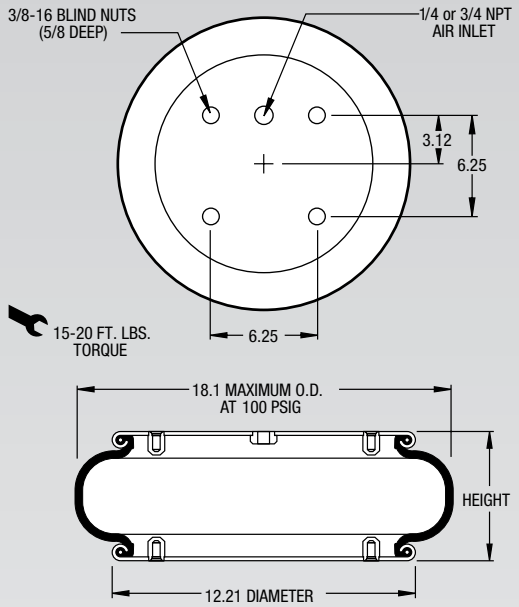


See page 12 for instructions on how to use chart.

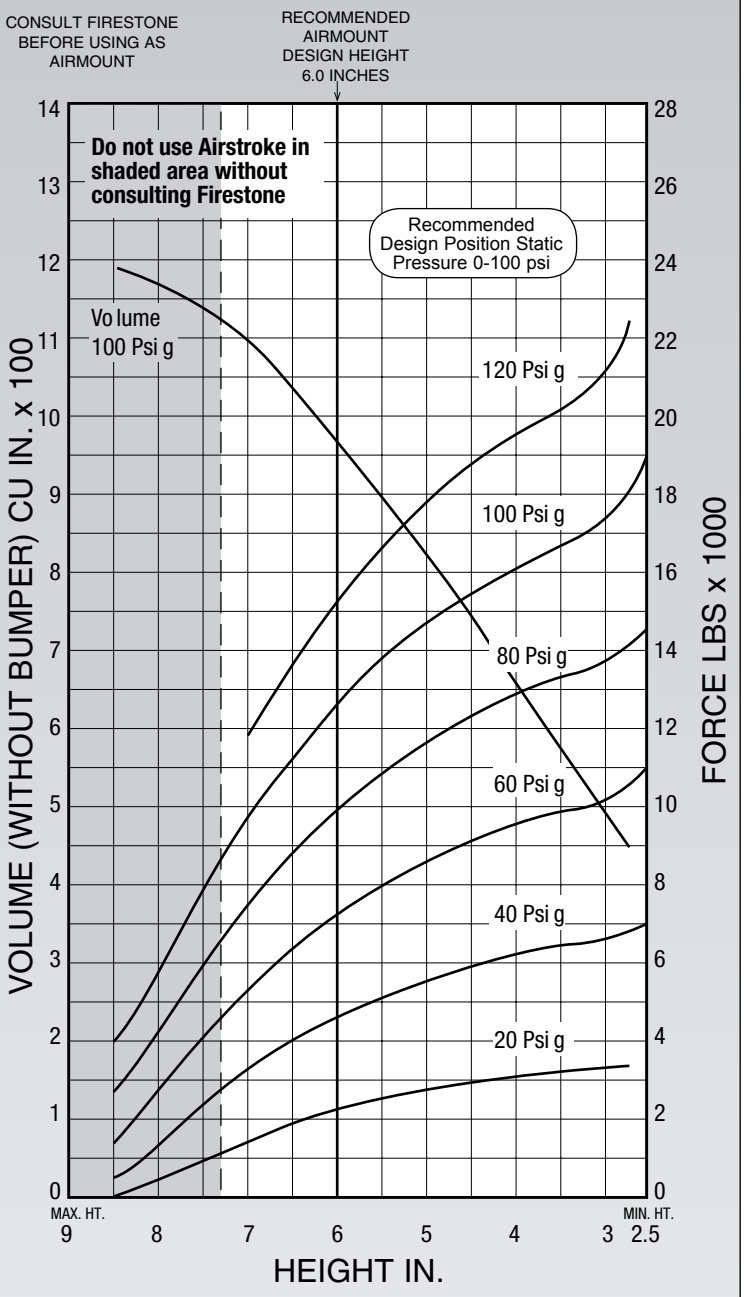
Dynamic Characteristics at 5.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 641 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,820	2,198	142	2.37
60	5,900	3,091	136	2.26
80	7,990	3,986	133	2.21
100	10,200	4,923	130	2.17

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6.0	692	1,600	3,270	5,130	7,000	8,990
5.0	586	2,070	4,260	6,530	8,800	11,200
4.0	463	2,440	4,940	7,470	10,080	12,710
3.0	328	2,660	5,360	8,060	10,860	13,630

	Description	Assembly Order No.
Style 153-2 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-8158
	Blind nuts, 3/4 NPT	W01-358-8157
Assembly weight..... 17.1 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

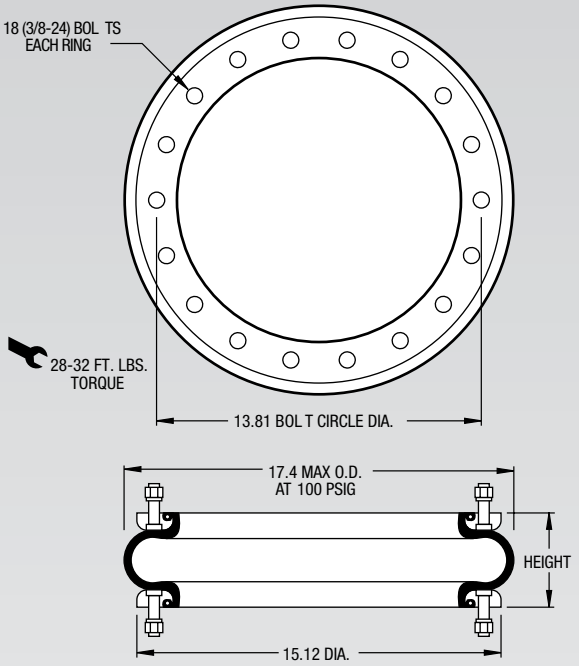


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 6.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 981 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	4,564	2,202	131	2.18
60	7,048	3,153	126	2.10
80	9,682	4,031	121	2.02
100	12,385	4,958	119	1.98

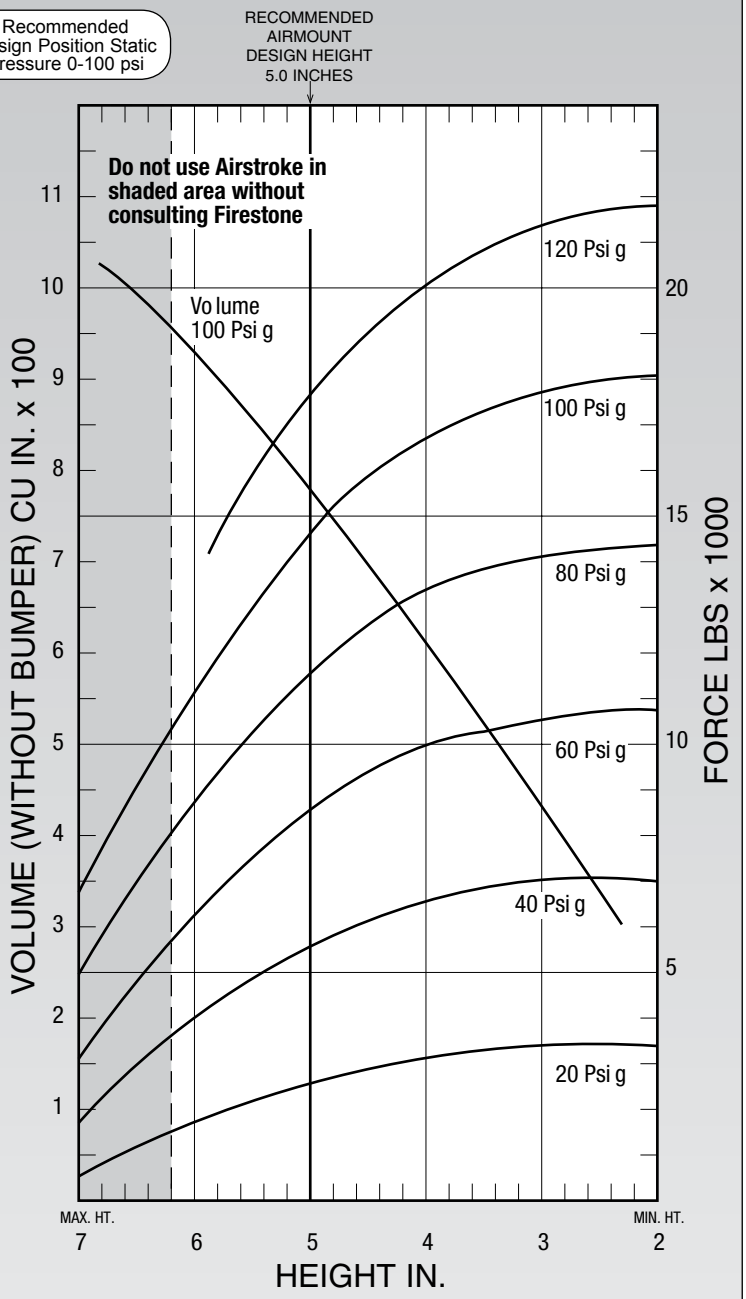
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
8.0	1,169	425	1,260	2,566	4,038	5,636
7.0	1,094	1,423	3,210	5,194	7,334	9,528
6.0	981	2,140	4,564	7,048	9,682	12,385
5.0	840	2,676	5,476	8,458	11,440	14,471
4.0	679	3,051	6,153	9,478	12,738	15,965
3.0	510	3,219	6,609	10,069	13,550	17,218

Description		Assembly Order No.
Style 119 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), $1^7/_8$ bolts, nuts, washers	W01-358-7478
	Rubber bellows only	W01-358-0119
	Rolled Plate Assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-7477
Assembly weight..... 12.1 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 17 lbs.		



NOTE: A bead plate part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*

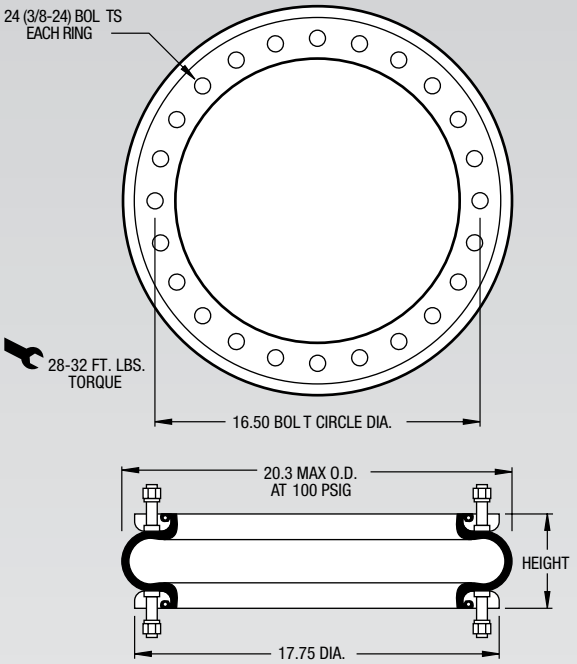


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 787 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	5,490	3,478	149	2.49
60	8,450	4,880	143	2.38
80	11,450	6,186	138	2.30
100	14,520	7,523	135	2.25

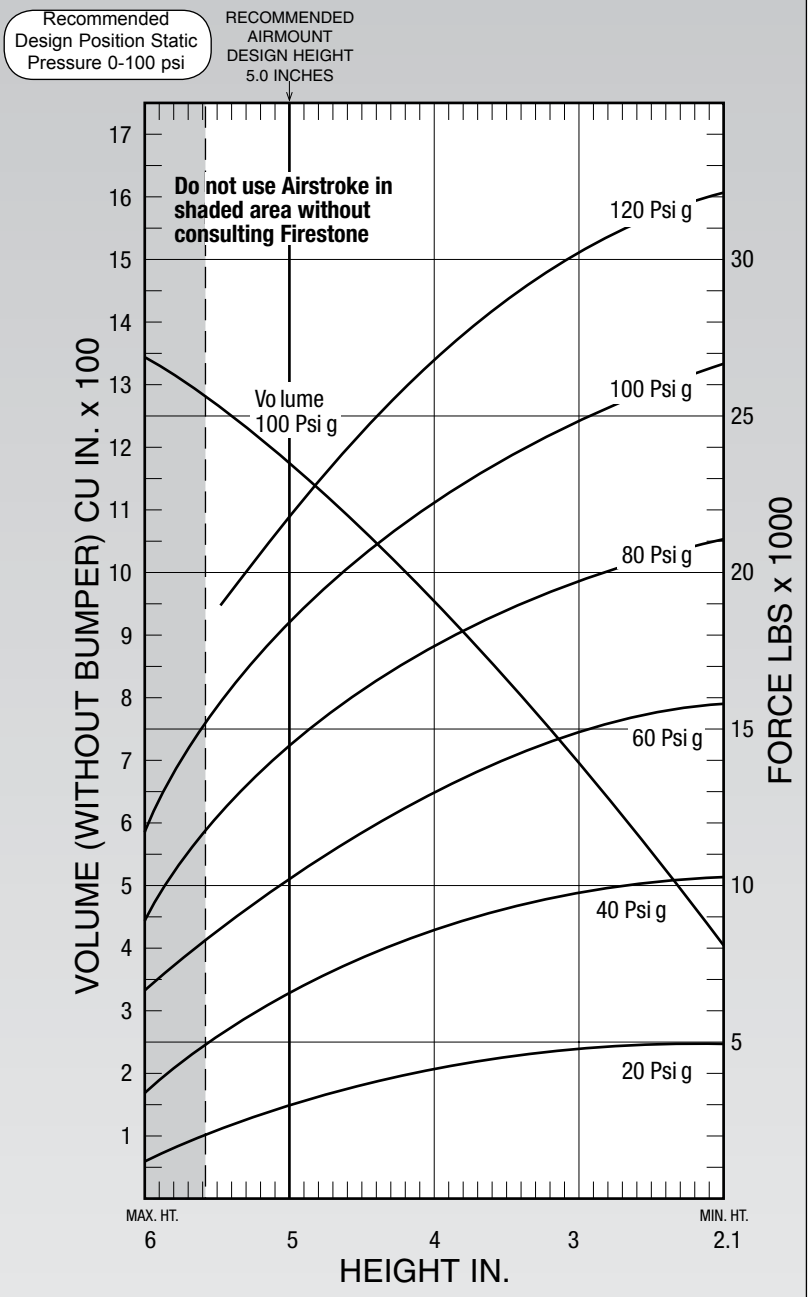
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6.0	932	1,640	3,800	6,100	8,550	11,070
5.0	787	2,560	5,490	8,450	11,450	14,520
4.0	617	3,080	6,470	9,850	13,190	16,600
3.0	436	3,310	6,920	10,530	14,030	17,630

	Description	Assembly Order No.
Style 121 Two Ply Bellows	Ribbed neck aluminum bead rings, $1\frac{7}{8}$ bolts, nuts, washers	W01-358-7197
	Rubber bellows only	W01-358-5135
	Rolled Plate Assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-7272
Assembly weight..... 15.3 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 20 lbs.		



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*

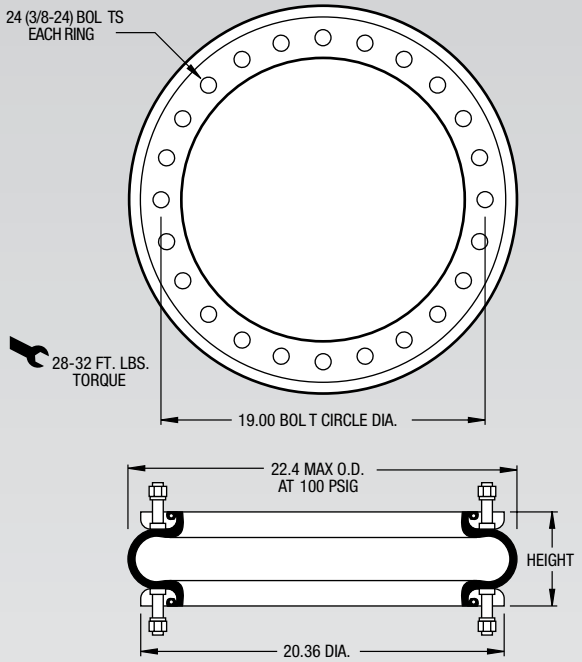


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,154 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	6,450	4,771	161	2.69
60	10,300	6,441	148	2.47
80	14,450	8,312	142	2.37
100	18,450	10,086	139	2.31

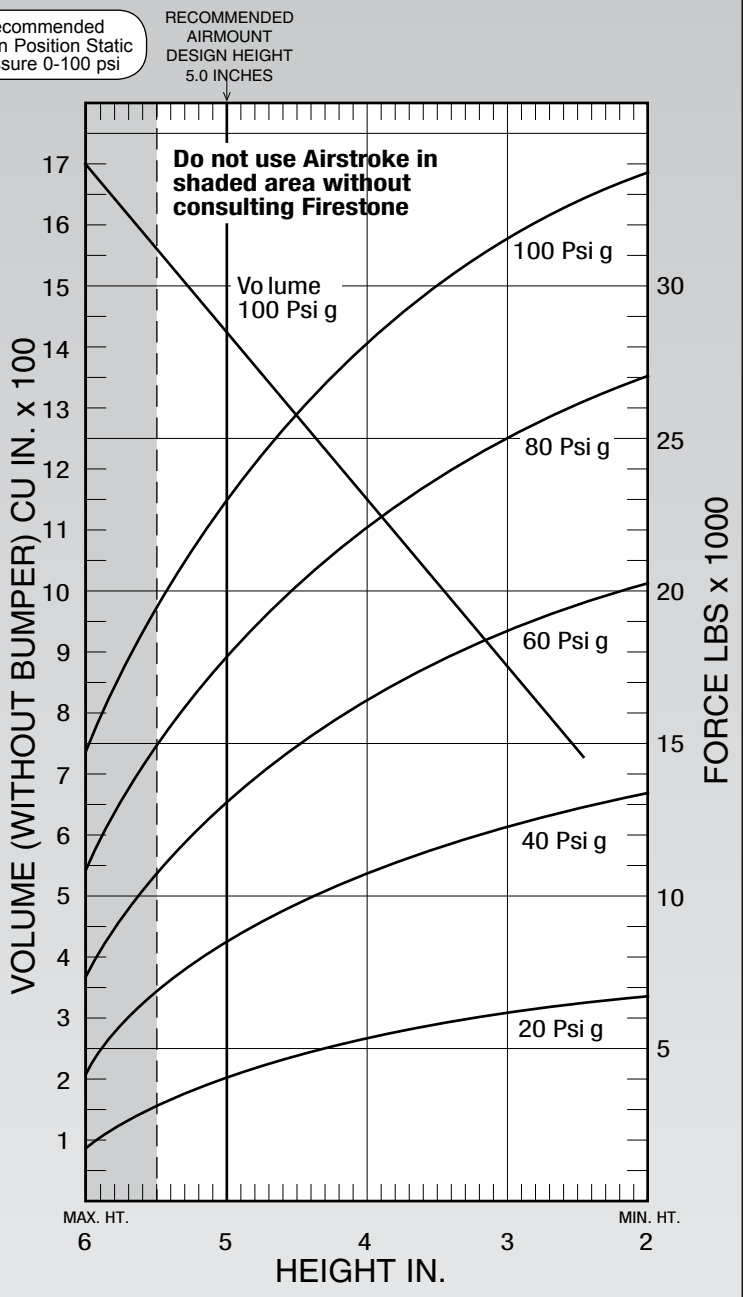
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	1,154	2,830	6,450	10,300	14,450	18,450
4.0	935	4,100	8,540	13,070	17,550	22,180
3.0	682	4,760	9,690	14,750	19,600	24,690

	Description	Assembly Order No.
Style 126 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7727
	Rolled Plate Assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-7726
	Rubber bellows only	W01-358-1026
Assembly weight..... 16.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 25 lbs.		



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*

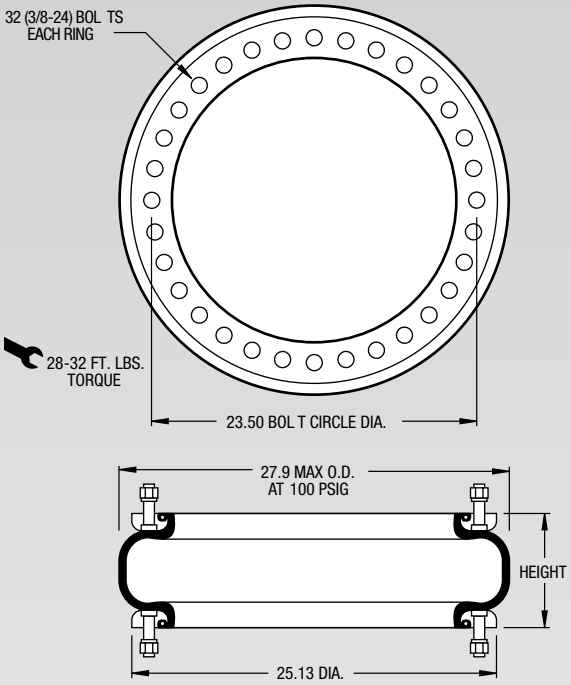


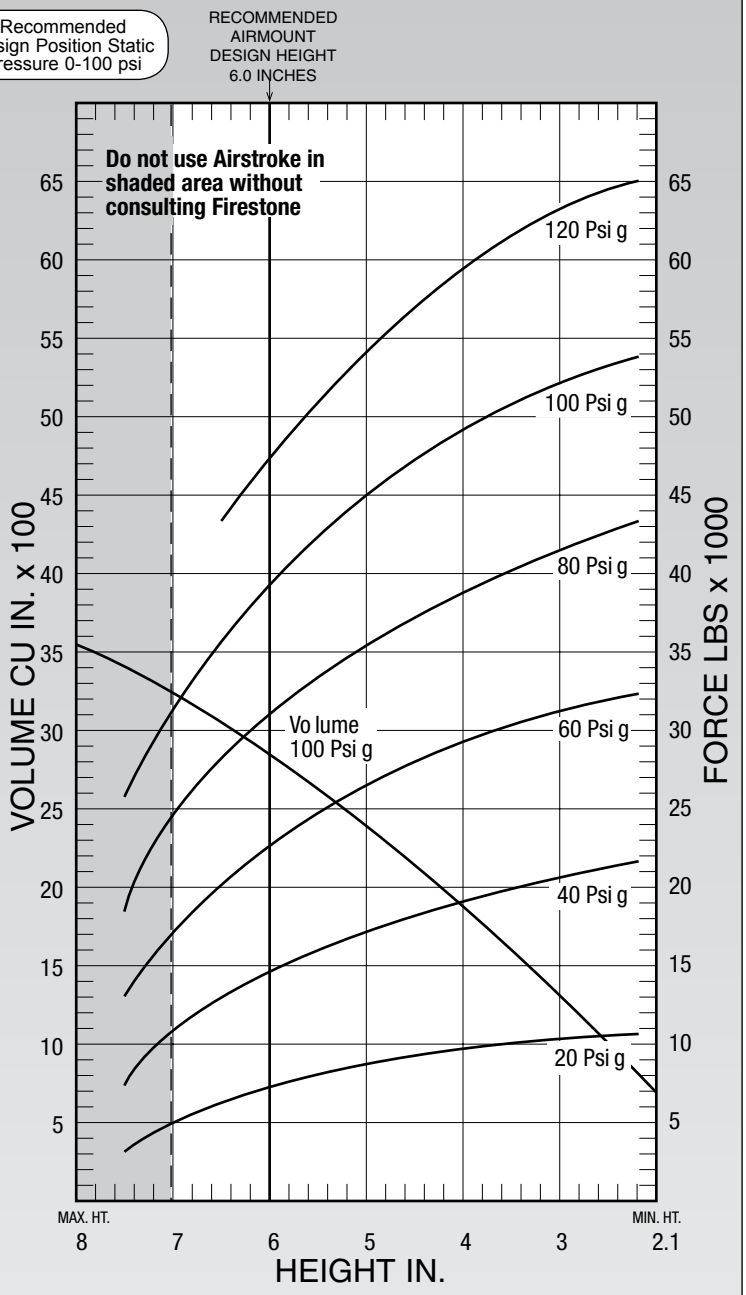
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,315 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	8,630	5,869	155	2.59
60	13,870	5,244	144	2.42
80	18,450	10,107	139	2.32
100	23,200	12,403	137	2.29

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6.0	1,694	1,800	4,000	7,100	10,900	15,000
5.0	1,473	4,220	8,630	13,870	18,450	23,200
4.0	1,196	5,200	10,840	16,630	22,460	28,070
3.0	875	6,010	12,040	19,020	25,960	32,000

Description		Assembly Order No.
Style 138-1.5 Two Ply High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), $1^7/_8$ bolts, nuts, washers	W01-358-7737
	?	W01-358-7734
	Rubber bellows only	W01-358-0147
Assembly weight..... 23.8 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ... 150 lbs.		





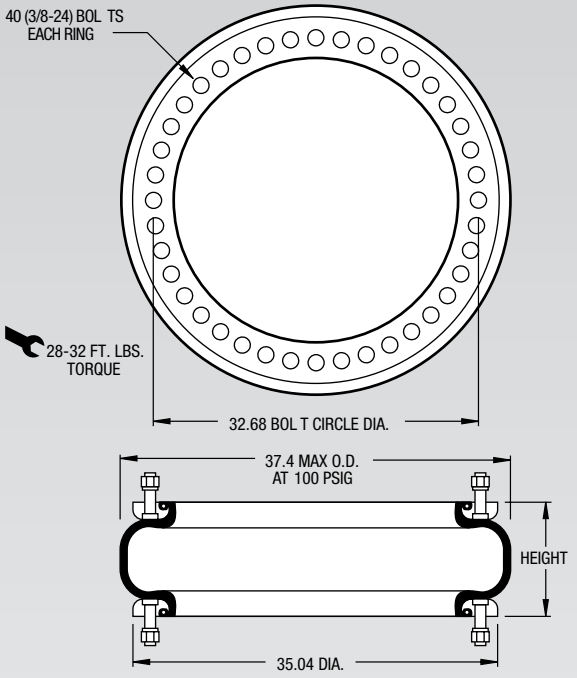
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 6.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 2,846 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	15,020	6,932	128	2.13
60	23,040	10,353	125	2.10
80	31,240	12,979	121	2.02
100	39,570	15,786	119	1.98

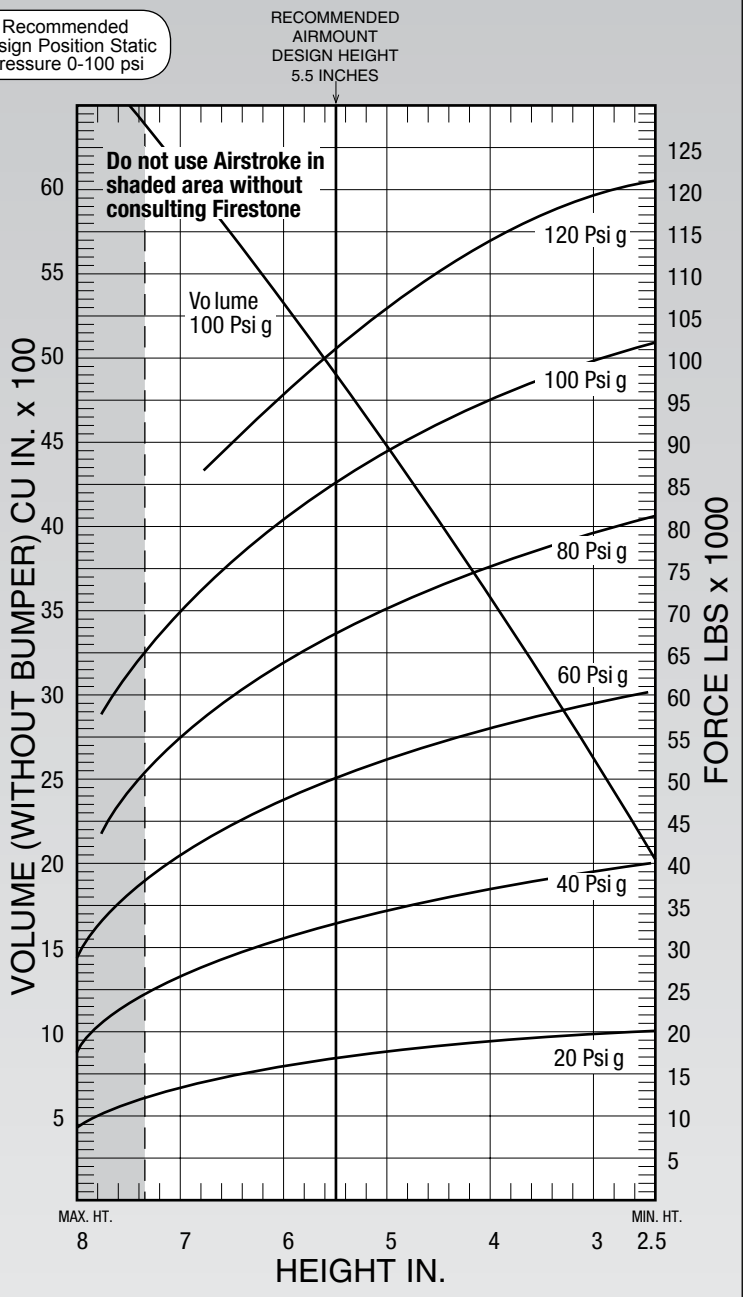
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
7.0	3,227	5,290	10,830	17,450	24,320	31,630
6.0	2,846	7,290	15,020	23,040	31,240	39,570
5.0	2,402	8,610	17,220	26,410	35,580	44,680
4.0	1,906	9,760	19,630	29,320	39,260	49,620
3.0	1,376	10,200	20,840	31,560	41,930	53,010

148-1 Firestone AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

	Description	Assembly Order No.
Style 148-1 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-9601
	Rubber bellows only	W01-358-1021
Assembly weight..... 72.9 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ... 310 lbs.		



NOTE: The effective length of the 1 7/8 bolt is 1.05" in this bead ring.

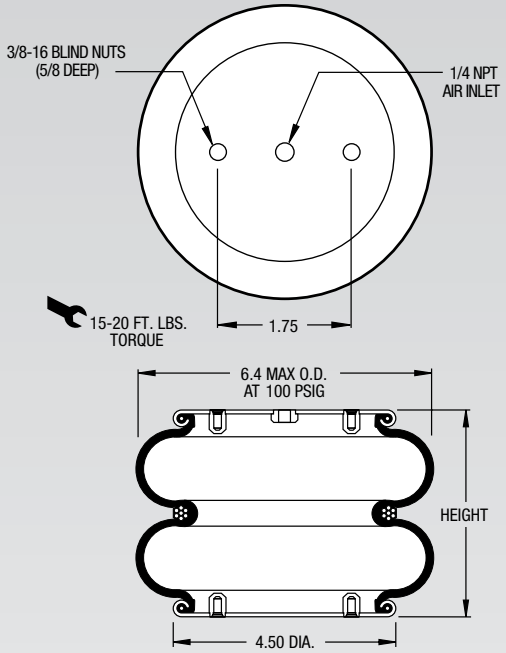


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 4,914 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	32,860	14,220	123	2.06
60	50,290	19,969	118	1.97
80	67,690	26,697	118	1.96
100	85,200	32,491	116	1.93

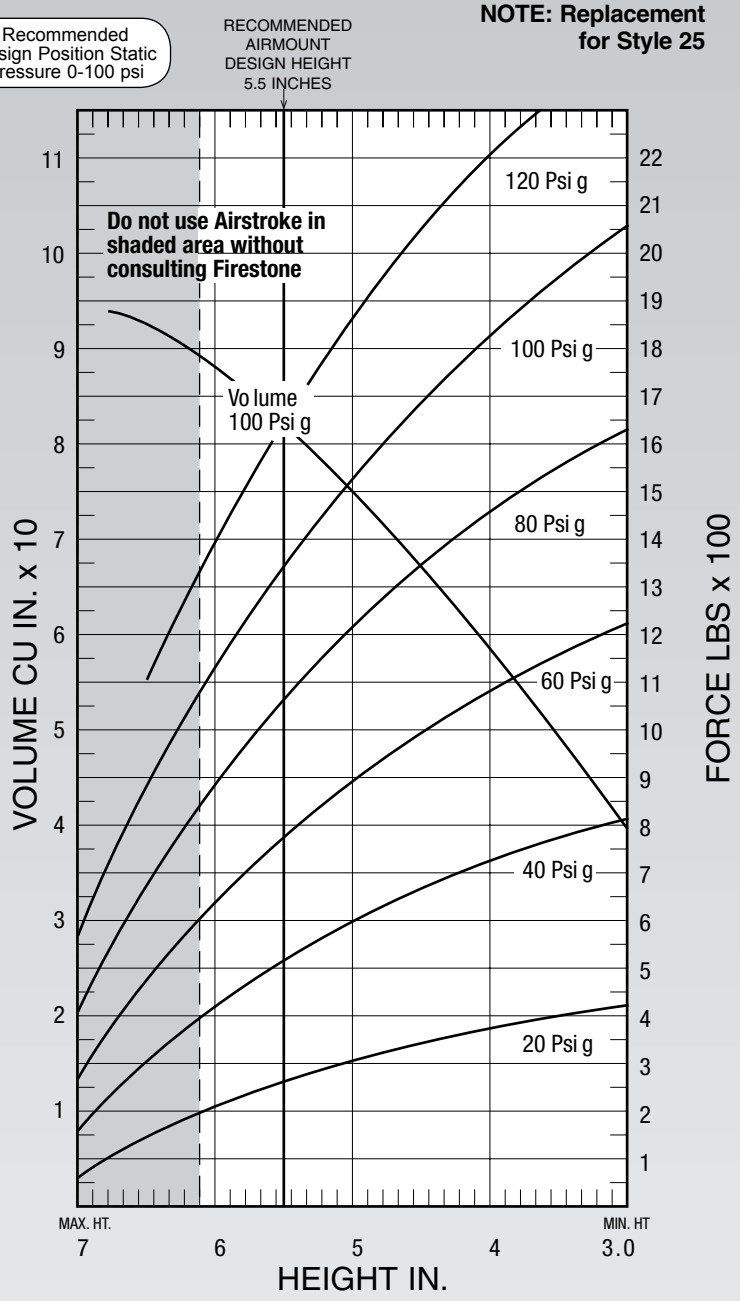
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
7.0	6,134	13,470	26,890	41,610	55,830	70,860
6.0	5,337	15,720	31,220	47,920	64,170	80,890
5.0	4,471	17,450	34,310	52,370	70,980	89,140
4.0	3,532	18,810	36,970	56,050	76,330	95,540
3.0	2,542	19,940	39,470	59,360	80,110	100,050

	Description	Assembly Order No.
Style 268 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7025
	Blind nuts, 3/4 NPT	W01-358-7047
	Blind nuts, 1/4 NPT both ends	W01-358-7035
	3/4 NPT both ends (no blind nuts)	W01-606-7025
	Socket head aluminum bead rings (bolts, nuts, washers not included, use cap screws)	W01-358-0030
	3/4 NPT (only) upper plate, blind nuts lower plate	W01-358-7030
	Rubber bellows only	W01-358-0319
Assembly weight..... 3.2 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 30 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. Bolts are not included. See pages 8-10 for explanation.

NOTE: Replacement for Style 25



See page 12 for instructions on how to use chart.

Dynamic Characteristics at 5.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 86 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	515	339	153	2.54
60	787	482	147	2.45
80	1,062	634	145	2.42
100	1,360	773	141	2.36

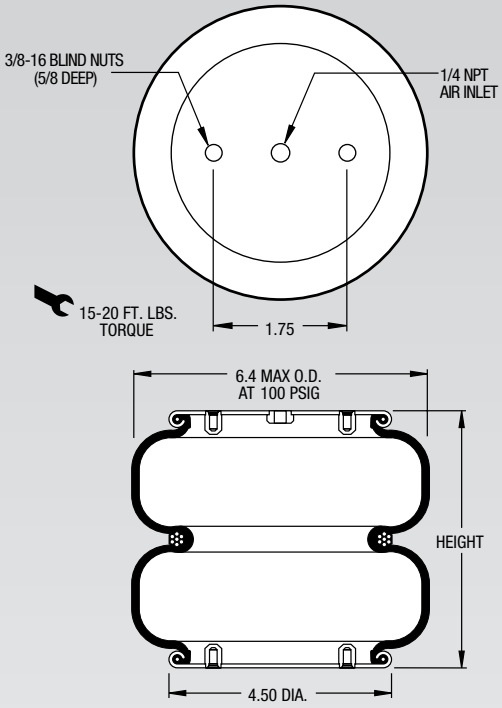
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
5.0	78	300	590	890	1,210	1,540
4.0	60	380	720	1,080	1,450	1,810
3.0	39	420	800	1,220	1,640	2,060

267-1.5 Firestone

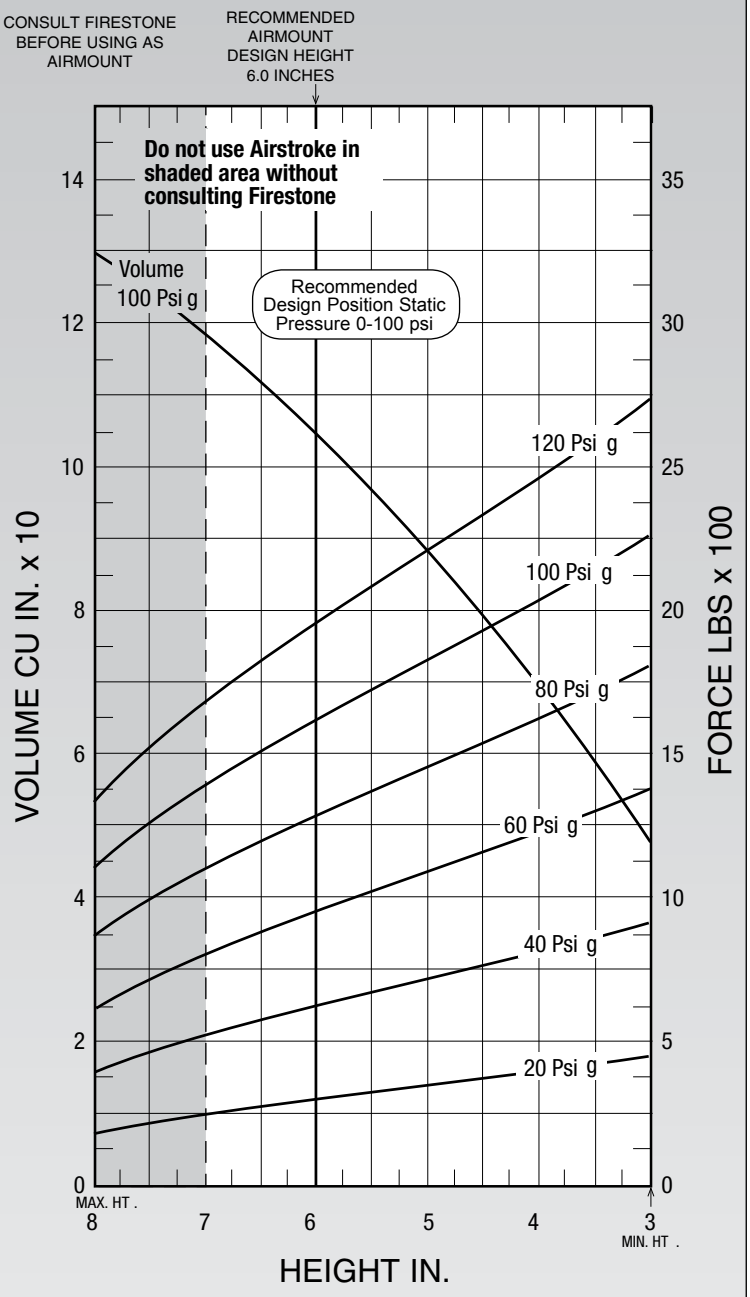
AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

NOTE: Replacement for Style 255-1.5

	Description	Assembly Order No.
Style 255-1.5 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-6955
	Blind nuts, 3/4 NPT	W01-358-6956
	Rubber bellows only	W01-358-0048
	Socket head aluminum bead rings (bolts, nuts, washers not included, use cap screws)	W01-358-6833
Assembly weight..... 3.3 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 50 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. Bolts are not included. See pages 8-10 for explanation.

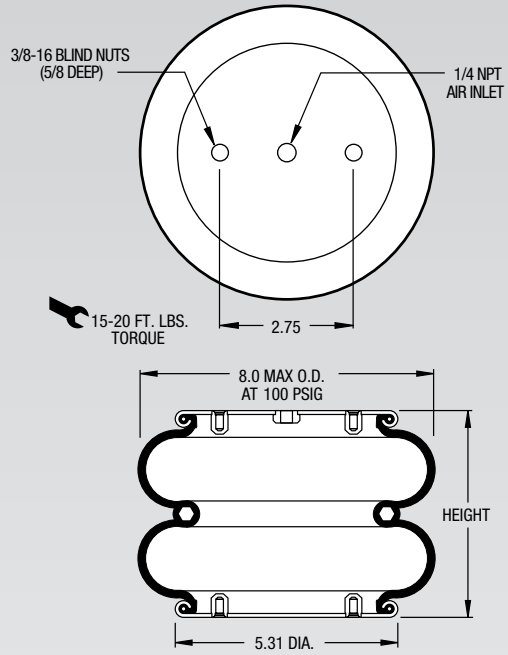


See page 12 for instructions on how to use chart.

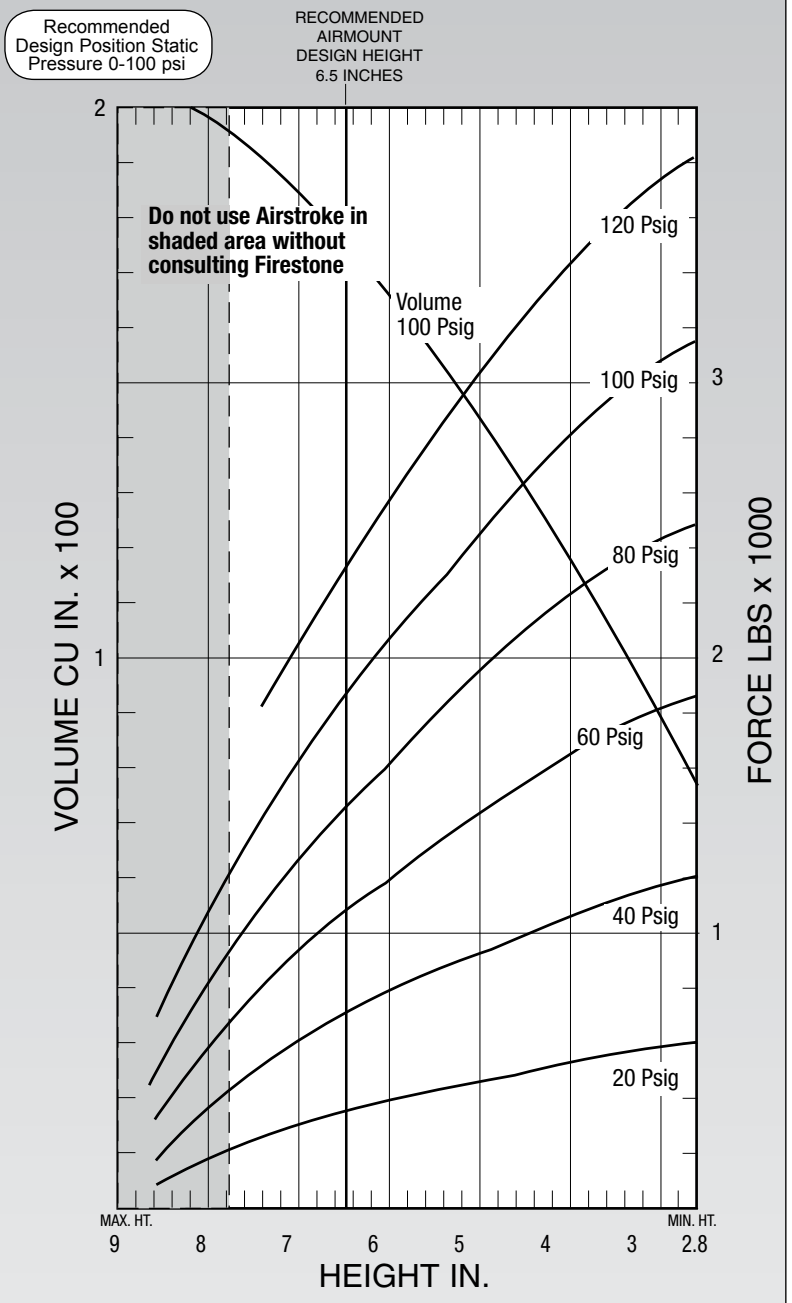
Dynamic Characteristics at 6.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 100 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	566	309	139	2.32
60	871	432	132	2.21
80	1,194	565	129	2.16
100	1,524	681	126	2.10

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
7.0	125	267	534	801	1,069	1,336
6.0	109	333	667	1,000	1,333	1,667
5.0	91	381	763	1,144	1,525	1,907
4.0	71	416	833	1,249	1,666	2,082

Description		Assembly Order No.
Style 224 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-3400
	Blind nuts, 3/4 NPT	W01-358-3403
	Countersunk steel bead rings, $1^{3}/_{4}$ bolts, nuts, washers,	W01-358-3407
Assembly weight..... 5.0 lbs.		
Force to collapse to minimum height (@ 0 PSIG)..... 14 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

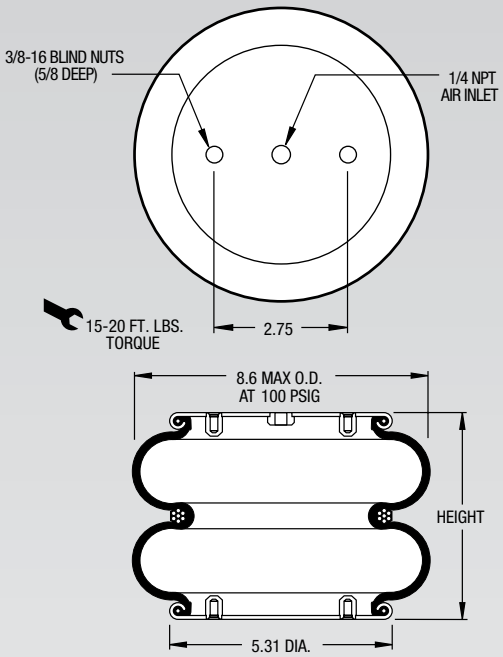


See page 12 for instructions on how to use chart.

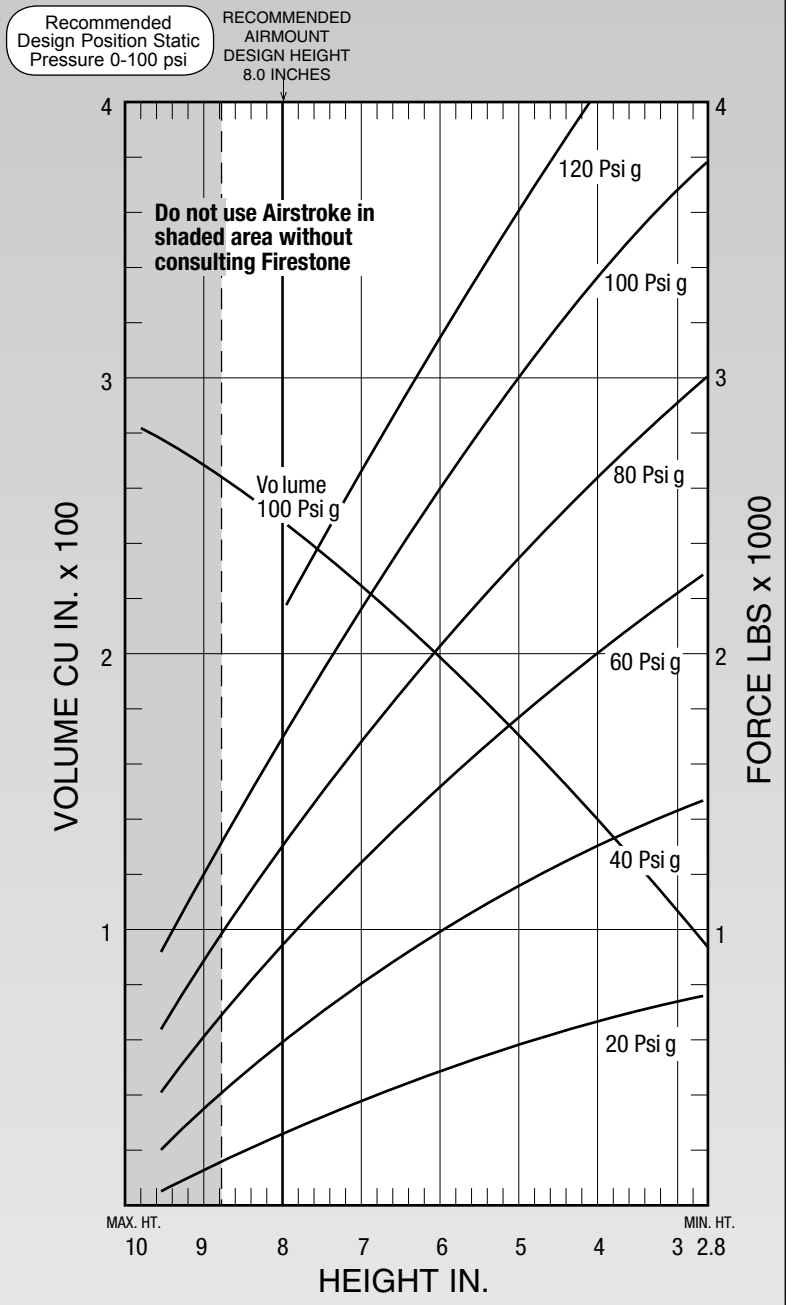
Dynamic Characteristics at 6.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 171 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	730	361	132	2.20
60	1,130	523	128	2.13
80	1,530	690	126	2.10
100	1,940	849	124	2.07

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
7.0	181	320	630	990	1,340	1,710
6.0	160	400	820	1,260	1,700	2,160
5.0	134	470	960	1,490	2,040	2,570
4.0	105	550	1,110	1,720	2,310	2,930
3.0	73	590	1,210	1,860	2,480	3,150

Description		Assembly Order No.
Style 26 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7325
	Blind nuts, 3/4 NPT	W01-358-7327
	Countersunk steel bead rings, $1^3/_4$ bolts, nuts, washers	W01-358-7333
	Rubber bellows only	W01-358-0142
Assembly weight..... 5.3 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 23 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



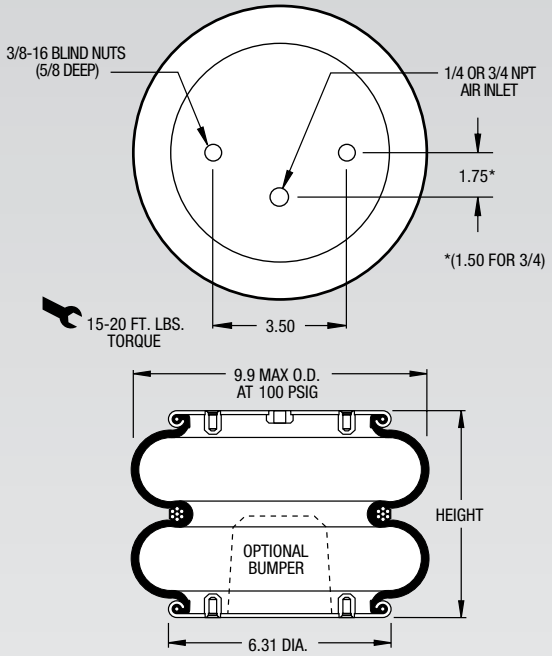
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 8.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 246 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	590	348	144	2.41
60	980	451	128	2.13
80	1,360	589	123	2.04
100	1,780	732	121	2.01

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
8.0	246	270	590	980	1,360	1,780
7.0	233	390	810	1,270	1,740	2,240
6.0	196	480	1,010	1,530	2,060	2,630
5.0	164	570	1,180	1,780	2,420	3,110
4.0	128	660	1,340	2,010	2,750	3,510

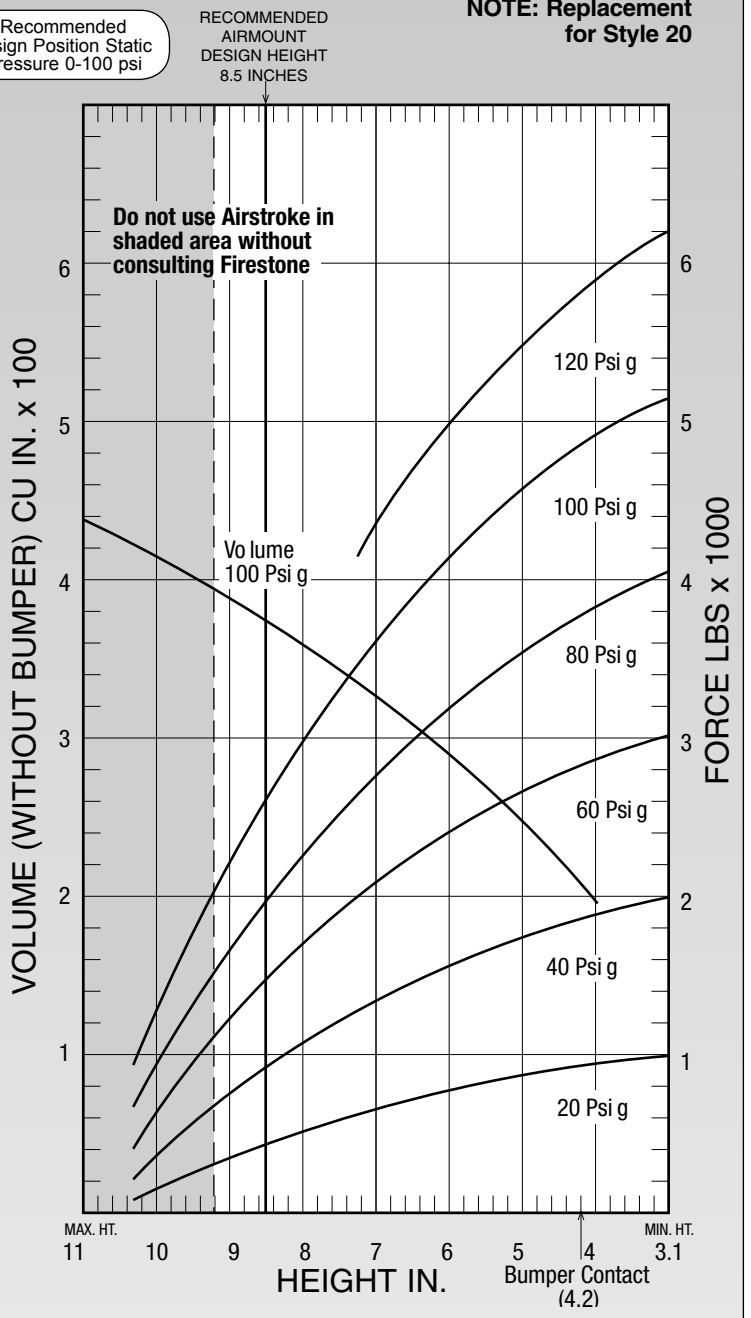
	Description	Assembly Order No.
Style 274 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-6910
	Blind nuts, 1/4 NPT, bumper	W01-358-6911
	Blind nuts, 3/4 NPT	W01-358-6900
	Blind nuts, 3/4 NPT, bumper	W01-358-6901
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-6923
	Rubber bellows only	W01-358-0138
Assembly weight..... 7.0 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 14 lbs.		

Style 202 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-7080
	Blind nuts, 3/4 NPT	W01-358-7119



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

NOTE: Replacement for Style 20

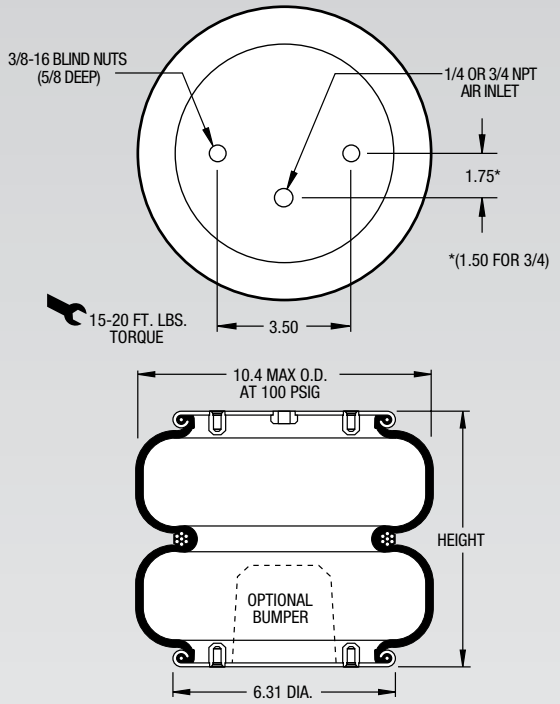


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 8.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 376 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	990	414	121	2.02
60	1,540	615	119	1.98
80	2,130	820	116	1.94
100	2,720	996	114	1.89

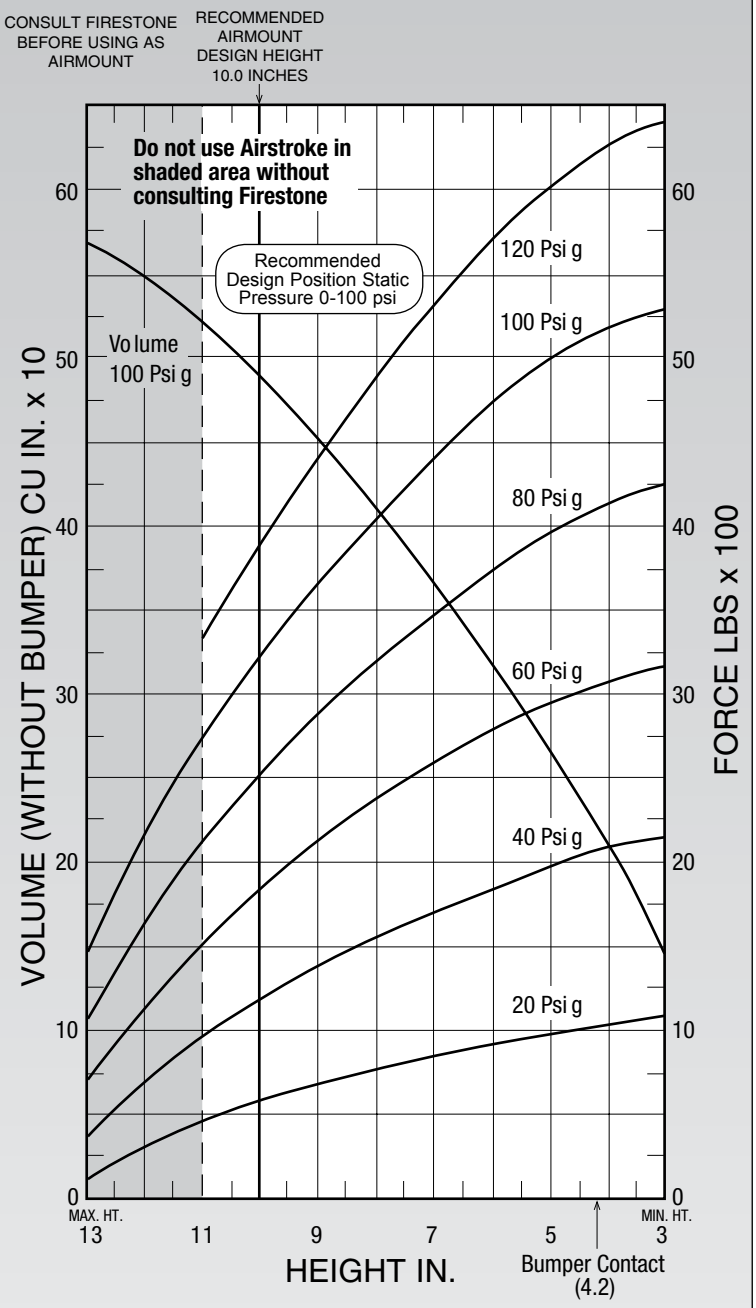
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
9.0	392	392	770	1,195	1,642	2,114
8.0	365	576	1,128	1,713	2,309	2,940
7.0	331	707	1,396	2,104	2,832	3,582
6.0	291	806	1,601	2,410	3,237	4,082
5.0	247	903	1,796	2,702	3,624	4,562
4.0	197	993	1,966	2,953	3,948	4,958

	Description	Assembly Order No.
Style 20-2 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-6951
	Blind nuts, 1/4 NPT, rubber bumper	W01-358-6947
	Blind nuts, 3/4 NPT	W01-358-6952
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7789
	Rubber bellows only	W01-358-0305
Assembly weight..... 7.7 lbs.		
Force to collapse to minimum height (@ 0 PSIG) .....17 lbs.		



NOTE: The bellows extends beyond the bead plates at minimum height

NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



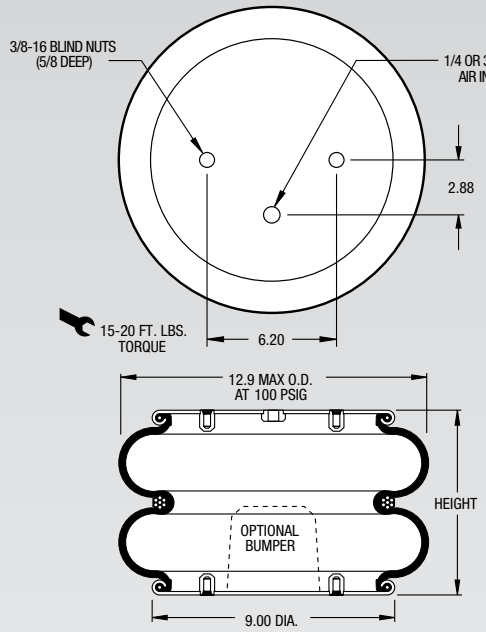
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 10.0 in. Design Height Consult factory before using as an Airmount isolator.				
Volume @ 100 PSIG = 488 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,184	376	106	1.77
60	1,848	534	101	1.68
80	2,531	669	97	1.61
100	3,238	813	94	1.57

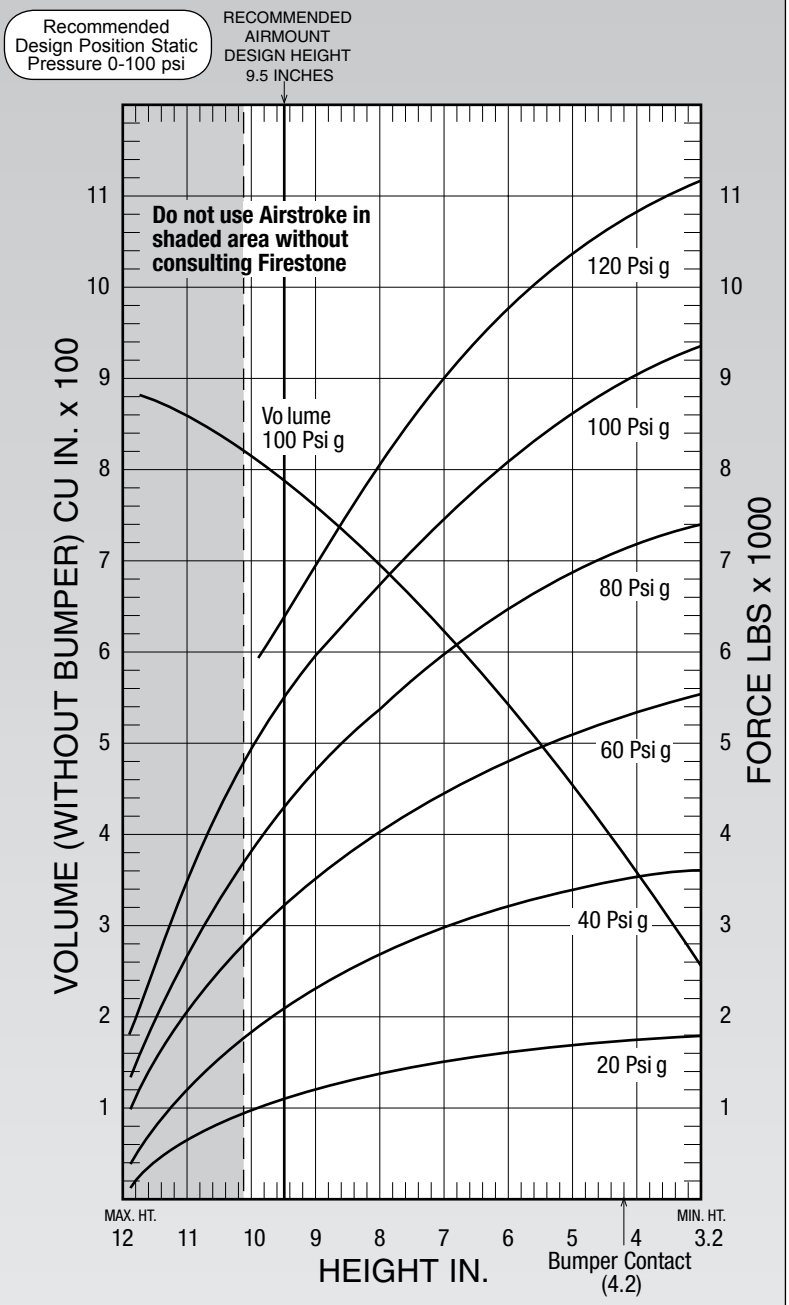
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
11.0	520	449	951	1,517	2,122	2,753
10.0	488	572	1,184	1,848	2,531	3,238
9.0	451	673	1,384	2134	2,880	3,661
8.0	409	759	1,554	2,377	3,193	4,049
7.0	364	836	1,704	2,590	3,485	4,416
6.0	316	907	1,845	2,786	3,753	4,748
5.0	256	975	1,979	2,954	3,968	5,005

	Description	Assembly Order No.
Style 22 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7180
	Blind nuts, 1/4 NPT, bumper	W01-358-7400
	Blind nuts, 3/4 NPT	W01-358-7184
	Blind nuts, 3/4 NPT, bumper	W01-358-7185
	Countersunk steel bead rings, 1 5/8 bolts, nuts, washers	W01-358-7431
	Rubber bellows only	W01-358-0226
Assembly weight..... 13.0 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 20 lbs.		

Style 210 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-7251
	Blind nuts, 1/4 NPT, bumper	W01-358-7291
	Blind nuts, 3/4 NPT	W01-358-7250
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7258
	Rubber bellows only	W01-358-7928



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

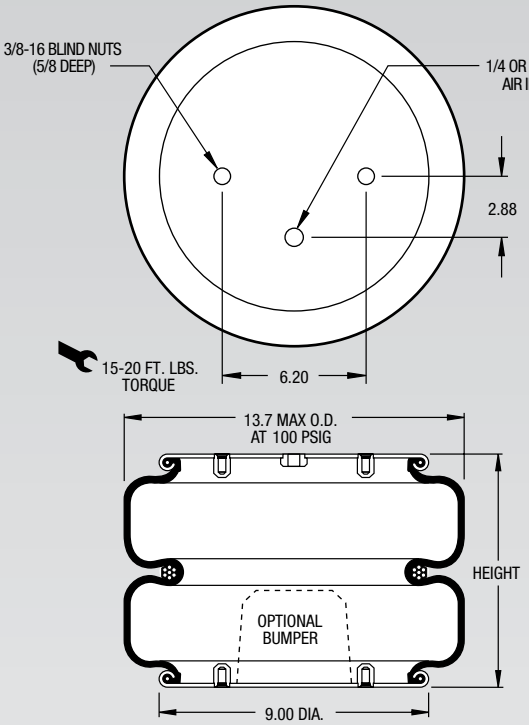


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 782 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,050	729	112	1.86
60	3,170	1,036	107	1.79
80	4,280	1,373	106	1.77
100	5,400	1,668	104	1.74

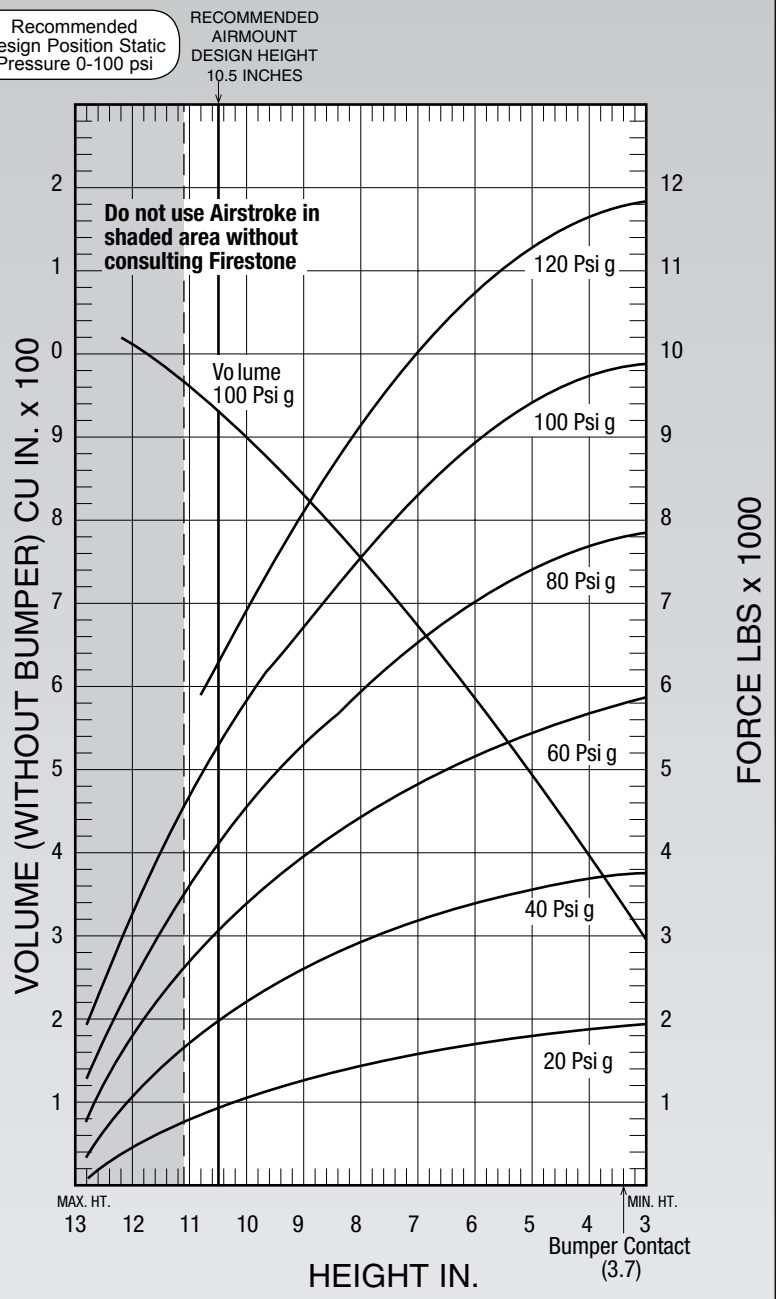
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	809	950	1,810	2,830	3,810	4,840
9.0	752	1,170	2,260	3,460	4,670	5,880
8.0	685	1,310	2,590	3,940	5,350	6,700
7.0	610	1,430	2,900	4,390	5,950	7,450
6.0	529	1,540	3,170	4,780	6,470	8,110
5.0	442	1,640	3,380	5,100	6,880	8,630
4.0	349	1,730	3,520	5,340	7,180	9,020

	Description	Assembly Order No.
Style 22-1.5 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7444
	Blind nuts, 1/4 NPT, rubber bumper	W01-358-7473
	Blind nuts, 3/4 NPT	W01-358-7442
	Blind nuts, 1/4 NPT(centered)	W01-358-7443
	Rubber bellows only	W01-358-0259
	Countersunk steel bead rings, 1 5/8 bolts, nuts, washers	W01-358-7480
Assembly weight..... 12.9 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 26 lbs.		



NOTE: The bellows extends beyond the bead plates at minimum height.

NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



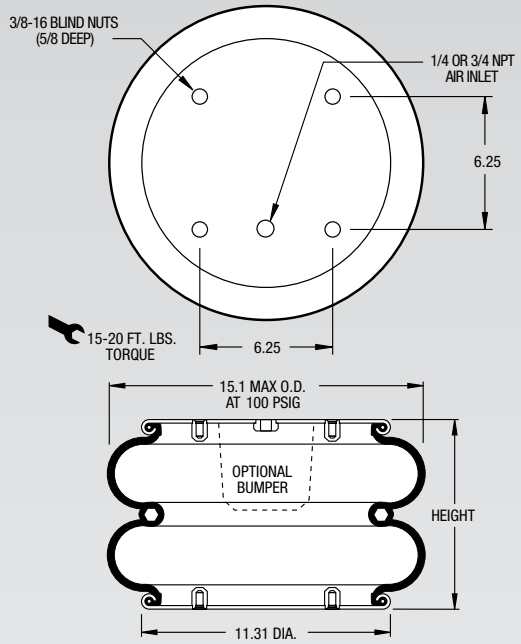
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 10.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 935 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,930	684	112	1.86
60	3,030	999	108	1.80
80	4,130	1,319	106	1.77
100	5,310	1,630	104	1.73

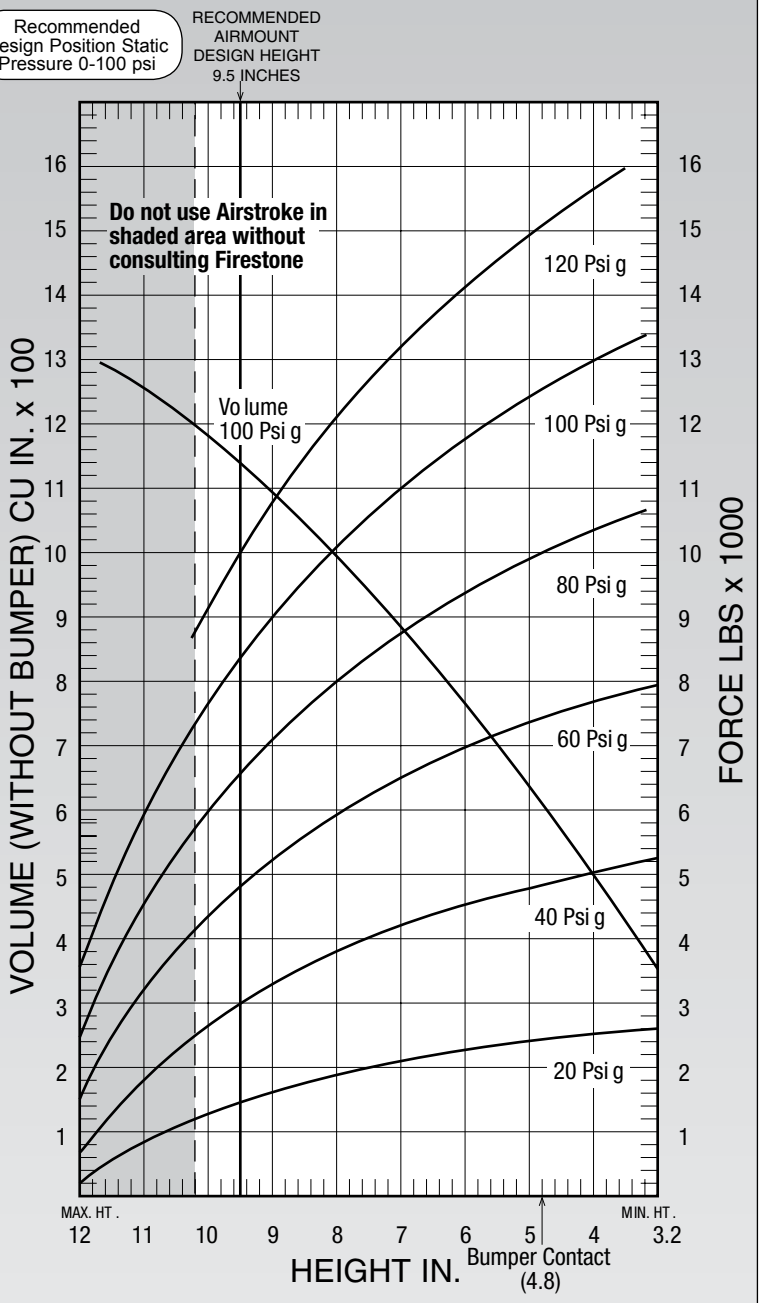
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	905	1,040	2,140	3,340	4,550	5,830
9.0	838	1,220	2,520	3,880	5,250	6,700
8.0	763	1,370	2,850	4,360	5,850	7,450
7.0	681	1,510	3,150	4,810	6,430	8,170
6.0	591	1,650	3,400	5,210	6,990	8,860
5.0	496	1,760	3,590	5,520	7,420	9,380
4.0	396	1,840	3,730	5,730	7,680	9,700

	Description	Assembly Order No.
Style 21 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7145
	Blind nuts, 1/4 NPT, bumper	W01-358-7146
	Blind nuts, 3/4 NPT	W01-358-7143
	Blind nuts, 3/4 NPT, bumper	W01-358-7144
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7139
	Rubber bellows only	W01-358-0213
Assembly weight..... 17.3 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 22 lbs.		

Style 205 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-7208
	Blind nuts, 1/4 NPT, bumper	W01-358-7221
	Blind nuts, 3/4 NPT	W01-358-7224
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7237
	Rubber bellows only	W01-358-7929



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

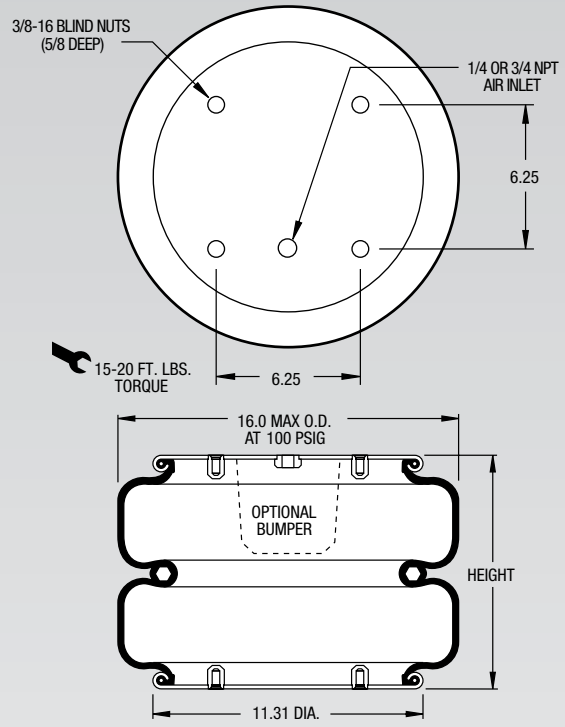


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,136 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,030	1,110	114	1.89
60	4,750	1,582	108	1.80
80	6,540	2,044	105	1.75
100	8,330	2,500	103	1.71

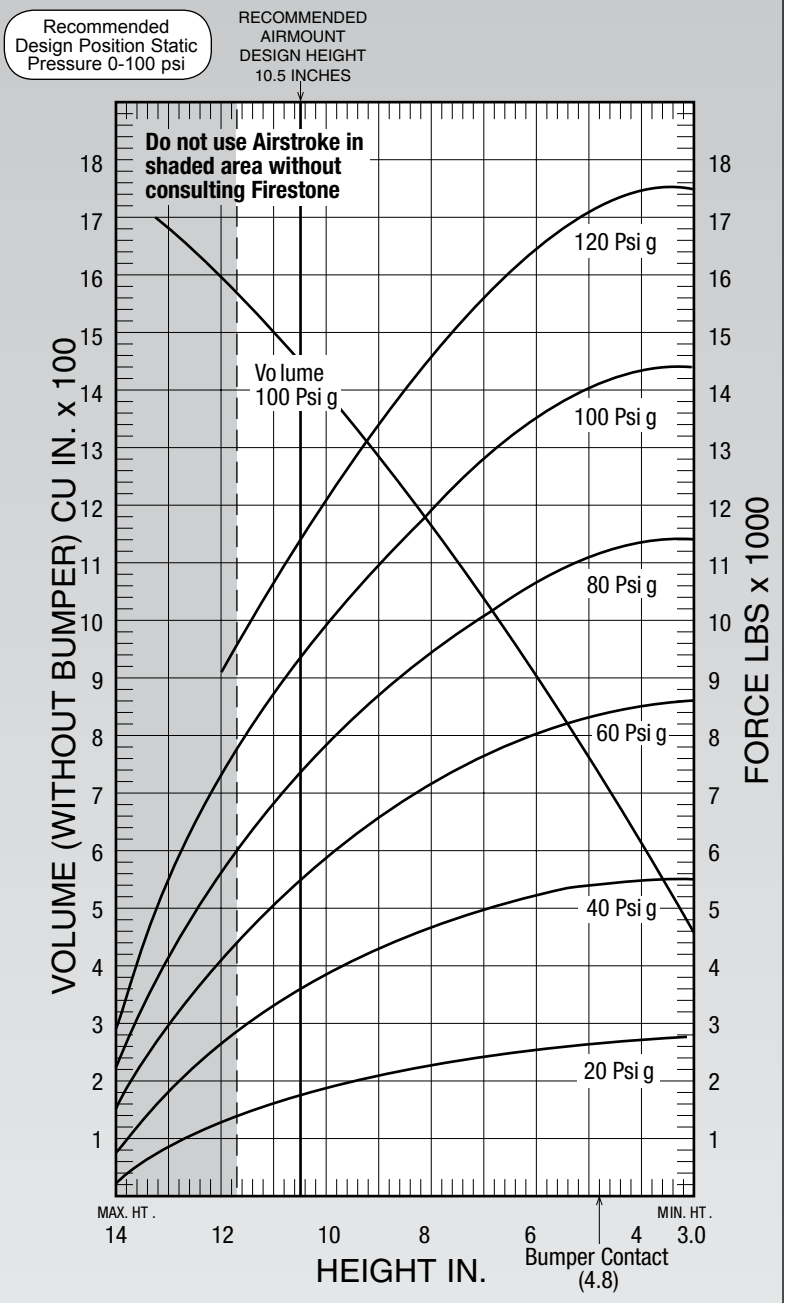
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	1,180	1,260	2,670	4,240	5,890	7,550
9.0	1,091	1,590	3,330	5,180	7,100	9,010
8.0	989	1,810	3,800	5,850	7,980	10,120
7.0	878	2,000	4,180	6,400	8,700	11,020
6.0	758	2,160	4,490	6,860	9,310	11,760
5.0	630	2,300	4,760	7,260	9,830	12,400
4.0	497	2,440	5,010	7,620	10,300	12,960

	Description	Assembly Order No.
Style 21-2 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-6800
	Blind nuts, 1/4 NPT, rubber bumper	W01-358-6801
	Blind nuts, 3/4 NPT	W01-358-9529
	Countersunk steel bead rings, 1 7/8 bolts, nuts, washers	W01-358-9531
Assembly weight..... 17.6 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 35 lbs.		



NOTE: The bellows extends beyond the bead plates at minimum height.

NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

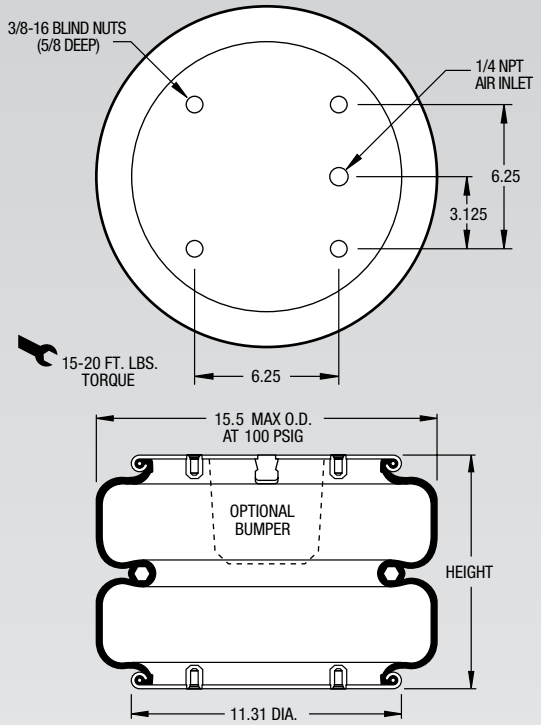


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 10.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,462 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,460	989	100	1.67
60	5,350	1,437	97	1.62
80	7,280	1,850	95	1.58
100	9,210	2,247	93	1.55

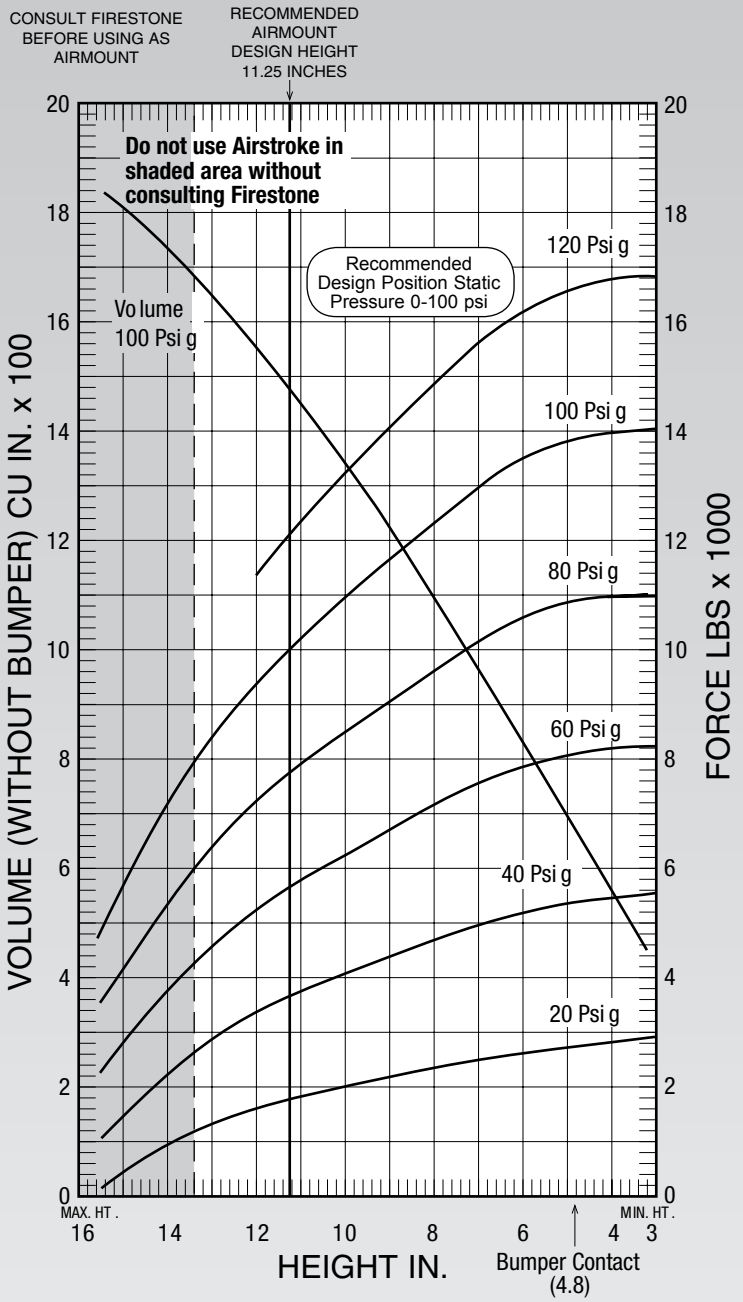
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
11.0	1,510	1,540	3,180	4,930	6,730	8,550
10.0	1,410	1,810	3,710	5,730	7,760	9,790
9.0	1,298	2,040	4,150	6,430	8,570	10,780
8.0	1,177	2,240	4,530	7,050	9,290	11,690
7.0	1,048	2,400	4,850	7,570	10,030	12,620
6.0	910	2,530	5,140	8,000	10,670	13,440
5.0	764	2,620	5,370	8,310	11,100	13,990
4.0	615	2,690	5,490	8,490	11,330	14,280

	Description	Assembly Order No.
Style 233-2 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-6810
	Blind nuts, 1/4 NPT, rubber bumper	W01-358-7781
	Blind nuts, 3/4 NPT	W01-358-6811
	Blind nuts, 3/4 NPT, rubber bumper	W01-358-6819
	Countersunk steel bead rings, 1 7/8 bolts, nuts, washers	W01-358-7558
Assembly weight..... 18.8 lbs		
Force to collapse to minimum height (@ 0 PSIG) ... 100 lbs.		



NOTE: The bellows extends beyond the bead plates at minimum height.

NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



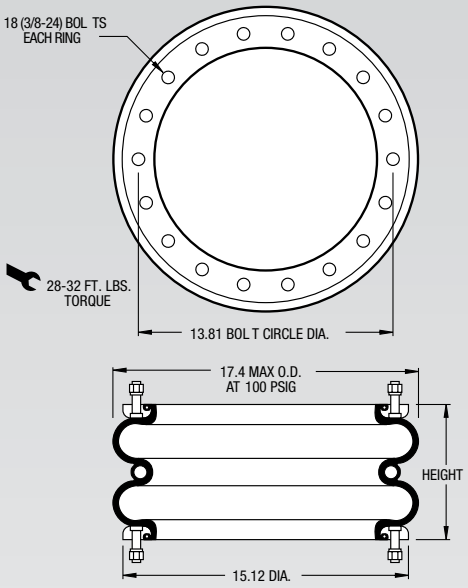
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 11.25 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,418 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,413	968	100	1.67
60	5,631	1,351	92	1.53
80	7,691	1,735	89	1.49
100	9,917	2,122	87	1.45

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
12.0	1,548	1,542	3,299	5,184	7,194	9,321
10.0	1,333	1,992	4,052	6,239	8,483	10,937
8.0	1,091	2,311	4,666	7,128	9,601	12,333
6.0	829	2,569	5,174	7,485	10,564	13,468
4.0	556	2,793	5,431	8,189	10,966	13,867

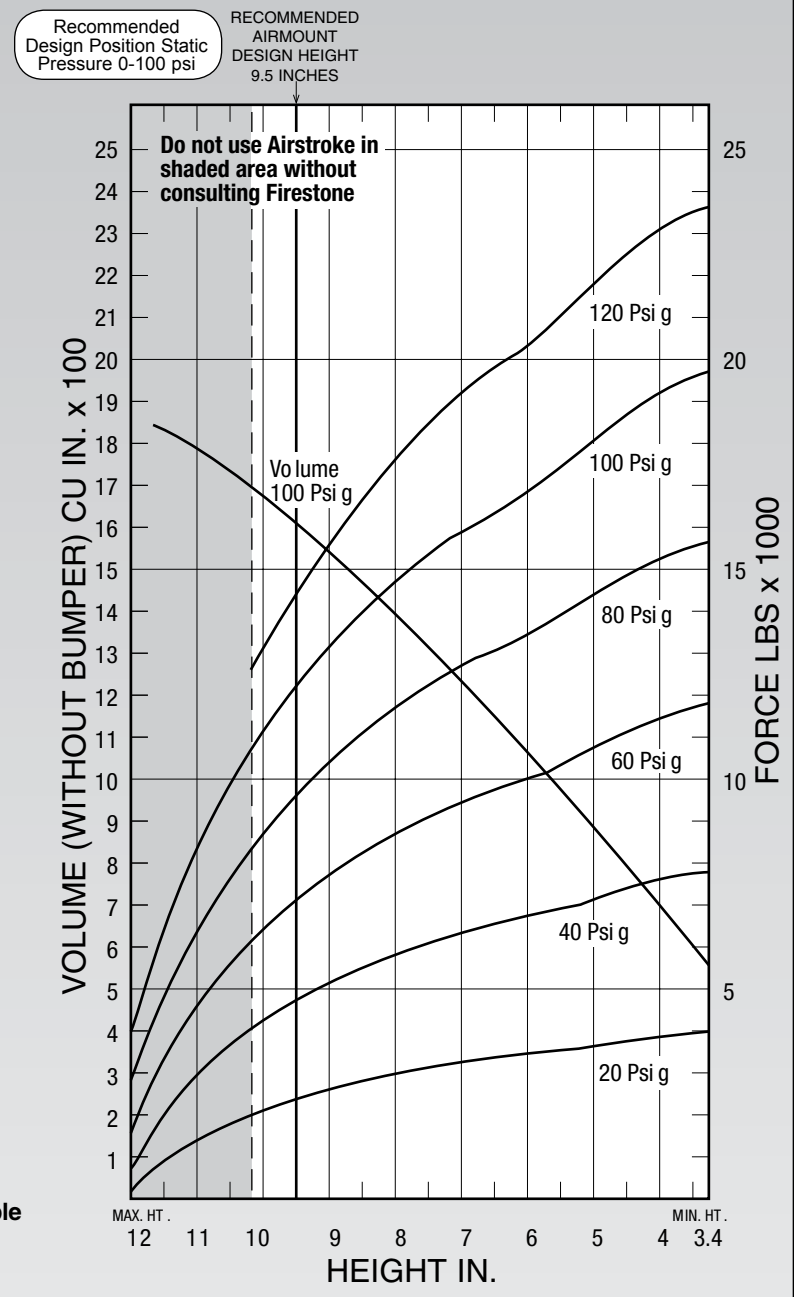
	Description	Assembly Order No.
Style 28 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7191
	Ribbed neck aluminum bead rings (unequal spacing) 1 7/8 b,n,w	W01-358-7194
	Ribbed neck aluminum bead rings (equal spacing) 1 1/4 b,n,w	W01-358-7192
	Rolled plate assembly*, 1/2 blind nut 3/4 NPT	W01-358-7271
	Rubber bellows only	W01-358-7925
Assembly weight..... 18.3 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 38 lbs.		

Style 201 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing)	W01-358-7244
	Rubber Bellows Only	W01-139-0201



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*



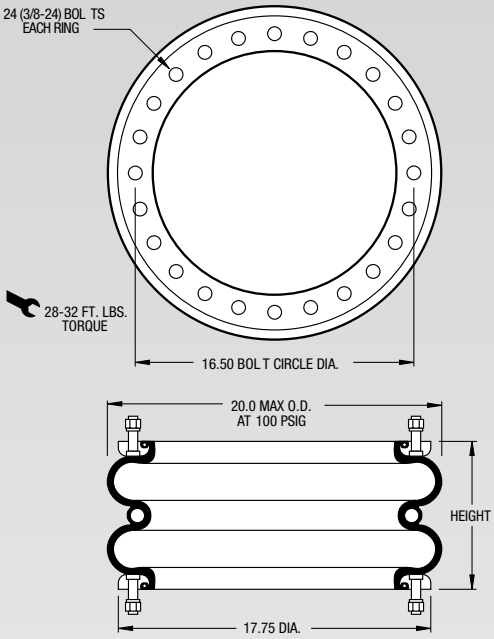
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,596 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	4,590	1,553	109	1.82
60	7,010	2,125	103	1.72
80	9,590	2,779	101	1.68
100	12,120	3,471	100	1.67

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	1,658	2,090	4,150	6,410	8,780	11,100
9.0	1,529	2,500	5,000	7,550	10,290	13,010
8.0	1,384	2,840	5,700	8,530	11,530	14,550
7.0	1,224	3,110	6,250	9,340	12,580	15,790
6.0	1,053	3,330	6,650	9,940	13,380	16,760
5.0	871	3,590	7,130	10,690	14,380	18,010
4.0	679	3,820	7,570	11,360	15,270	19,130

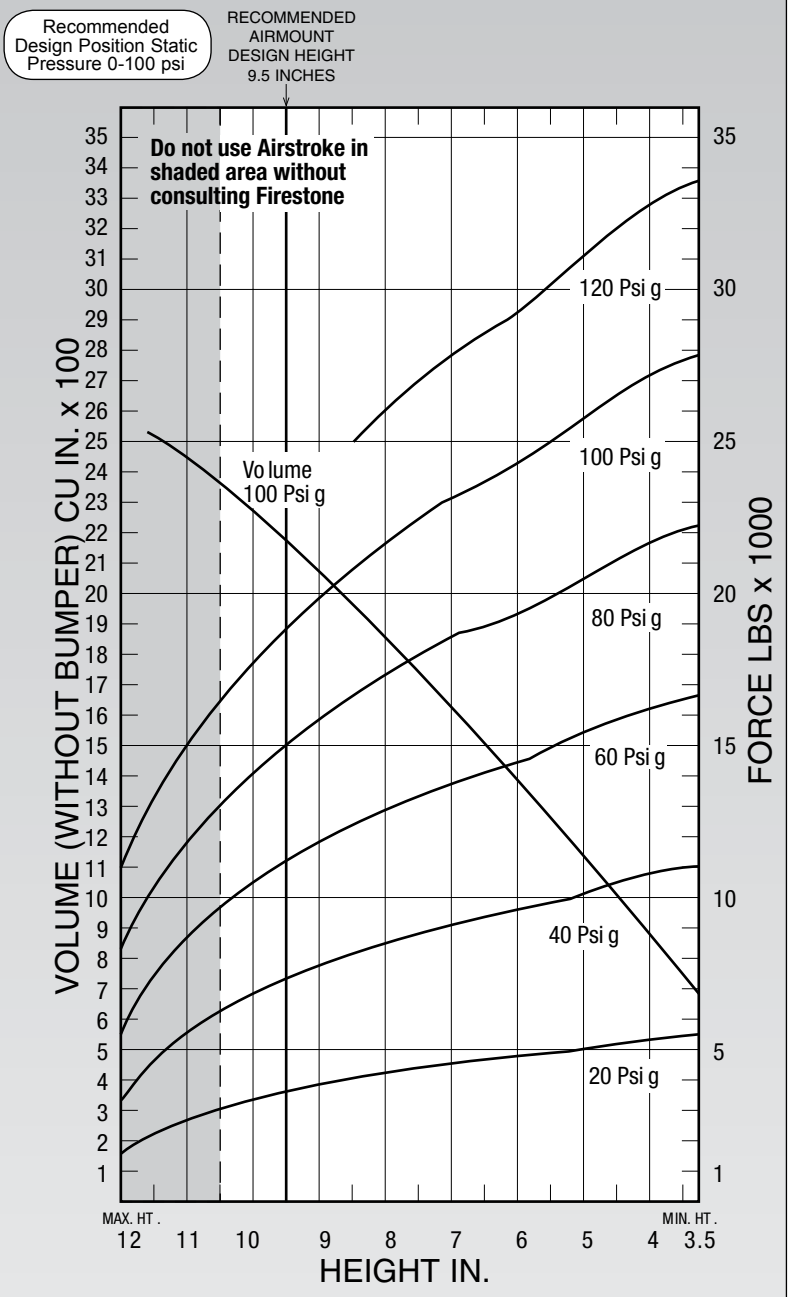
	Description	Assembly Order No.
Style 203 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7227
	Ribbed neck aluminum bead rings (equal spacing) 1 1/4 b,n,w	W01-358-7225
	Rolled plate assembly*, 1/2 blind nut 3/4 NPT	W01-358-7273
	Rubber bellows only	W01-358-0205
Assembly weight..... 25.6 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 40 lbs.		

Style 218 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing) 1 7/8 bolts, nuts, washers	W01-358-7228



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*



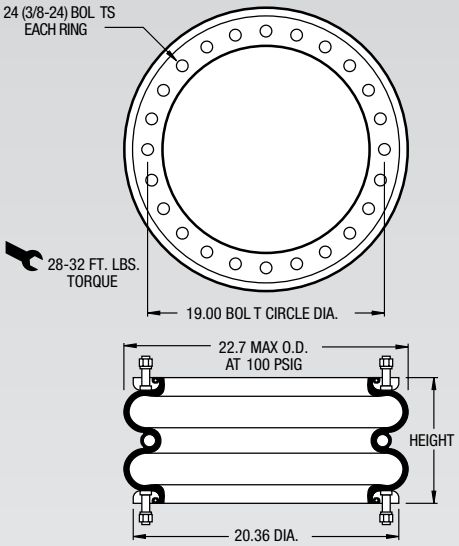
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 2,163 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	7,210	2,190	103	1.72
60	11,100	3,150	100	1.67
80	14,970	4,040	97	1.62
100	18,890	4,971	96	1.60

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	2,261	3,330	6,710	10,340	14,000	17,680
9.0	2,067	3,820	7,680	11,780	15,850	19,970
8.0	1,853	4,210	8,450	12,880	17,370	21,840
7.0	1,625	4,520	9,010	13,700	18,590	23,280
6.0	1,385	4,790	9,510	14,460	19,490	24,360
5.0	1,135	5,070	10,140	15,380	20,580	25,790
4.0	870	5,350	10,760	16,260	21,750	27,240

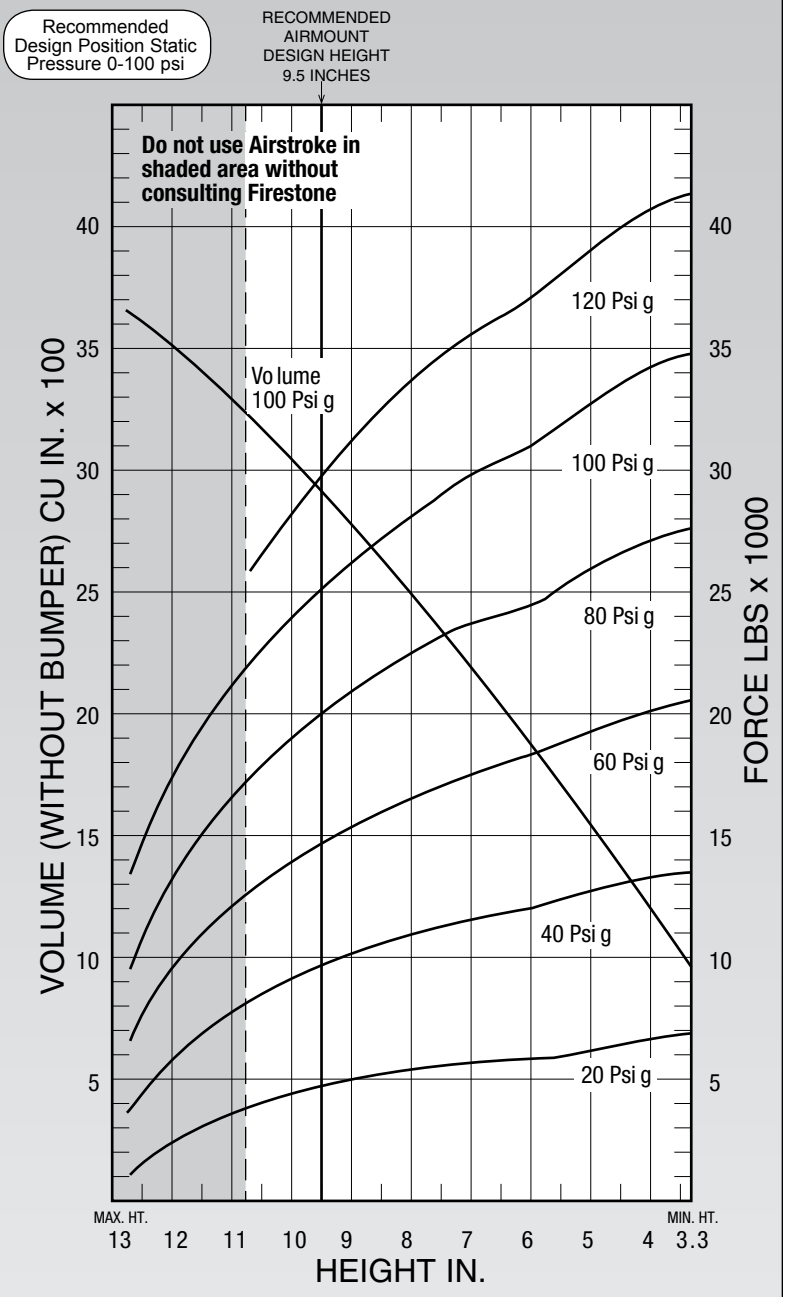
	Description	Assembly Order No.
Style 29 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7203
	Ribbed neck aluminum bead rings (unequal spacing) 1 7/8 b,n,w	W01-358-7205
	Ribbed neck aluminum bead rings (equal spacing) 1 1/4 b,n,w	W01-358-7201
	Rolled plate assembly*,1/2 blind nuts 3/4 NPT	W01-358-7275
	Rubber bellows only	W01-358-7902
Assembly weight..... 28.8 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 70 lbs.		

Style 207 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7242
	Ribbed neck aluminum bead rings (unequal spacing) 1 7/8 b,n,w	W01-358-7239
	Rubber bellows only	W01-139-0207



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*

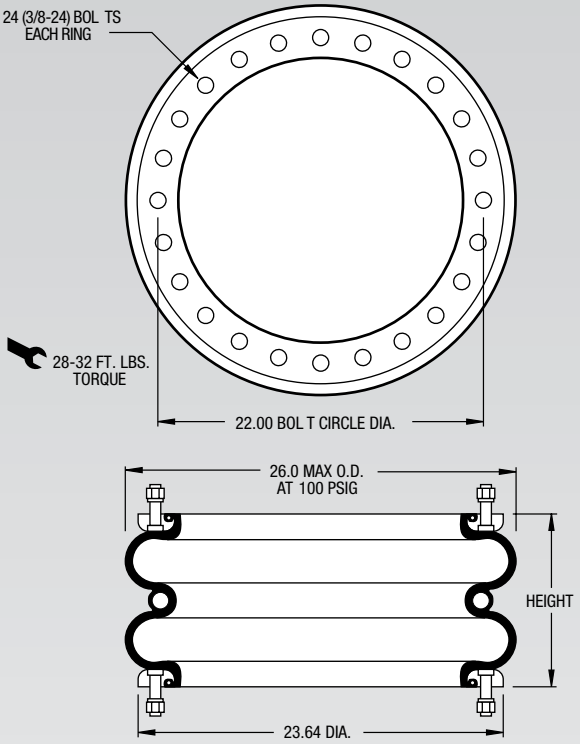


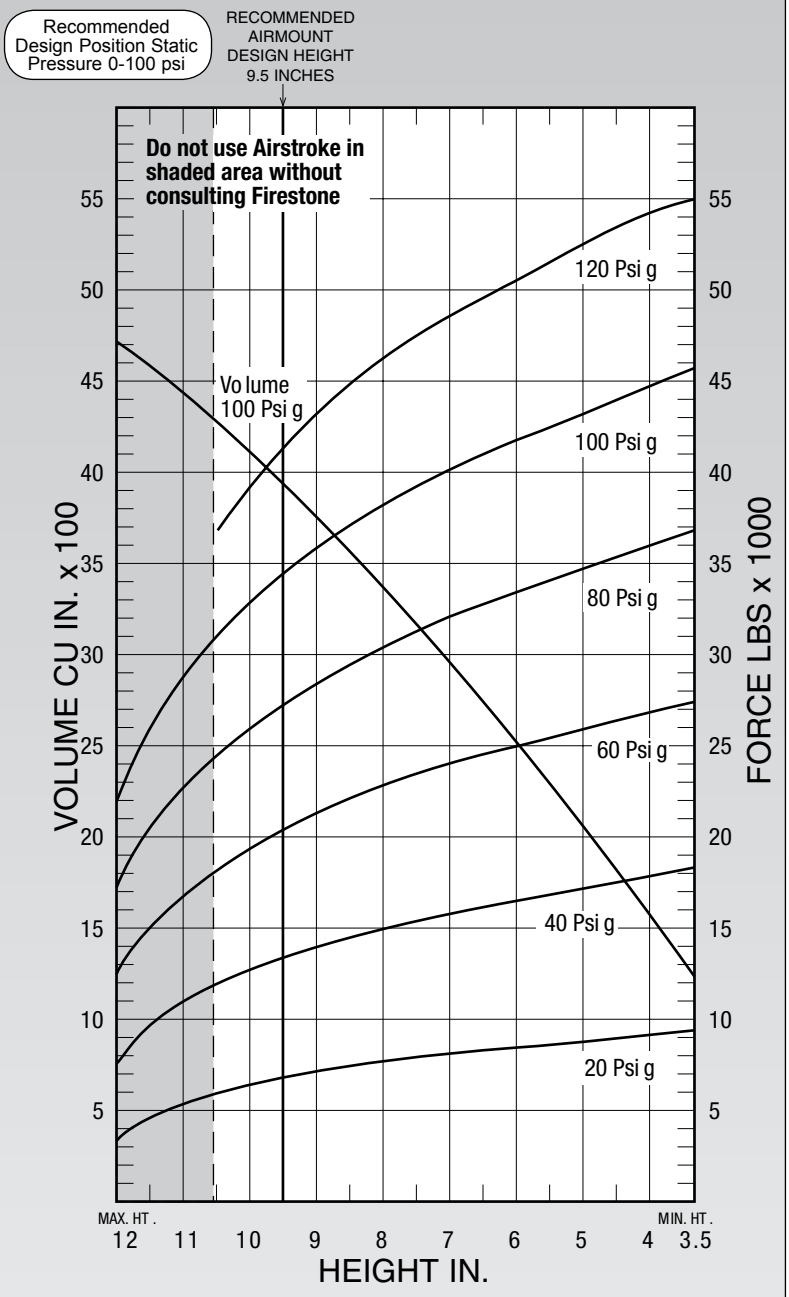
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 2,934 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	9,780	2,752	96	1.60
60	14,860	3,737	94	1.57
80	20,060	4,844	92	1.54
100	25,350	5,917	91	1.51

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	3,064	4,480	9,320	14,130	19,110	24,190
9.0	2,796	4,990	10,200	15,520	20,940	26,410
8.0	2,512	5,440	10,990	16,680	22,480	28,270
7.0	2,206	5,780	11,650	17,620	23,740	29,830
6.0	1,889	5,950	12,090	18,330	24,640	31,000
5.0	1,559	6,310	12,720	19,340	26,040	32,740
4.0	1,211	6,650	13,320	20,150	27,140	34,100

	Description	Assembly Order No.
Style 200 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7772
	Ribbed neck aluminum bead rings (equal spacing) 1 1/4 b,n,w	W01-358-7775
	Rubber bellows only	W01-358-5126
Assembly weight..... 34.9 lbs		
Force to collapse to minimum height (@ 0 PSIG) ... 100 lbs.		





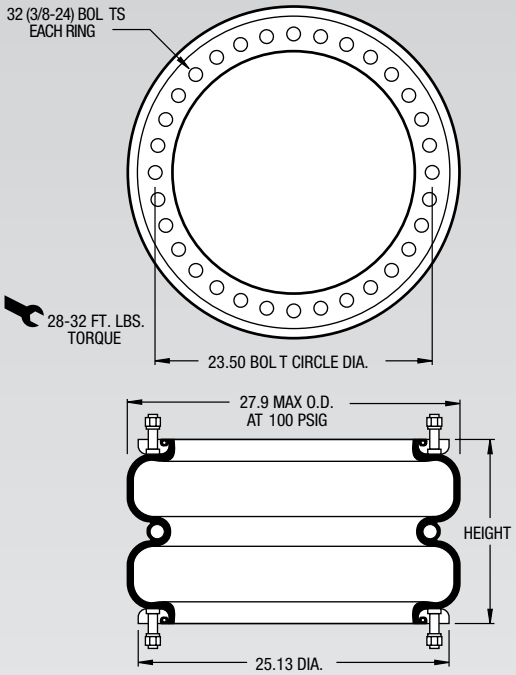
See page 12 for instructions on how to use chart.

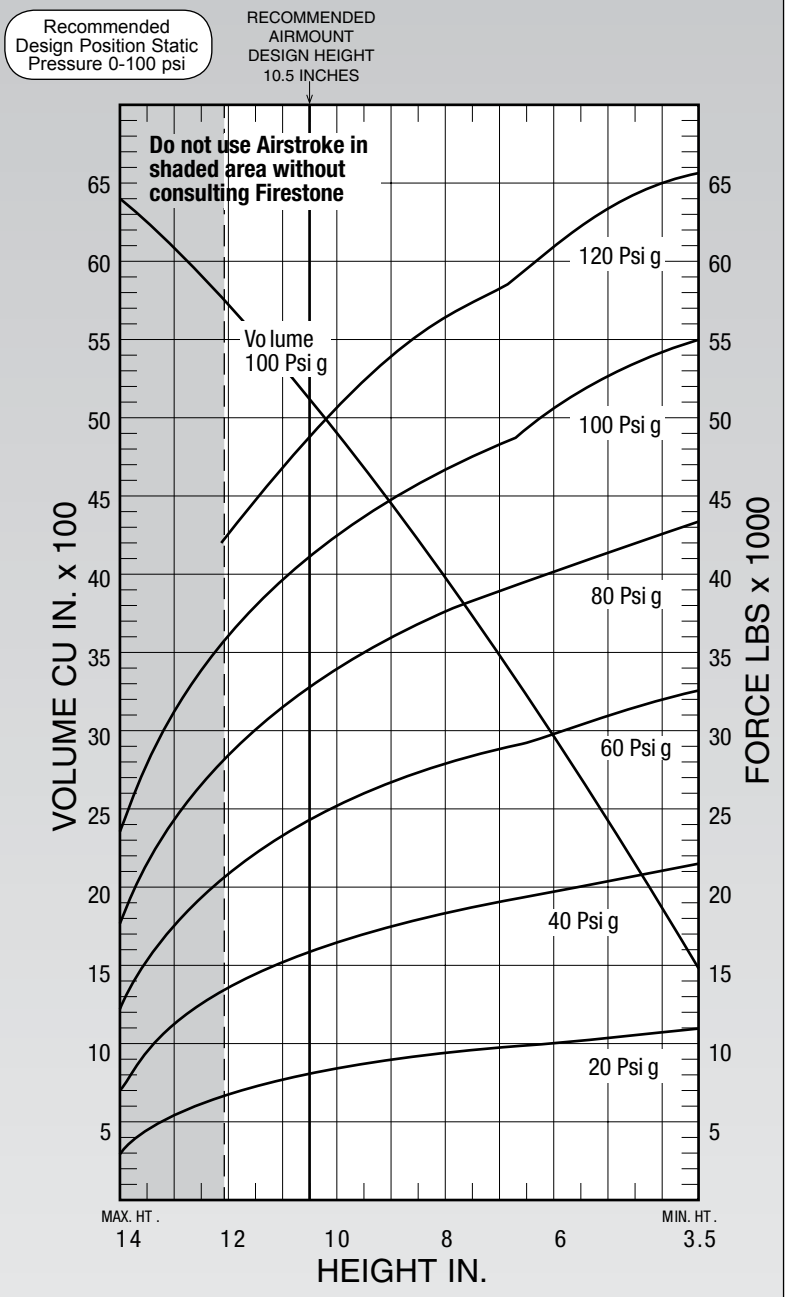
Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 3,921 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	13,290	3,784	100	1.67
60	20,390	5,336	96	1.60
80	27,330	6,763	93	1.56
100	34,620	8,105	91	1.51

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	4,099	6,270	12,530	19,300	25,970	33,040
9.0	3,734	7,070	13,960	21,360	28,550	36,020
8.0	3,343	7,710	15,070	22,960	30,580	38,450
7.0	2,928	8,180	15,920	24,160	32,200	40,400
6.0	2,495	8,540	16,610	25,110	33,550	41,960
5.0	2,055	8,880	17,280	26,010	34,790	43,400
4.0	1,589	9,260	18,000	26,960	36,020	44,850

NOTE: Replacement for Style 211

Description		Assembly Order No.
Style 215 — Two Ply High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), $1^{7}/_{8}$ bolts, nuts, washers	W01-358-7230
	Ribbed neck aluminum bead rings (unequal spacing) $1^{7}/_{8}$ b,n,w	W01-358-7301
	Ribbed neck aluminum bead rings (equal spacing) $1^{1}/_{4}$ b,n,w	W01-358-7302
	Rubber bellows only	W01-358-7912
Assembly weight ..... 41.0 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ... 160 lbs.		





See page 12 for instructions on how to use chart.

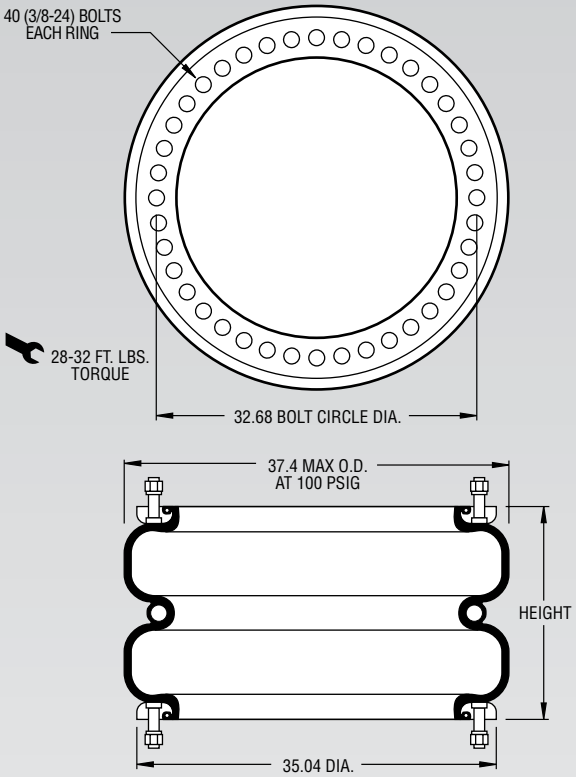
Dynamic Characteristics at 10.5 in. Design Height
(Required for Airmount isolator design only)

Volume @ 100 PSIG = 5,094 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	15,840	3,858	93	1.54
60	24,140	5,370	88	1.47
80	32,550	6,857	86	1.44
100	40,980	8,203	84	1.40

Force Table (Use for Airstroke™ actuator design)

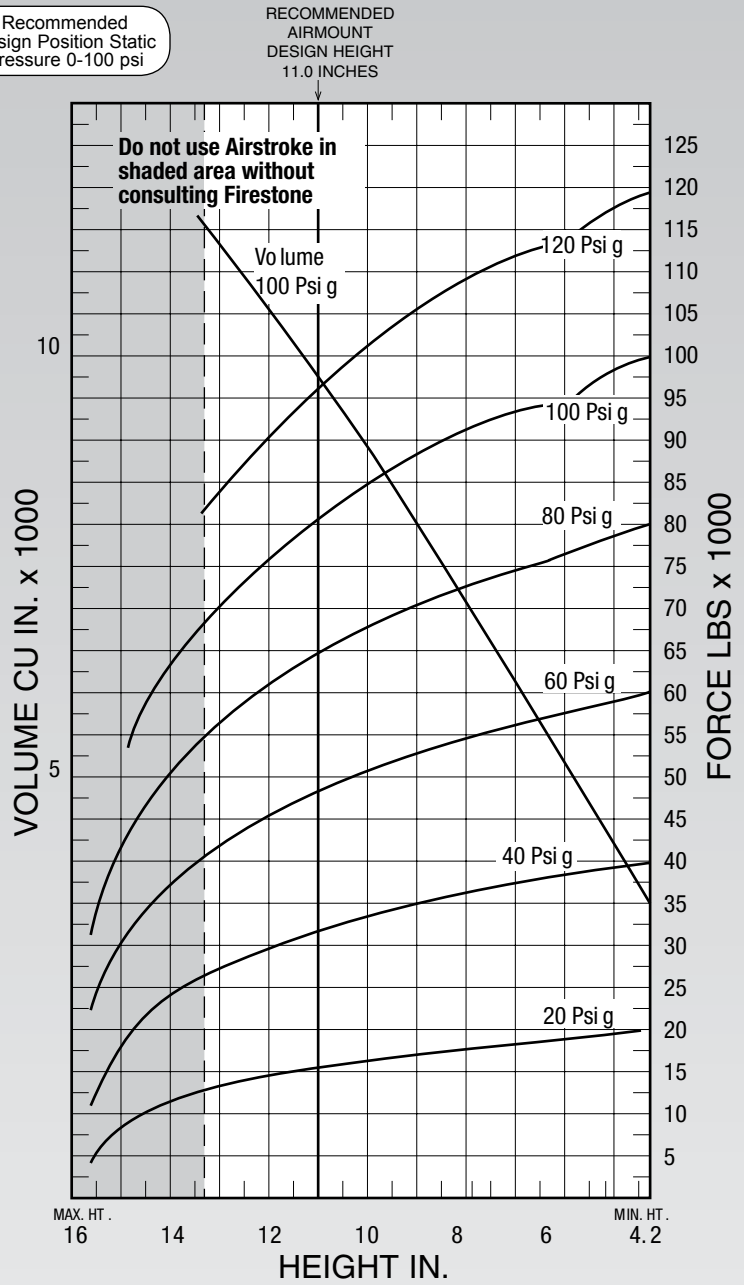
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
12.0	5,701	6,520	13,310	20,720	28,410	36,100
10.0	4,882	8,170	16,480	25,050	33,720	42,350
8.0	3,964	9,120	18,460	27,920	37,570	47,010
6.0	2,973	9,910	19,940	30,070	40,430	51,100
4.0	1,907	10,790	21,290	31,970	42,980	54,390

Description		Assembly Order No.
Style 248-2 Four Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-9602
Assembly weight..... 78.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ... 350 lbs.		



NOTE: The effective length of 1 7/8 bolt is 1.05" in this bead ring.

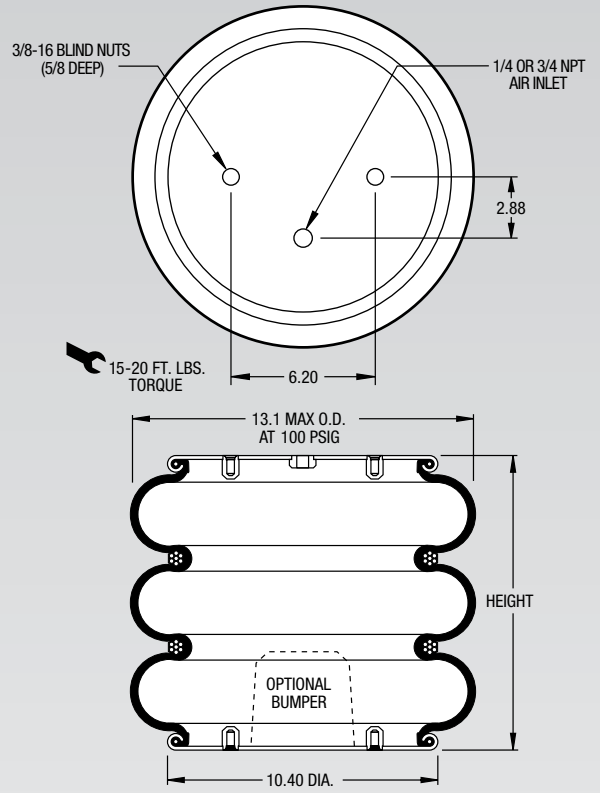
Dynamic Characteristics at 11.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 9,815 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	30,830	6,746	88	1.46
60	47,720	9,549	84	1.40
80	63,890	12,423	83	1.38
100	79,730	14,989	81	1.36



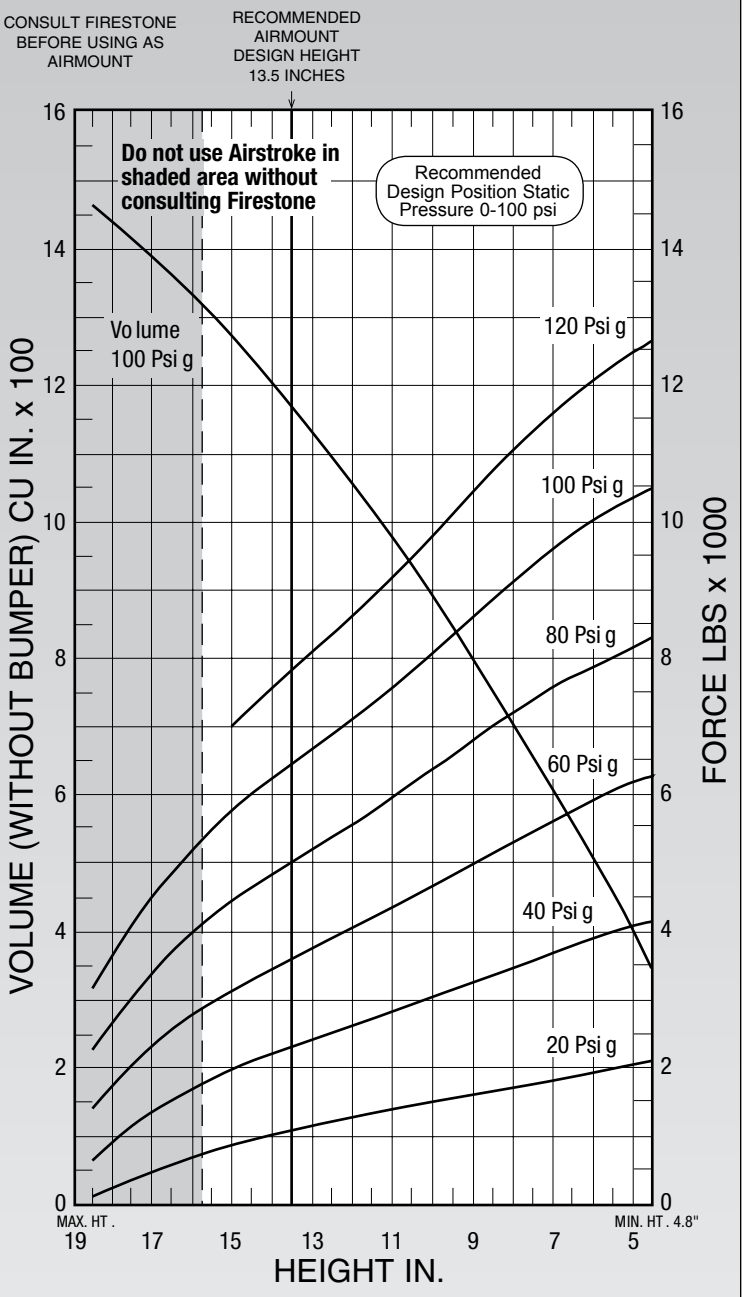
See page 12 for instructions on how to use chart.

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
13.0	11,386	12,660	26,460	41,020	55,290	69,700
11.0	9,815	15,200	30,830	47,720	63,890	79,730
9.0	8,090	16,890	34,210	52,080	69,850	87,790
7.0	6,243	18,210	37,030	55,570	74,410	93,230
5.0	4,304	19,270	38,820	58,730	78,570	98,180

Description		Assembly Order No.
Style 352 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-8048
	Blind nuts, 3/4 NPT	W01-358-8047
Assembly weight..... 17.6 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ... 200 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



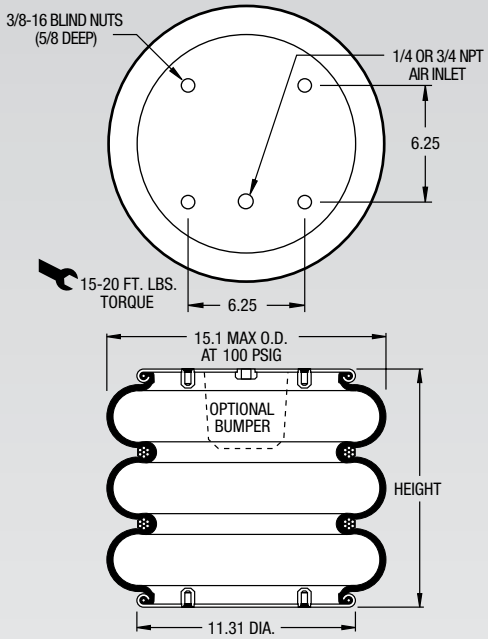
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 13.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,168 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,319	475	85	1.42
60	3,631	675	81	1.35
80	5,017	851	77	1.29
100	6,463	1,042	75	1.26

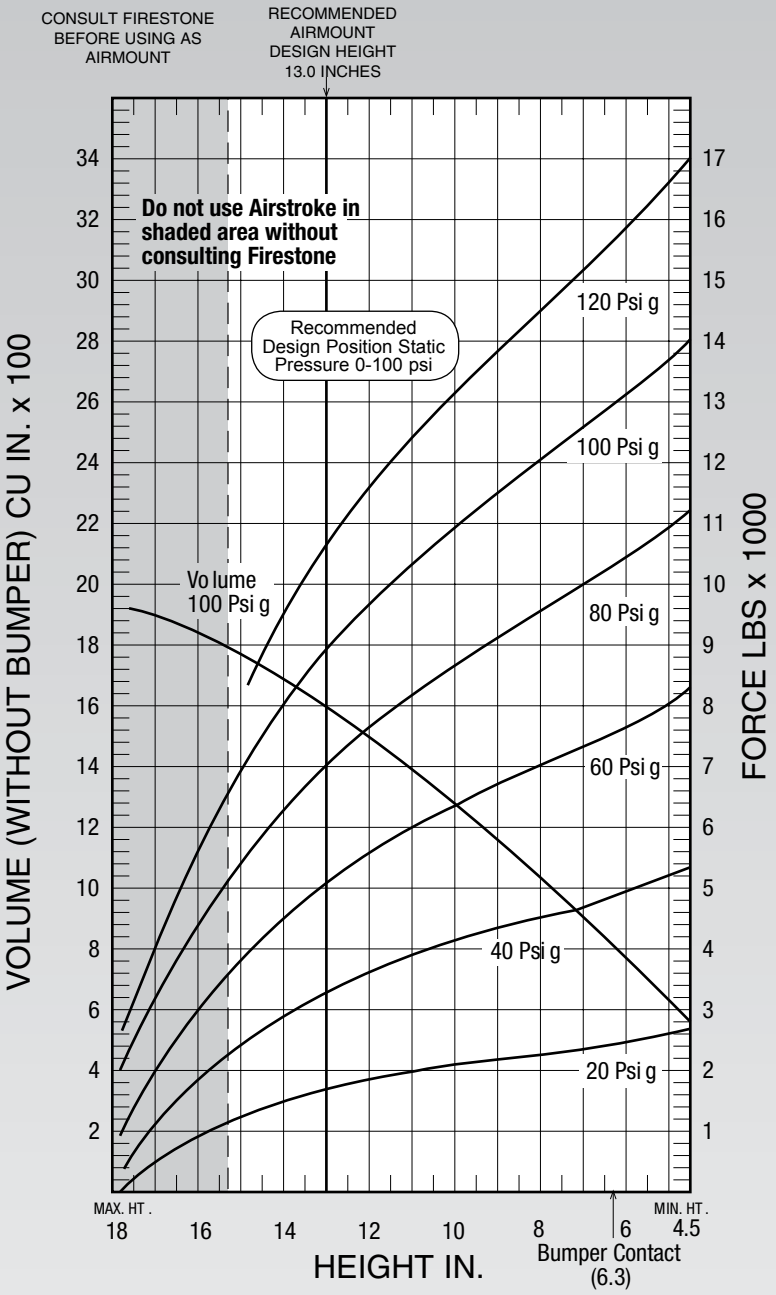
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
16.0	1,330	679	1,695	2,780	4,000	5,221
14.0	1,203	1,015	2,211	3,480	4,838	6,248
12.0	1,057	1,278	2,622	4,068	5,557	7,104
10.0	892	1,497	3,025	4,662	6,365	8,069
8.0	708	1,700	3,457	5,296	7,201	9,127
6.0	507	1,917	3,896	5,910	7,881	10,030
5.0	400	2,040	4,095	6,169	8,165	10,363

	Description	Assembly Order No.
Style 313 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7808
	Blind nuts, 1/4 NPT, bumper	W01-358-7811
	Blind nuts, 3/4 NPT	W01-358-7802
	Blind nuts, 3/4 NPT, bumper	W01-358-7807
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-7801
	Rubber bellows only	W01-358-7900
Assembly weight..... 20.6 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 46 lbs.		

Style 39 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-1098
	Blind nuts, 3/4 NPT	W01-358-7815
	Countersunk steel bead rings, 1 3/4 bolts, nuts, washers	W01-358-1099



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.

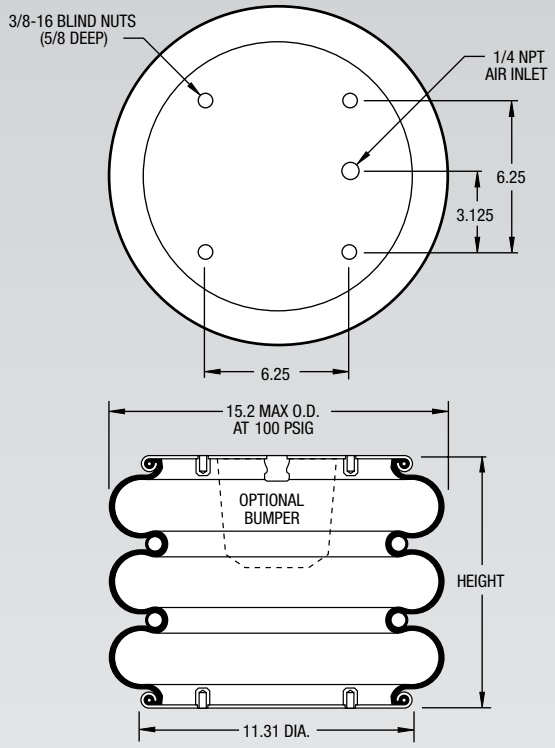


See page 12 for instructions on how to use chart.

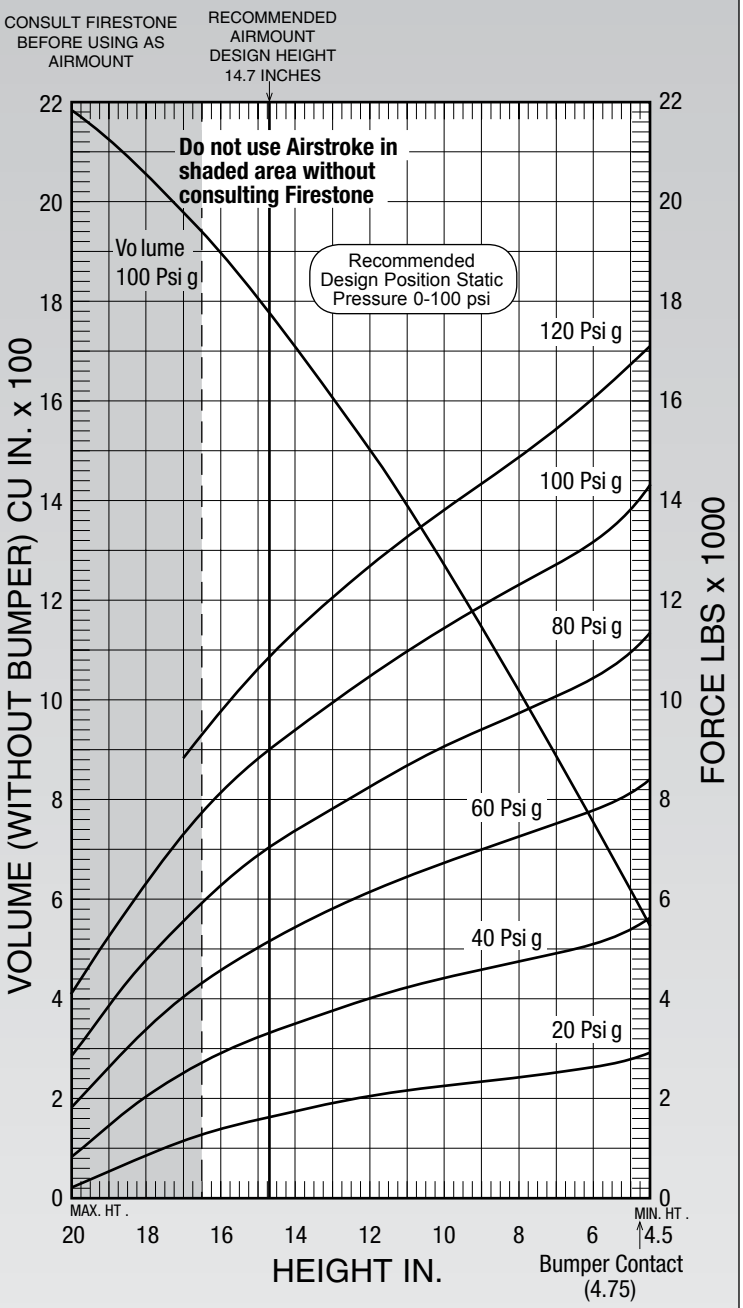
Dynamic Characteristics at 13.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,585 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,310	716	87	1.45
60	5,120	1,049	85	1.41
80	7,020	1,348	82	1.37
100	8,960	1,668	81	1.35

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
15.0	1,760	1,280	2,500	3,870	5,470	7,040
13.0	1,585	1,710	3,310	5,120	7,020	8,960
11.0	1,379	1,970	3,920	6,030	8,200	10,360
9.0	1,149	2,140	4,340	6,710	9,120	11,480
7.0	898	2,350	4,730	7,290	9,920	12,510
5.0	625	2,640	5,230	8,050	10,940	13,670

Description		Assembly Order No.
Style 333 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-7845
	Blind nuts, 1/4 NPT, bumper	W01-358-7838
	Blind nuts, 3/4 NPT	W01-358-7842
	Blind nuts, 3/4 NPT, bumper	W01-358-7849
	Countersunk steel bead ring 1 3/4 bolts, nuts, washers	W01-358-7830
	Rubber bellows only	W01-358-7019
Assembly weight..... 26.2 lbs.		
Force to collapse to minimum height (@ 0 PSIG) ..... 65 lbs.		



NOTE: A bead plate part is shown. This part is also available with bead rings. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

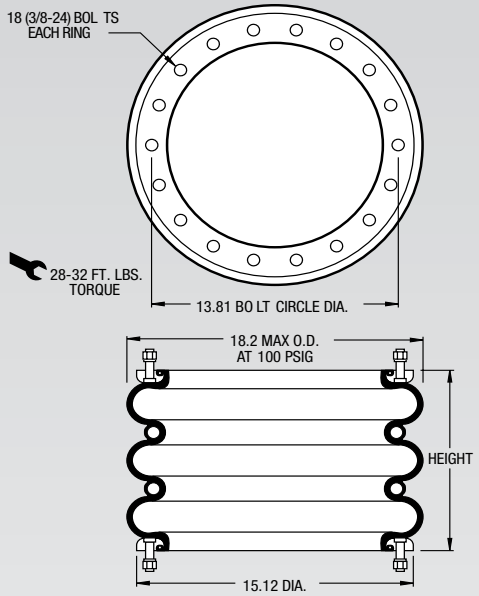
Dynamic Characteristics at 14.70 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,786 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,282	685	86	1.43
60	5,167	933	80	1.33
80	7,000	1,179	77	1.28
100	8,940	1,425	75	1.25

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
16.0	1,904	1,338	2,866	4,524	6,241	8,062
14.0	1,718	1,706	3,478	5,388	7,325	9,338
12.0	1,507	1,981	3,955	6,083	8,200	10,405
10.0	1,274	2,208	4,376	6,698	9,003	11,400
8.0	1,022	2,389	4,733	7,220	9,710	12,278
6.0	754	2,574	5,087	7,724	10,396	13,139
4.0	473	3,049	5,871	8,787	11,827	14,918

	Description	Assembly Order No.
Style 312 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7761
	Ribbed neck aluminum bead rings (unequal spacing) 1 7/8 b,n,w	W01-358-7760
	Rolled plate assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-7286
	Rubber bellows only	W01-358-7914
Assembly weight..... 24.8 lbs		
Force to collapse to minimum height (@ 0 PSIG) ... 135 lbs.		

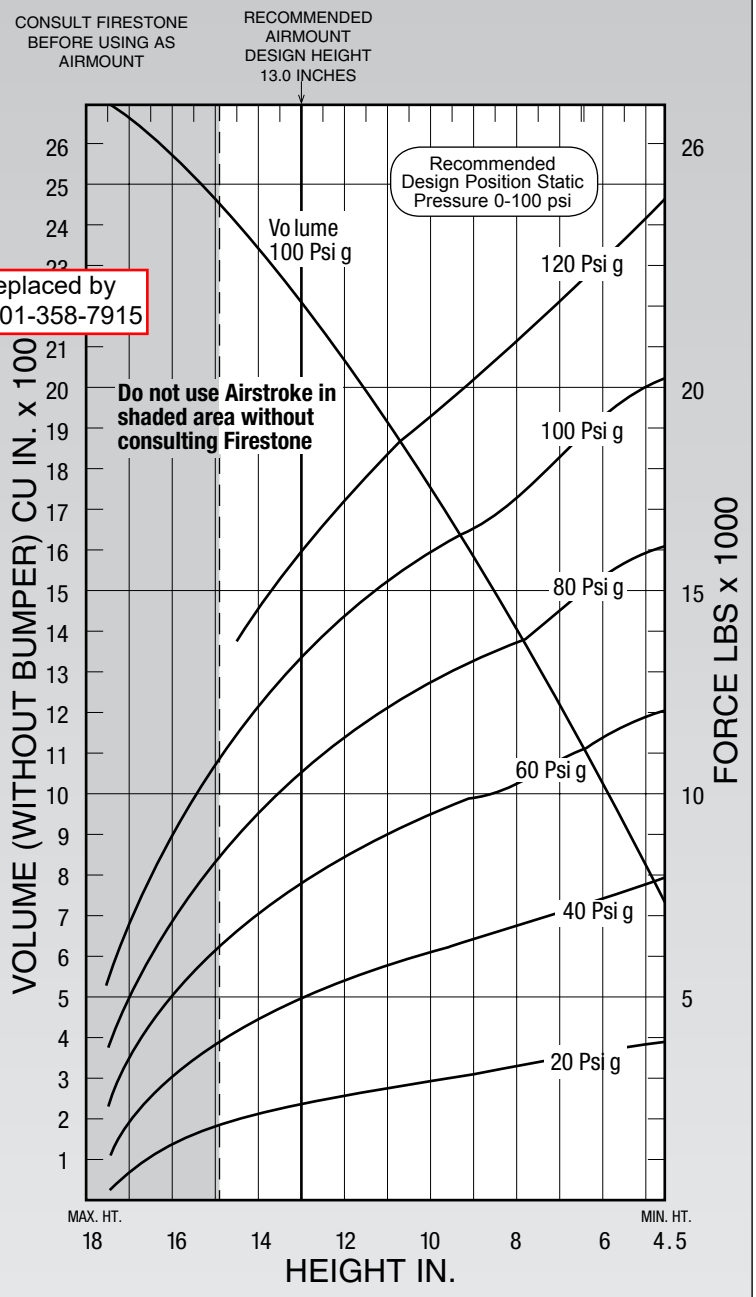
Replaced by W01-358-7915

Style 314 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-8003
	Ribbed neck aluminum bead rings (unequal spacing) 1 7/8 b,n,w	W01-358-8004
	Rubber bellows only	W01-358-7926



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*



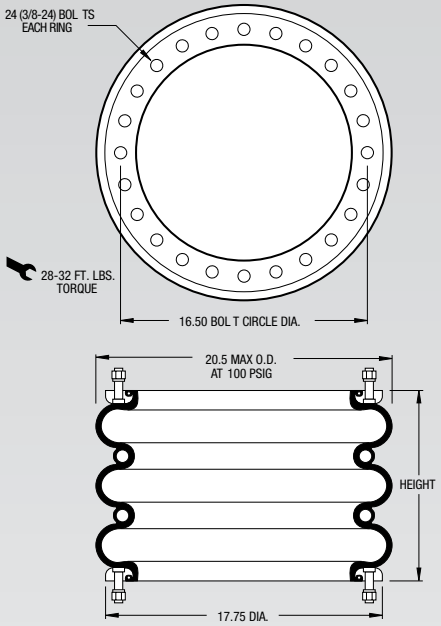
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 13.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 2,207 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	5,100	1,056	85	1.42
60	7,930	1,536	83	1.38
80	10,730	1,950	80	1.33
100	13,530	2,371	79	1.31

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
14.0	2,342	2,300	4,640	7,230	9,820	12,420
12.0	2,061	2,760	5,510	8,560	11,510	14,450
10.0	1,744	3,130	6,260	9,620	12,870	16,060
8.0	1,400	3,340	6,940	10,370	13,820	17,440
6.0	1,021	3,790	7,580	11,510	15,350	19,280

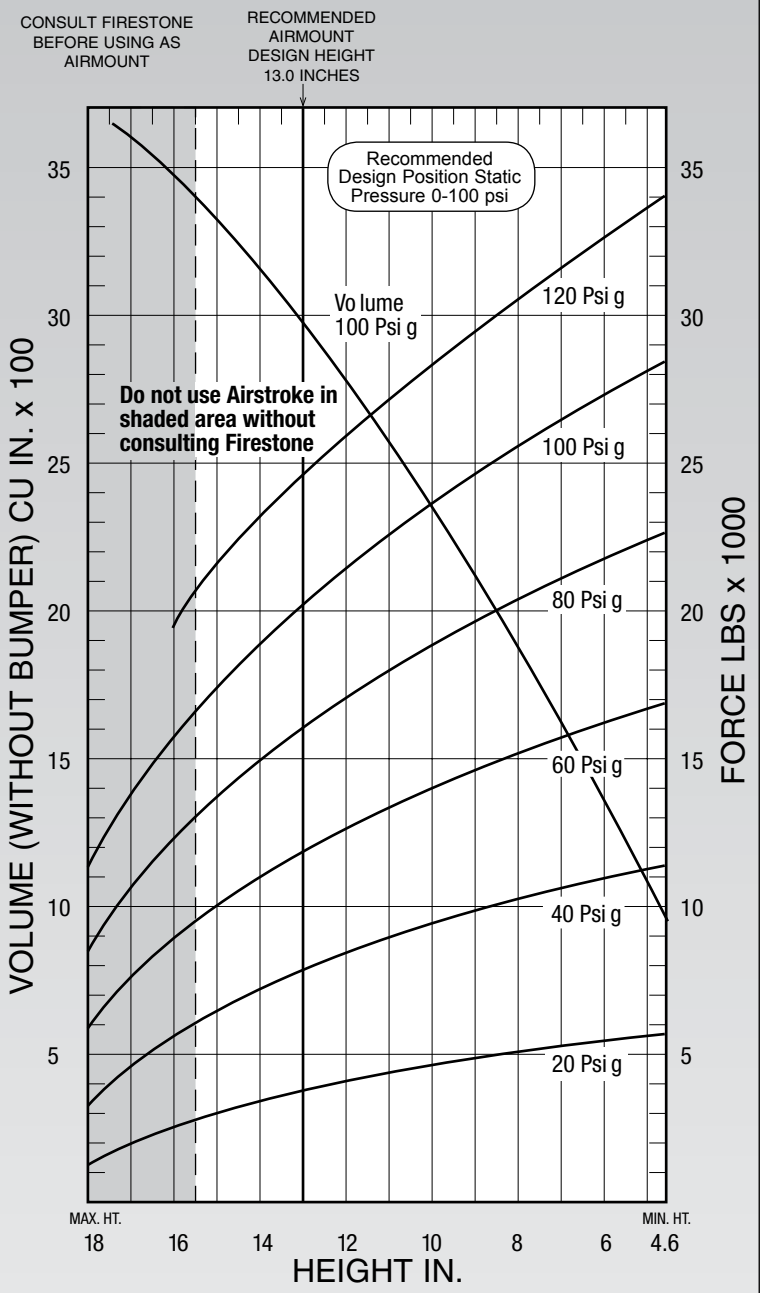
	Description	Assembly Order No.
Style 323 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), $1^7/_8$ bolts, nuts, washers	W01-358-7823
	Rolled plate assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-7274
	Rubber bellows only	W01-358-7921
Assembly weight..... 34.1 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 70 lbs.		

Style 324 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), $1^7/_8$ bolts, nuts, washers	W01-358-7829
	Rubber bellows only	W01-358-0324



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*



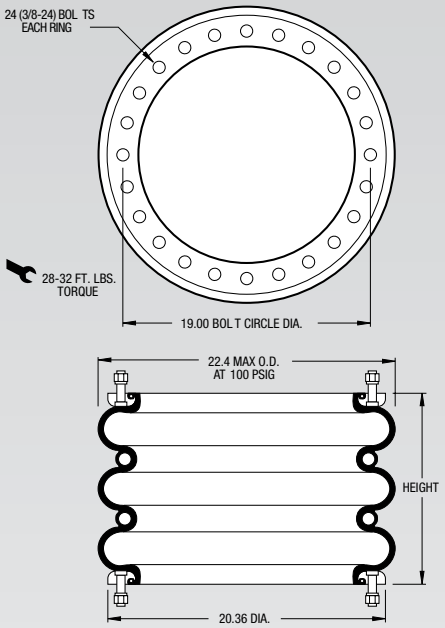
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 13.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 3,073 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	8,010	1,744	88	1.46
60	12,030	2,104	78	1.31
80	16,270	2,784	78	1.30
100	20,580	3,624	79	1.31

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
15.0	3,470	3,220	6,640	10,280	13,960	17,740
13.0	3,073	3,960	8,010	12,030	16,270	20,580
11.0	2,632	4,330	8,910	13,420	18,030	22,770
9.0	2,150	4,740	9,610	14,450	19,410	24,420
7.0	1,639	5,030	10,120	15,410	20,770	26,200
5.0	1,093	5,610	11,140	16,590	22,380	28,170

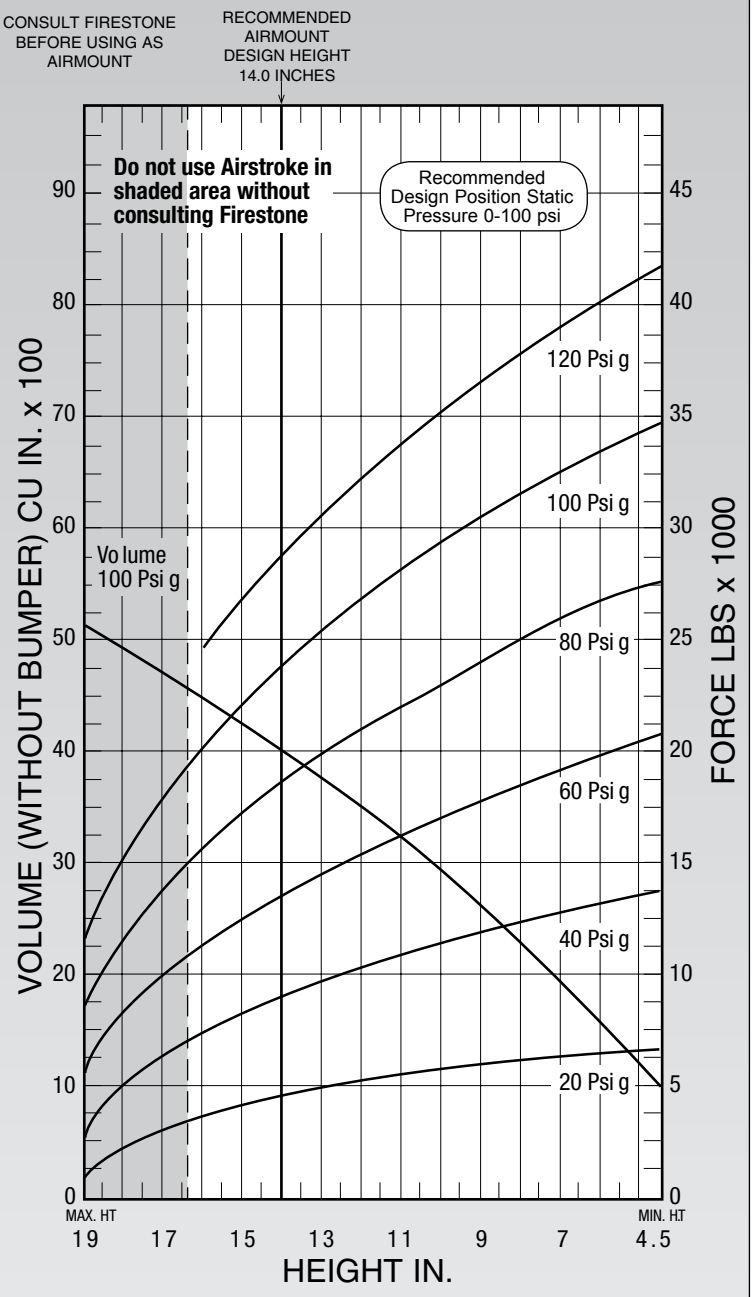
	Description	Assembly Order No.
Style 320 Two Ply Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-7324
	Rolled plate assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-7276
	Rubber bellows only	W01-358-0987
Assembly weight..... 39.5 lbs		
Force to collapse to minimum height (@ 0 PSIG) ..... 90 lbs.		

Style 328 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-9528
	Rolled plate assembly*, 1/2 blind nuts, 3/4 NPT	W01-358-9526



NOTE: A bead ring part is shown. This part is also available with rolled plates. See page 11 for explanation.

**Increase the minimum height by .70 inch. Add .70 inch to the height (bottom axis) before reading loads.*



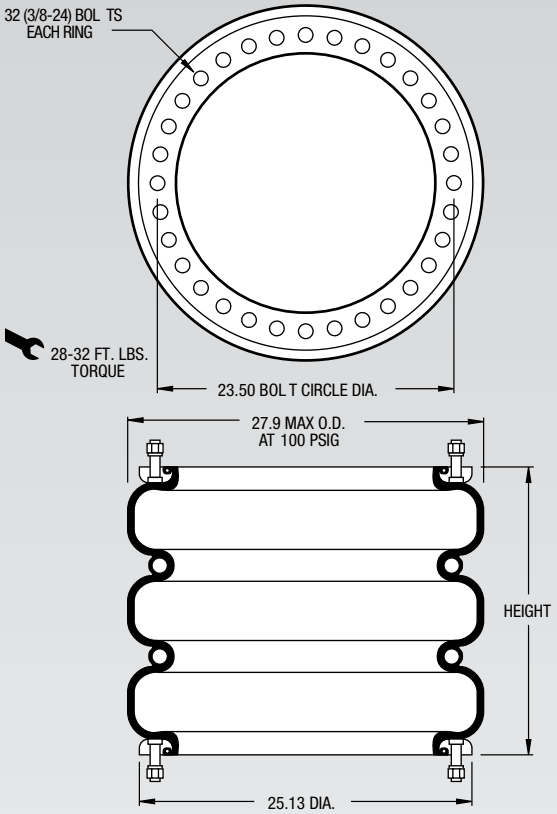
See page 12 for instructions on how to use chart.

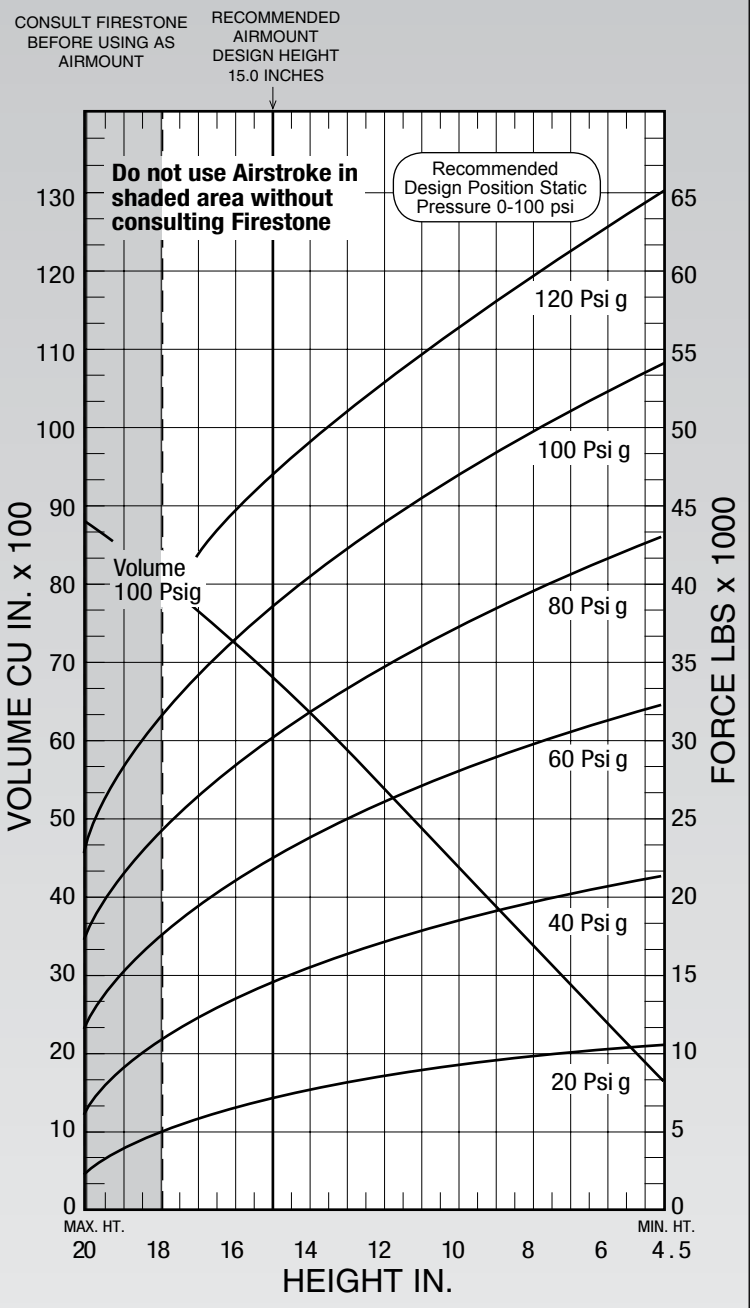
Dynamic Characteristics at 14.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 4,263 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	9,340	1,588	77	1.29
60	14,250	2,515	79	1.32
80	19,200	3,114	76	1.26
100	24,220	3,724	74	1.23

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
16.0	4,754	3,730	7,930	11,990	16,370	21,230
14.0	4,263	4,450	9,340	14,250	19,200	24,220
12.0	3,716	5,230	10,470	15,700	21,260	26,980
10.0	3,122	5,860	11,420	17,220	23,580	29,680
8.0	2,495	5,940	12,020	18,170	24,700	31,120
6.0	1,819	6,210	13,150	20,030	26,890	33,870

NOTE: Replacement for Style 319

	Description	Assembly Order No.
Style 321 Two Ply High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), $1^7/_8$ bolts, nuts, washers	W01-358-7304
	Ribbed neck aluminum bead rings (unequal spacing) $1^7/_8$ b,n,w	W01-358-7306
	Ribbed neck aluminum bead rings (equal spacing), $^7/_8$ bolts, nuts, washers	W01-358-7319
	Rubber bellows only	W01-358-7919
Assembly weight..... 54.5 lbs		
Force to collapse to minimum height (@ 0 PSIG) ... 180 lbs.		





See page 12 for instructions on how to use chart.

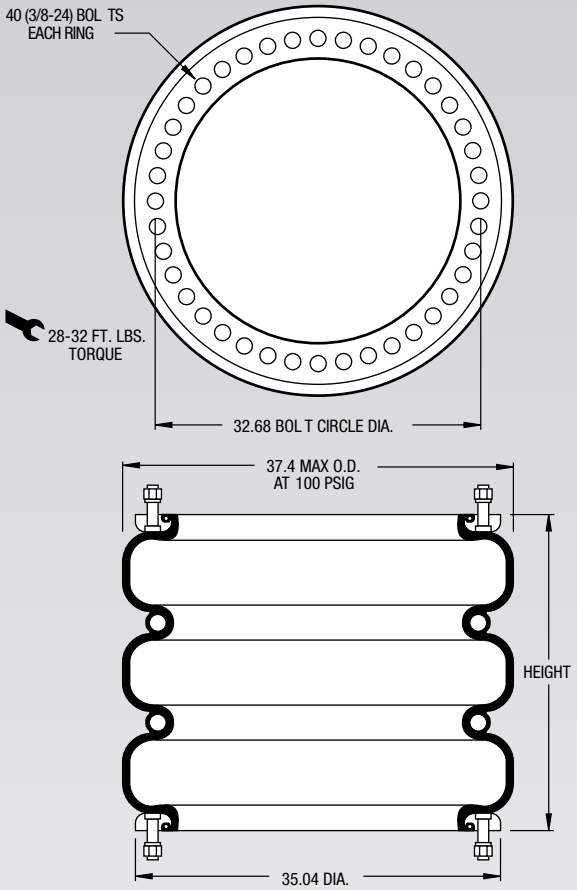
Dynamic Characteristics at 15.0 in. Design Height
(Required for Airmount isolator design only)

Volume @ 100 PSIG = 6,984 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	15,080	2,731	80	1.34
60	23,220	3,602	74	1.23
80	31,160	4,554	72	1.20
100	39,070	5,532	71	1.18

Force Table (Use for Airstroke™ actuator design)

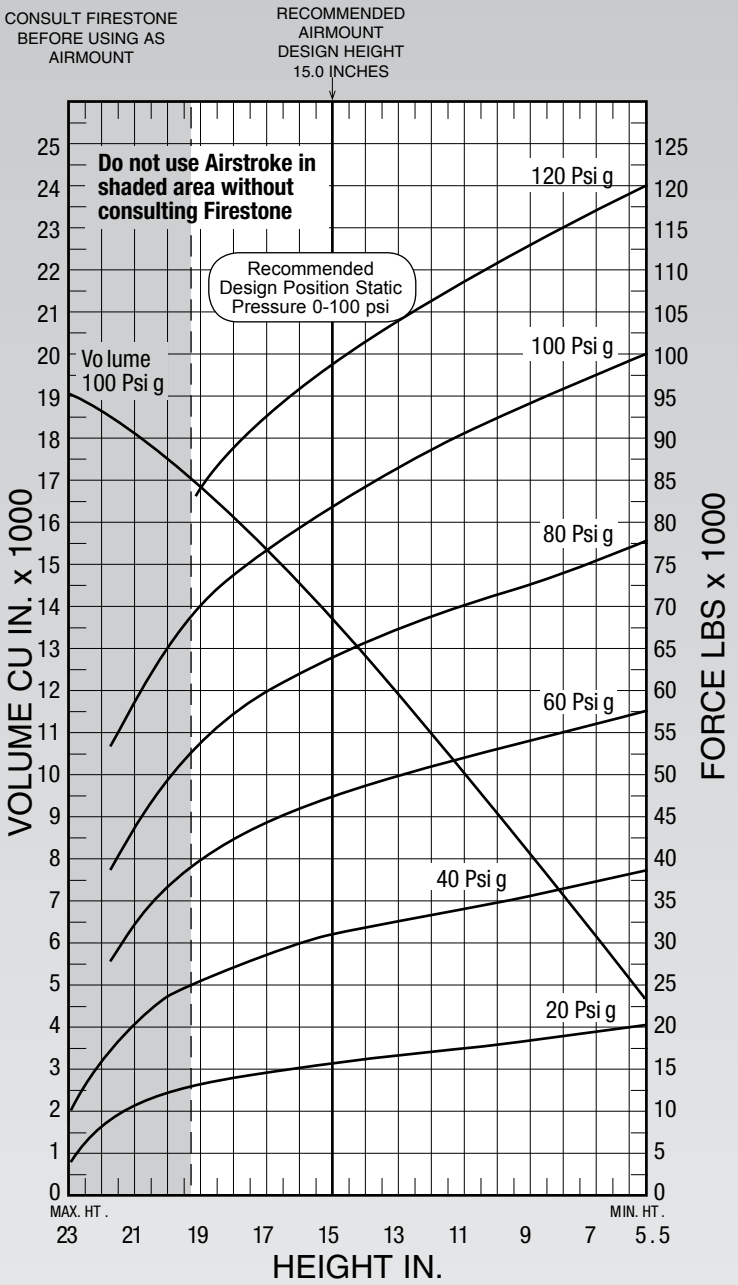
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
18.0	8,136	5,300	11,230	17,840	24,760	31,660
16.0	7,390	6,830	13,920	21,490	29,220	37,010
14.0	6,560	7,830	15,890	24,130	32,390	40,830
12.0	5,660	8,230	17,080	25,960	34,870	44,060
10.0	4,711	8,950	18,220	27,640	36,450	46,370
8.0	3,717	9,250	19,030	29,160	39,320	49,270
6.0	2,653	10,100	20,350	31,200	41,890	52,170

Description		Assembly Order No.
Style 348-3 High Strength Bellows	Ribbed neck aluminum bead rings (equal spacing), 1 7/8 bolts, nuts, washers	W01-358-9603
	Rubber bellows only	W01-358-1023
Assembly weight..... 102.5 lbs		
Force to collapse to minimum height (@ 0 PSIG) ... 380 lbs.		



NOTE: The effective length of the 1 7/8 bolt is 1.05" in this bead ring.

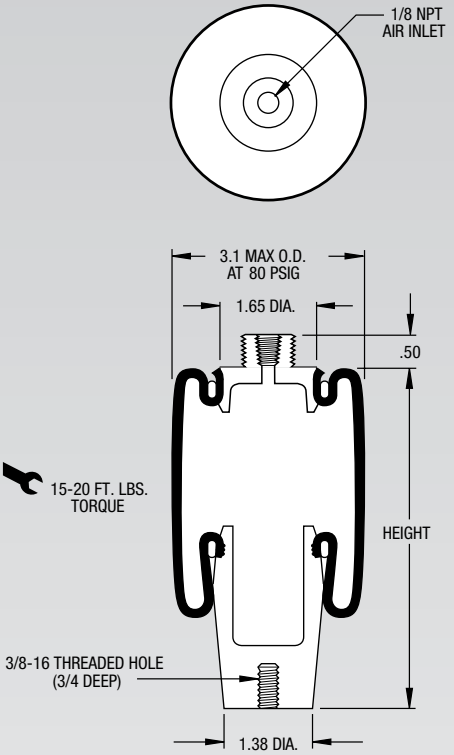
Dynamic Characteristics at 15.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 13,501 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	31,480	4,761	73	1.22
60	47,870	6,586	70	1.16
80	64,870	8,614	68	1.14
100	82,540	10,592	67	1.12



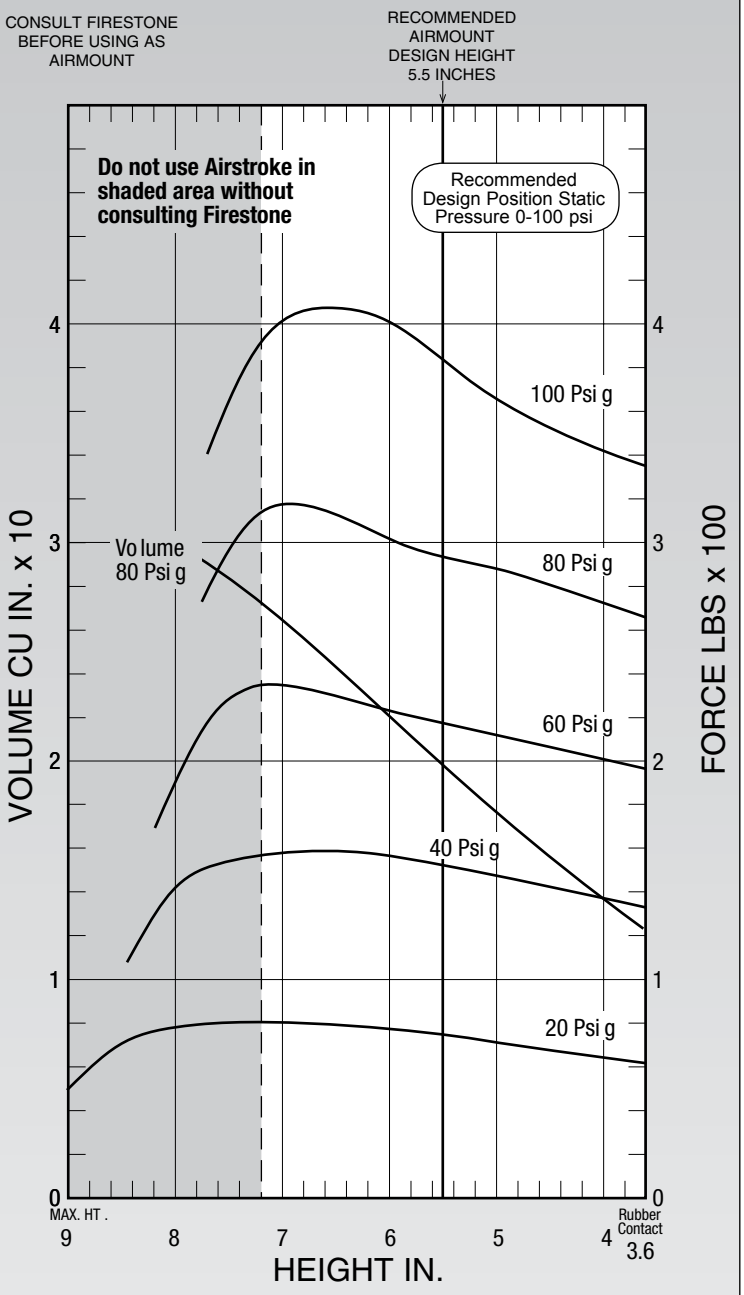
See page 12 for instructions on how to use chart.

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
18.0	15,946	14,080	27,430	43,790	57,710	74,670
16.0	14,340	15,190	30,370	46,420	62,810	80,190
14.0	12,634	16,230	32,380	49,170	66,610	84,820
12.0	10,843	17,330	33,880	51,470	69,410	89,150
10.0	8,984	18,290	35,370	53,580	71,930	93,030
8.0	7,075	19,070	36,970	55,590	74,740	96,470
6.0	5,102	19,760	38,620	57,550	77,790	99,680

Description		Assembly Order No.
Style 4004 Two Ply Bellows	Blind nut, 1/8 NPT	W02-358-4004
Assembly weight..... .7 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

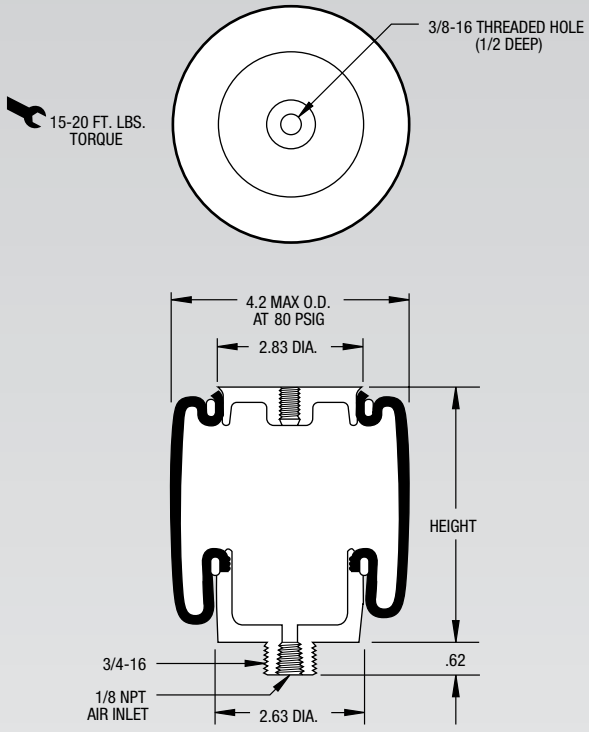


See page 12 for instructions on how to use chart.

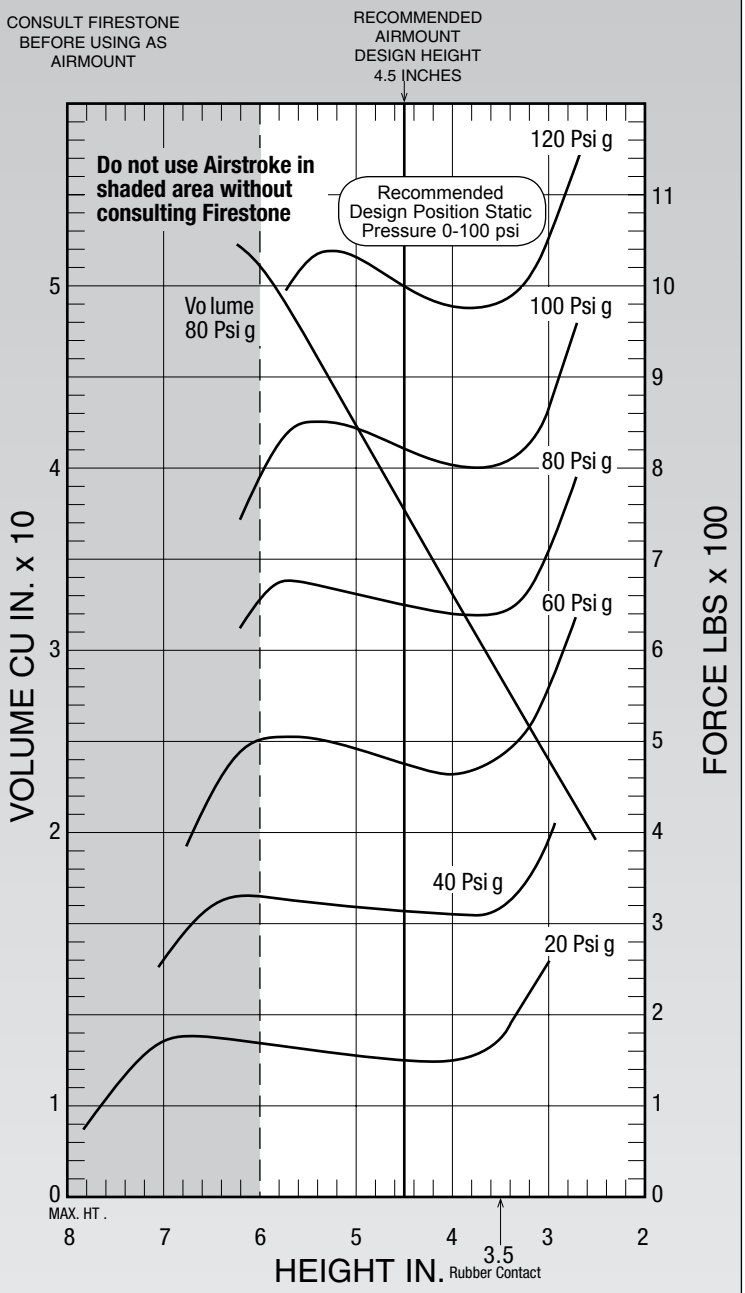
Dynamic Characteristics at 5.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 80 PSIG = 20 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	150	55	113	1.88
60	220	70	107	1.78
80	290	91	105	1.74
100	380	99	95	1.59

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 80 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
7.0	26	80	160	230	320	410
6.0	22	80	160	220	300	400
5.0	18	70	150	210	290	370
4.0	14	60	140	200	270	340

Description		Assembly Order No.
Style 7002 Two Ply Bellows	Blind nut, 1/8 NPT	W02-358-7002
Assembly weight..... 1.0 lb.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

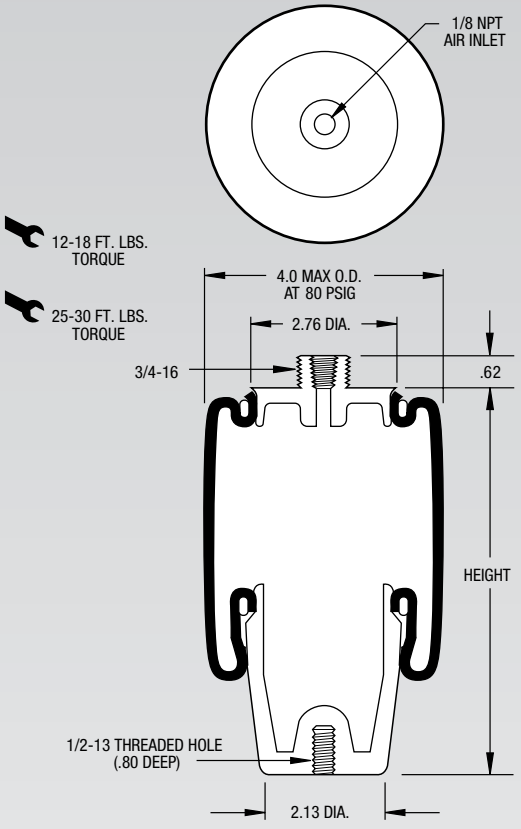


See page 12 for instructions on how to use chart.

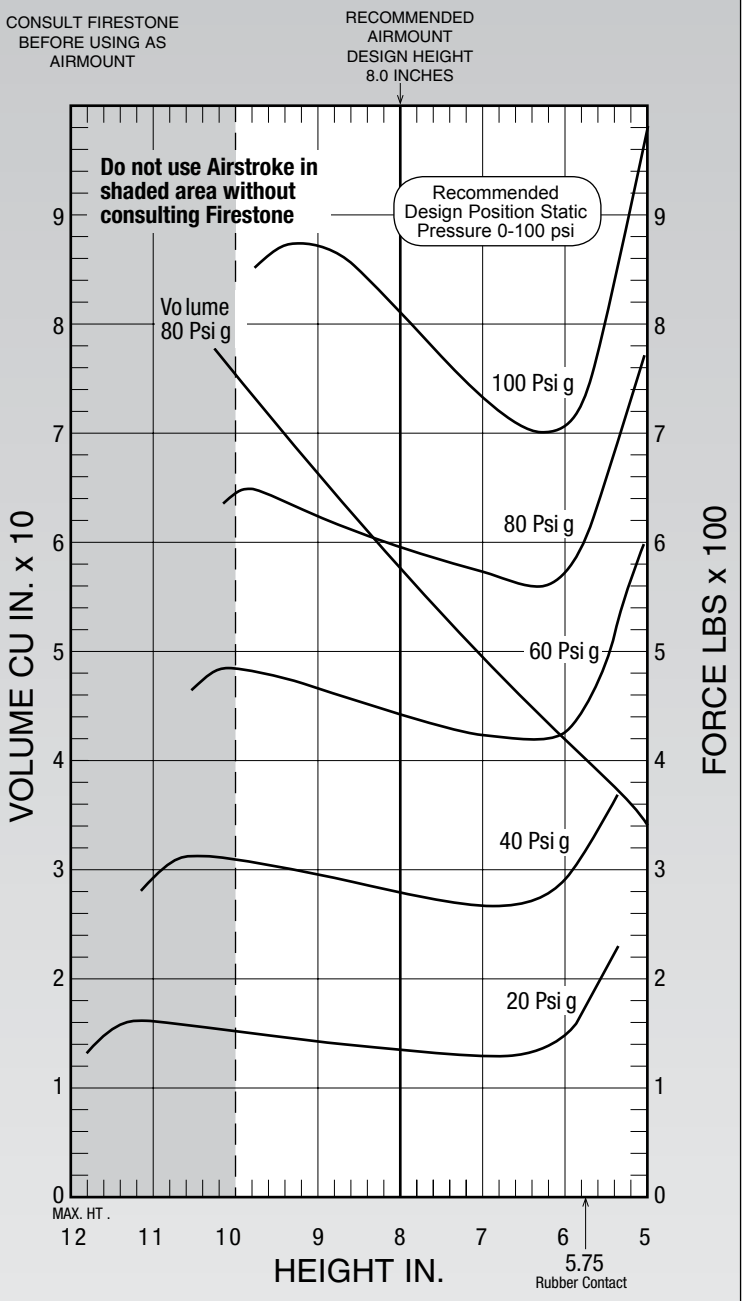
Dynamic Characteristics at 4.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 80 PSIG = 37 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	310	137	124	2.07
60	480	178	114	1.91
80	650	239	114	1.89
100	820	280	110	1.81

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 80 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
6.0	50	170	330	510	680	860
5.0	42	150	320	490	660	840
4.0	33	150	310	470	640	800

Description		Assembly Order No.
Style 7010 Two Ply Bellows	Blind nut, 1/8 NPT	W02-358-7010
Assembly weight..... 1.6 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

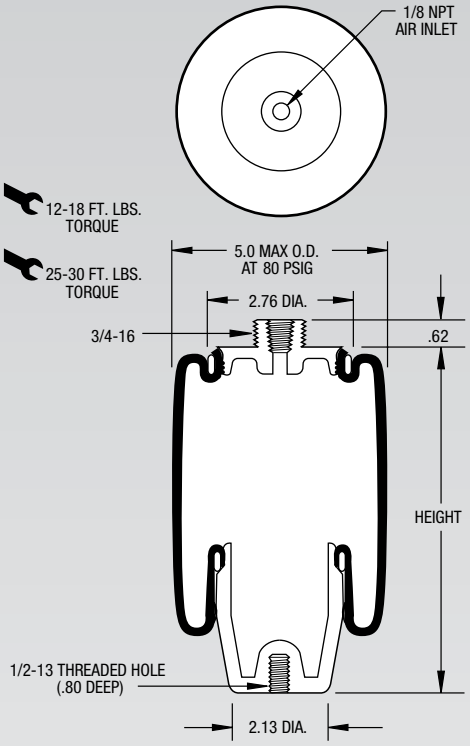


See page 12 for instructions on how to use chart.

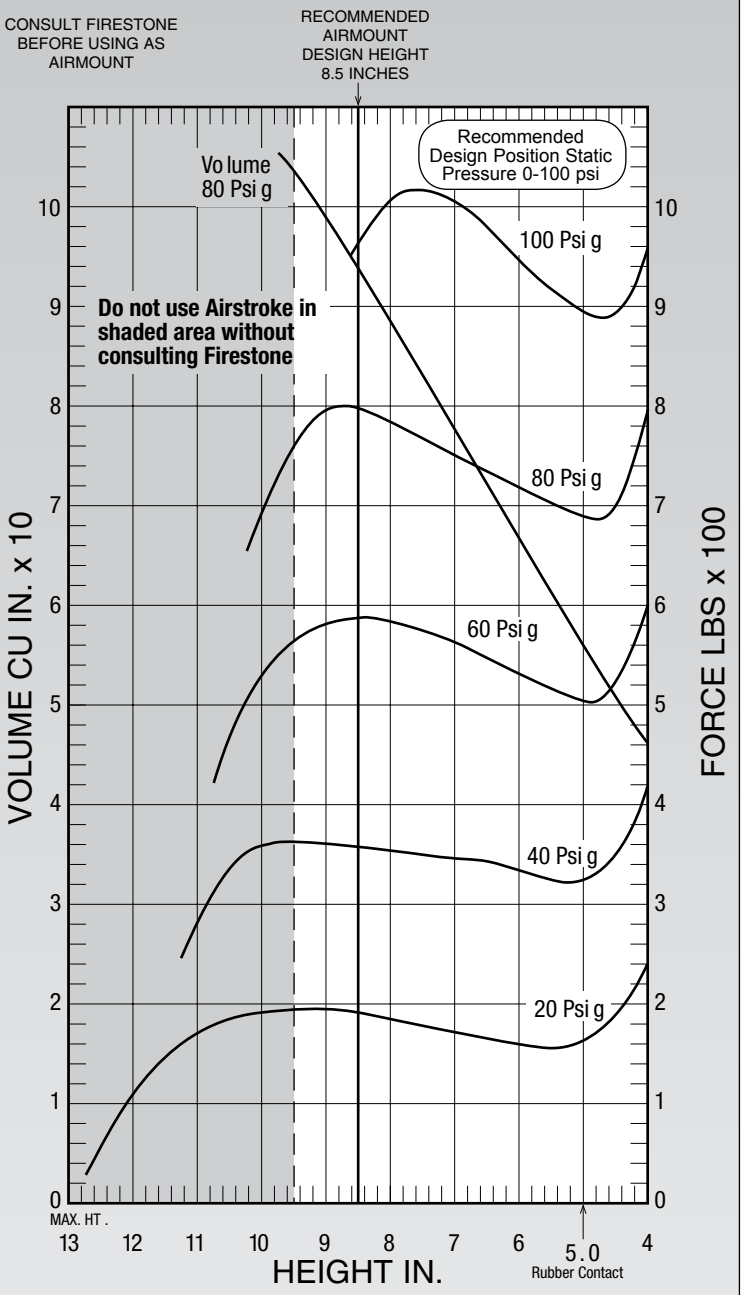
Dynamic Characteristics at 8.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 80 PSIG = 58 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	280	62	88	1.47
60	440	89	84	1.40
80	600	116	83	1.38
100	810	107	68	1.13

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 80 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	75	150	310	480	650	880
9.0	67	140	300	470	630	870
8.0	58	140	280	440	600	810
7.0	50	130	270	430	580	740

Description		Assembly Order No.
Style 7012 Two Ply Bellows	Blind nut, 1/8 NPT	W02-358-7012
Assembly weight..... 1.8 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

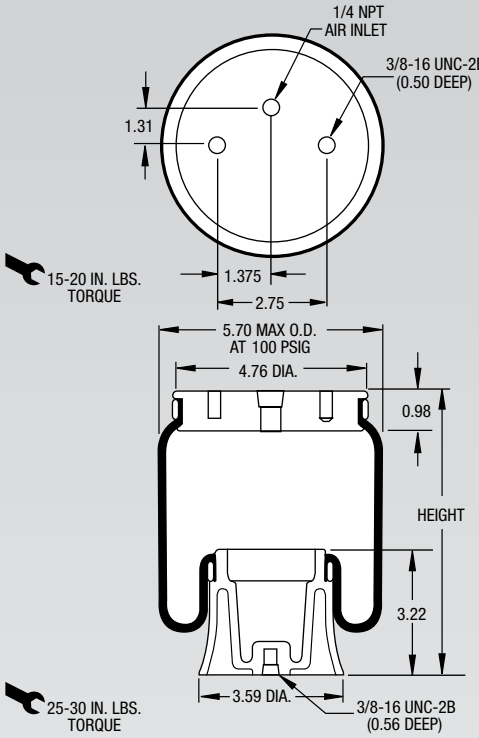


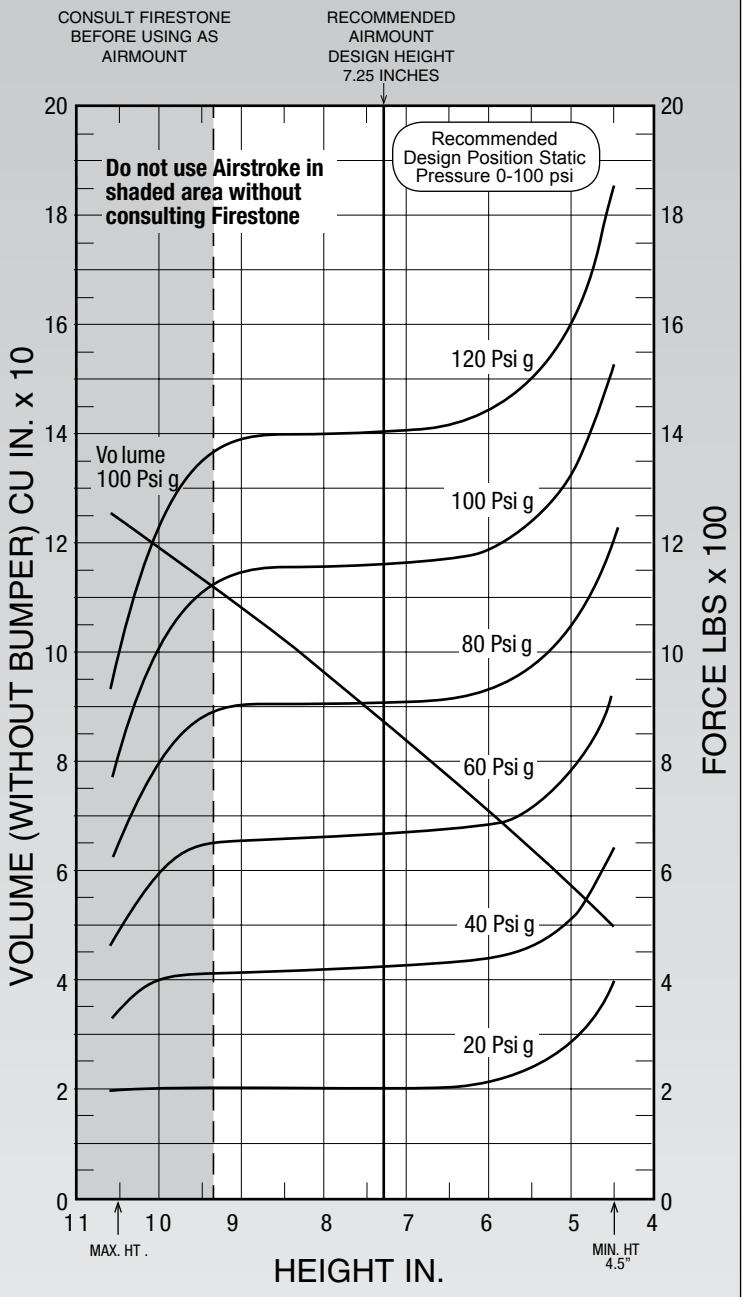
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 8.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 80 PSIG = 93 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	360	69	82	1.37
60	590	115	83	1.38
80	800	131	76	1.27
100	1,000	184	80	1.34

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 80 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
9.0	98	200	370	590	800	1,020
8.0	87	190	360	590	780	1,020
7.0	76	170	350	560	750	1,000
6.0	66	160	340	530	720	950
5.0	56	170	330	510	690	890

Description		Assembly Order No.
Style 110/70 Two Ply Bellows	Blind nut, 1/4 NPT	W26-358-9025
Assembly weight..... 1.5 lbs.		





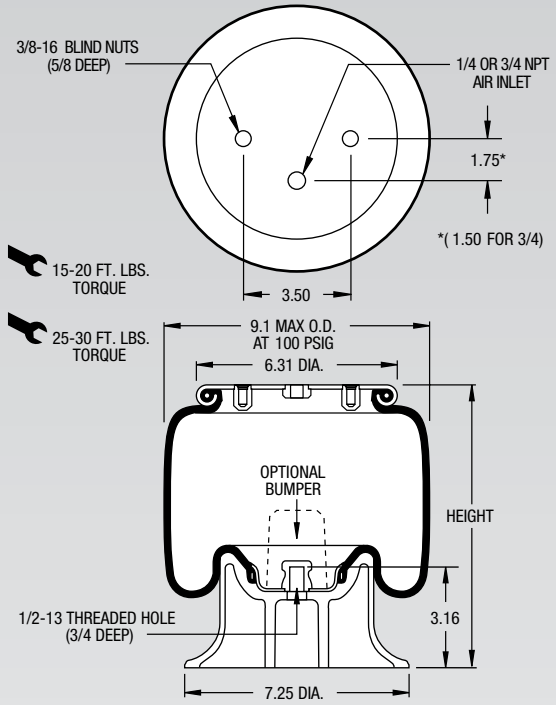
NOTE: Recommended operating pressure not to exceed 100 psig.

See page 12 for instructions on how to use chart.

Dynamic Characteristics at 7.25 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 87 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	430	132	104	1.73
60	670	181	98	1.63
80	910	230	94	1.57
100	1160	279	92	1.53

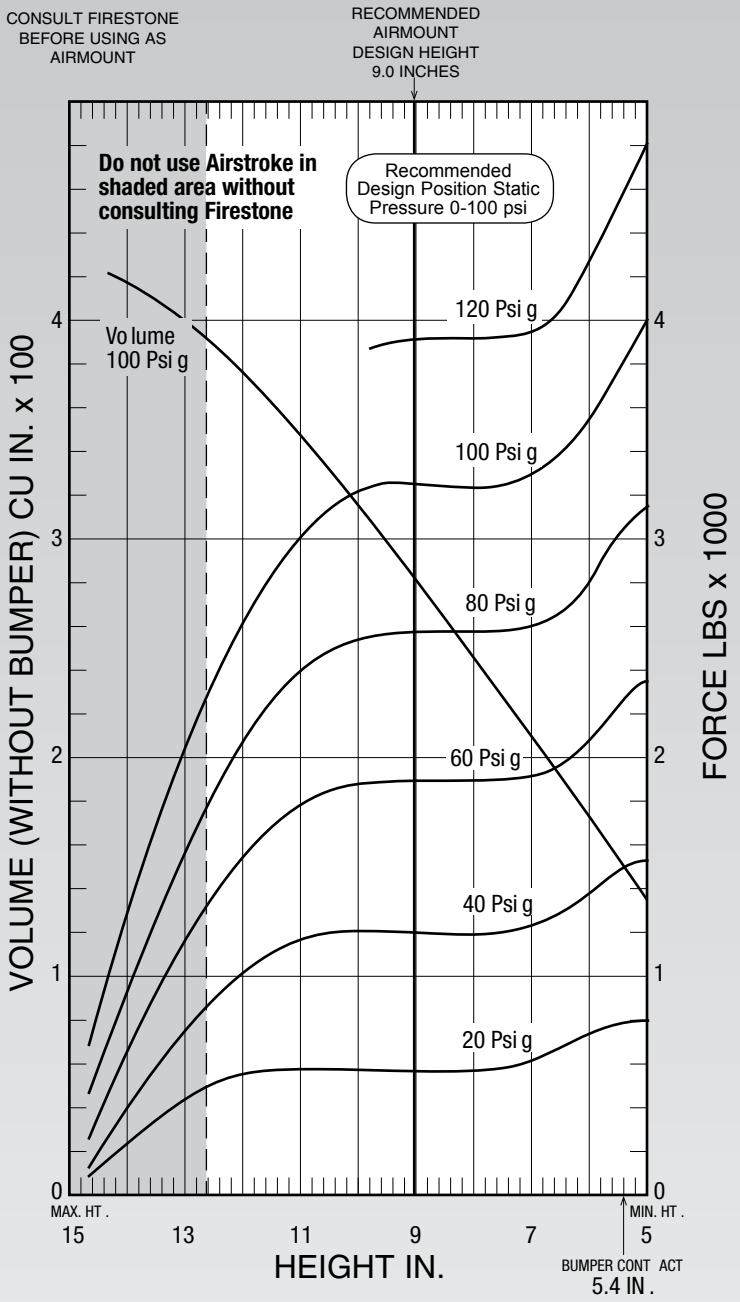
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
9	108	200	415	655	900	1145
8	96	200	415	655	910	1155
7	84	205	430	670	915	1160
6	71	220	445	690	935	1200
5	58	300	515	790	1050	1325

	Description	Assembly Order No.
Style 1T14C-1 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-5310
	Blind nuts, 1/4 NPT, bumper	W01-358-5311
	Blind nuts, 3/4 NPT	W01-358-5305
	Blind nuts, 3/4 NPT, bumper	W01-358-5306
	Countersunk steel bead ring 1 3/4 bolts, nuts, washers	W01-358-5307
Assembly weight..... 6.5 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

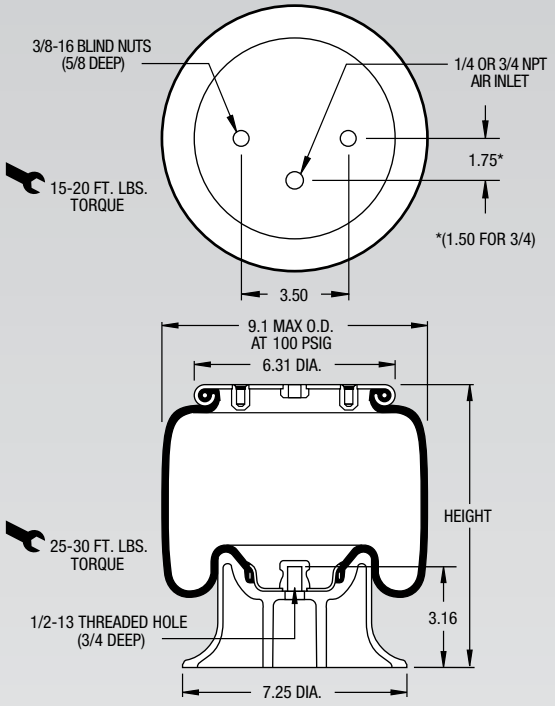
Dynamic Characteristics at 9.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 280 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,170	250	85	1.42
60	1,890	398	86	1.44
80	2,570	535	86	1.43
100	3,240	658	85	1.41

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
12.0	376	540	1,010	1,530	2,040	2,600
11.0	347	570	1,160	1,770	2,380	3,010
10.0	314	590	1,210	1,880	2,540	3,220
9.0	280	590	1,190	1,890	2,570	3,240
8.0	246	580	1,200	1,890	2,570	3,240
7.0	211	620	1,240	1,920	2,600	3,300
6.0	176	740	1,380	2,060	2,790	3,530

1T14C-3 Firestone

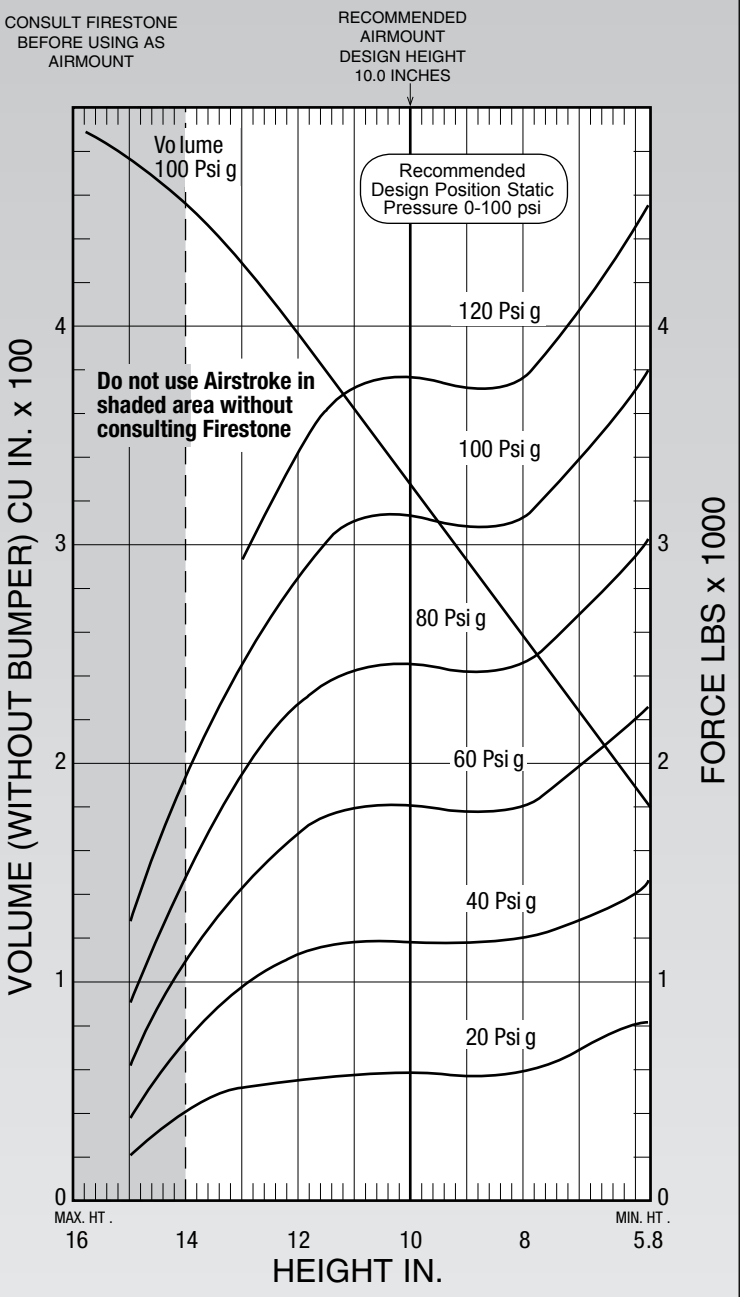
AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

Description		Assembly Order No.
Style 1T14C-3 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-5405
Assembly weight..... 6.8 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.

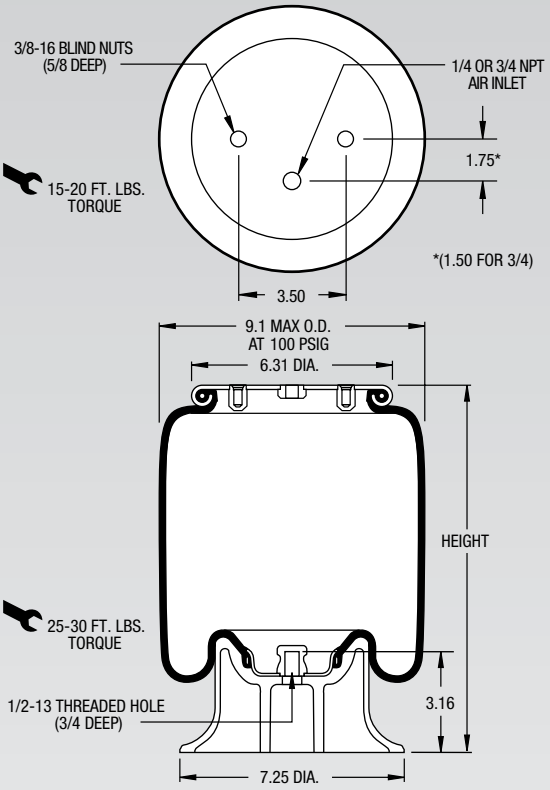


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 10.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 313 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,180	280	92	1.53
60	1,810	356	83	1.39
80	2,450	453	81	1.35
100	3,120	552	79	1.32

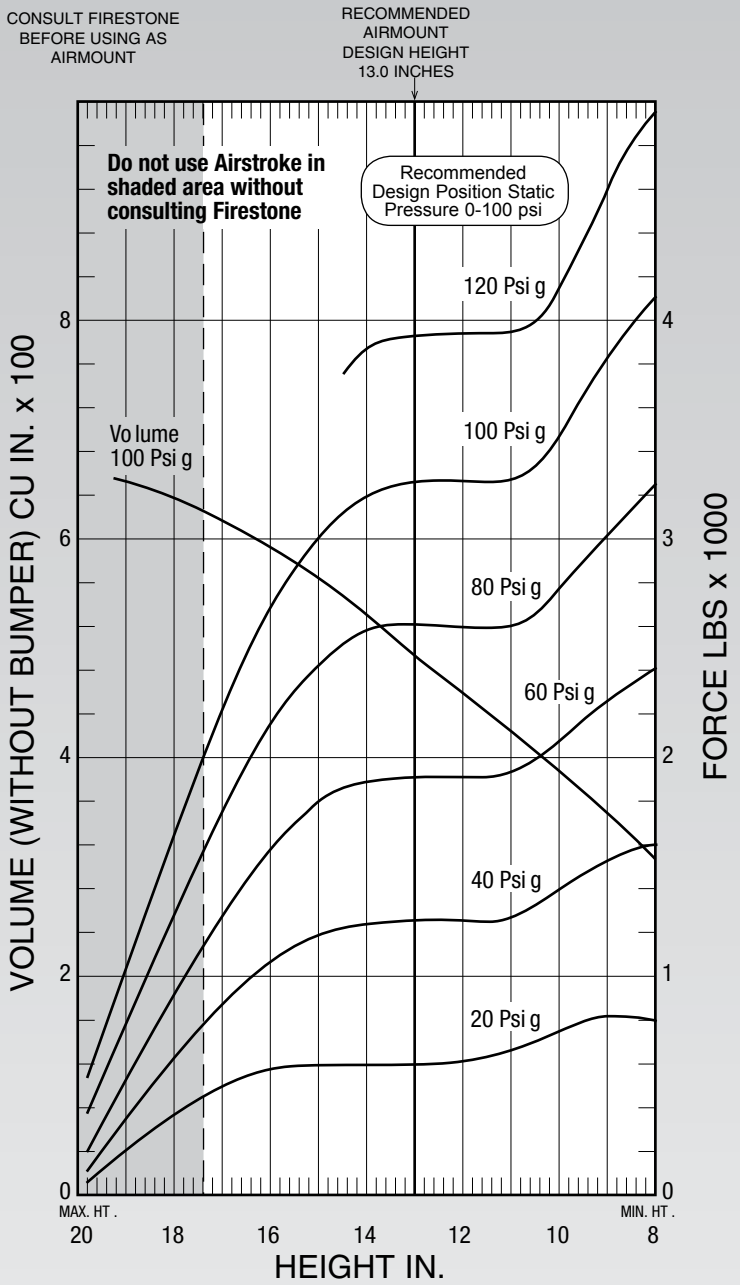
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
14.0	430	410	730	1,080	1,490	1,960
12.0	378	560	1,120	1,680	2,280	2,870
10.0	313	580	1,170	1,820	2,440	3,130
8.0	246	610	1,190	1,810	2,430	3,110
6.0	176	800	1,500	2,180	2,960	3,740

	Description	Assembly Order No.
Style 1T14C-7 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-5712
	Blind nuts, 3/4 NPT	W01-358-5708
Assembly weight..... 7.0 lbs.		
Style 1T28C-7 High Strength Bellows	Blind nuts, 1/4 NPT	W01-358-5743



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

Dynamic Characteristics at 13.0 in. Design Height
(Required for Airmount isolator design only)

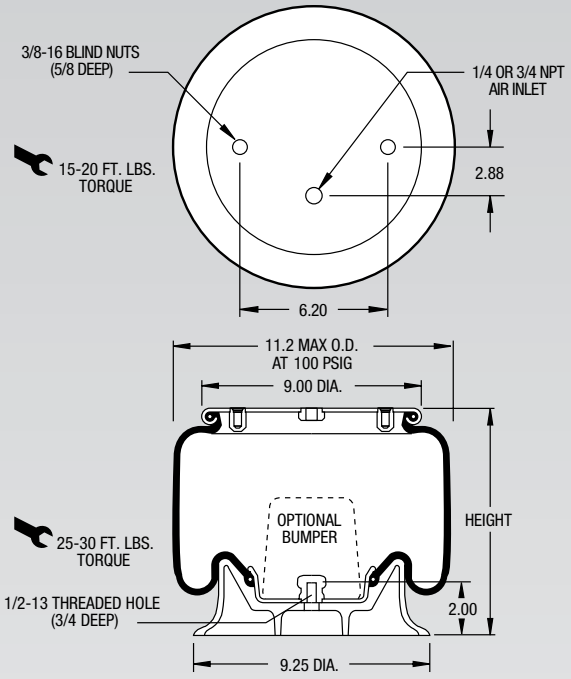
Volume @ 100 PSIG = 490 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	1,250	166	68	1.14
60	1,920	243	67	1.12
80	2,610	305	64	1.07
100	3,260	397	66	1.10

Force Table (Use for Airstroke™ actuator design)

Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
17.0	615	500	890	1,310	1,790	2,260
15.0	558	600	1,210	1,820	2,460	3,070
13.0	490	600	1,250	1,920	2,610	3,260
11.0	421	660	1,280	1,930	2,610	3,270
9.0	349	820	1,540	2,270	3,040	3,850

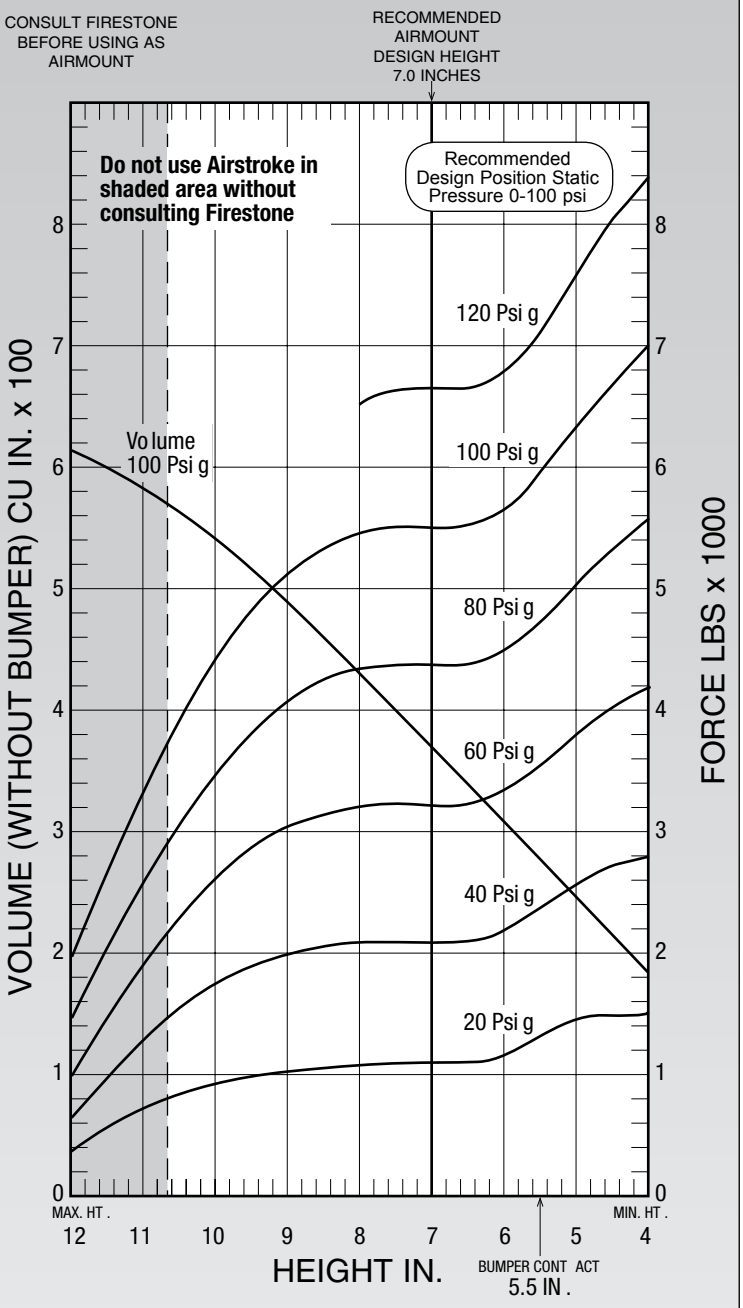
1T15T-1 Firestone AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

Description		Assembly Order No.
Style 1T15T-1 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9400
	Blind nuts, 1/4 NPT, bumper	W01-358-9402
	Blind nuts, 3/4 NPT	W01-358-9401
Assembly weight..... 9.6 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation..



See page 12 for instructions on how to use chart.

Dynamic Characteristics at 7.0 in. Design Height
(Required for Airmount isolator design only)

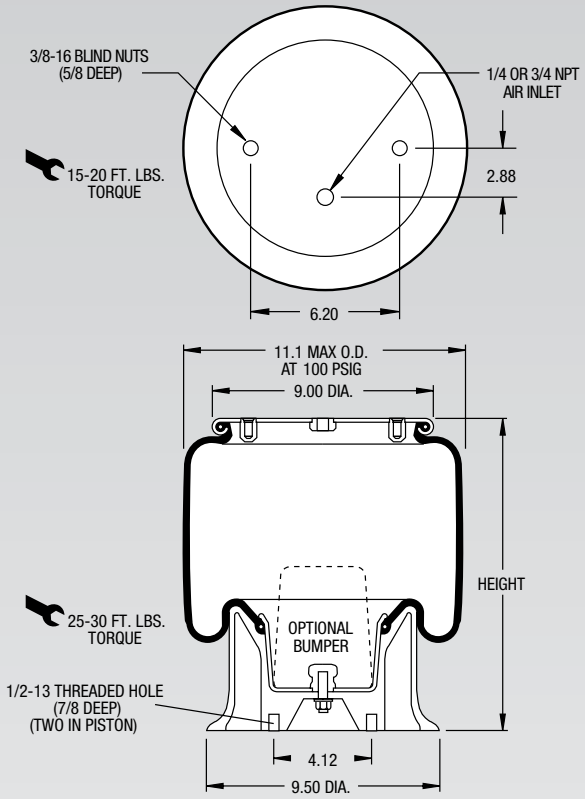
Volume @ 100 PSIG = 373 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,100	658	105	1.75
60	3,220	908	100	1.66
80	4,370	1,168	97	1.62
100	5,490	1,408	95	1.58

Force Table (Use for Airstroke™ actuator design)

Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
10.0	541	920	1,750	2,600	3,470	4,410
9.0	490	1,030	2,010	3,050	4,050	5,130
8.0	433	1,100	2,090	3,210	4,330	5,470
7.0	373	1,110	2,100	3,220	4,370	5,490
6.0	314	1,160	2,190	3,330	4,480	5,650
5.0	251	1,450	2,570	3,780	5,010	6,290

Firestone 1T15LP-3

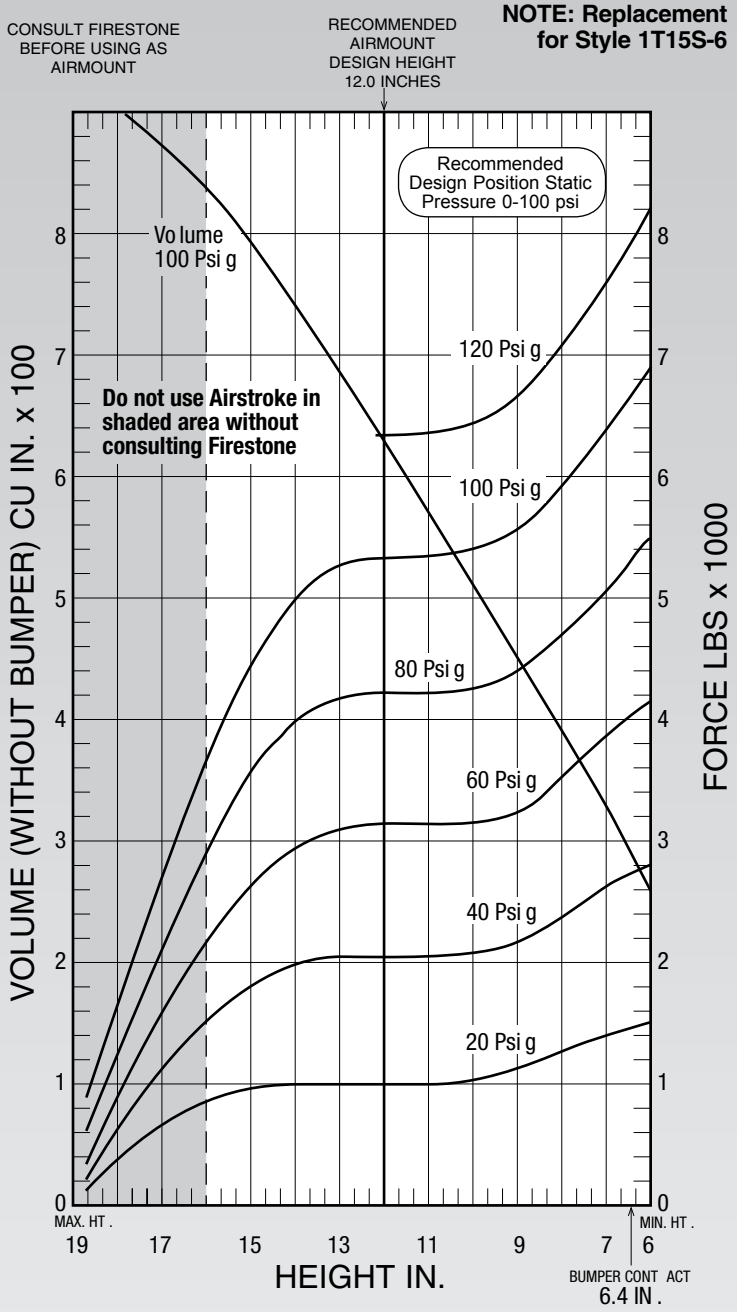
Description		Assembly Order No.
Style 1T15LP-3 Two Ply Bellows	Blind nuts, 1/4 NPT, bumper	W01-358-9049
	Blind nuts, 3/4 NPT	W01-358-9051
Assembly weight..... 13.7 lbs.		



NOTE: Bellows will not compress properly with less than 20 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.

NOTE: Replacement for Style 1T15S-6



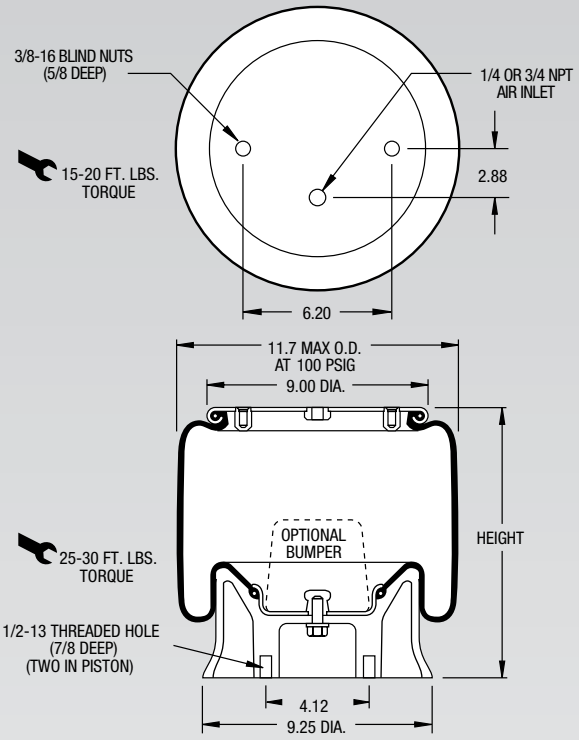
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 12.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 625 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,040	363	79	1.32
60	3,140	513	76	1.26
80	4,220	657	74	1.23
100	5,340	813	73	1.22

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
16.0	834	830	1,580	2,140	2,860	3,600
14.0	739	1,010	1,980	2,930	3,980	5,000
12.0	625	980	2,040	3,140	4,220	5,340
10.0	509	1,030	2,100	3,160	4,270	5,410
8.0	392	1,280	2,380	3,520	4,690	5,930

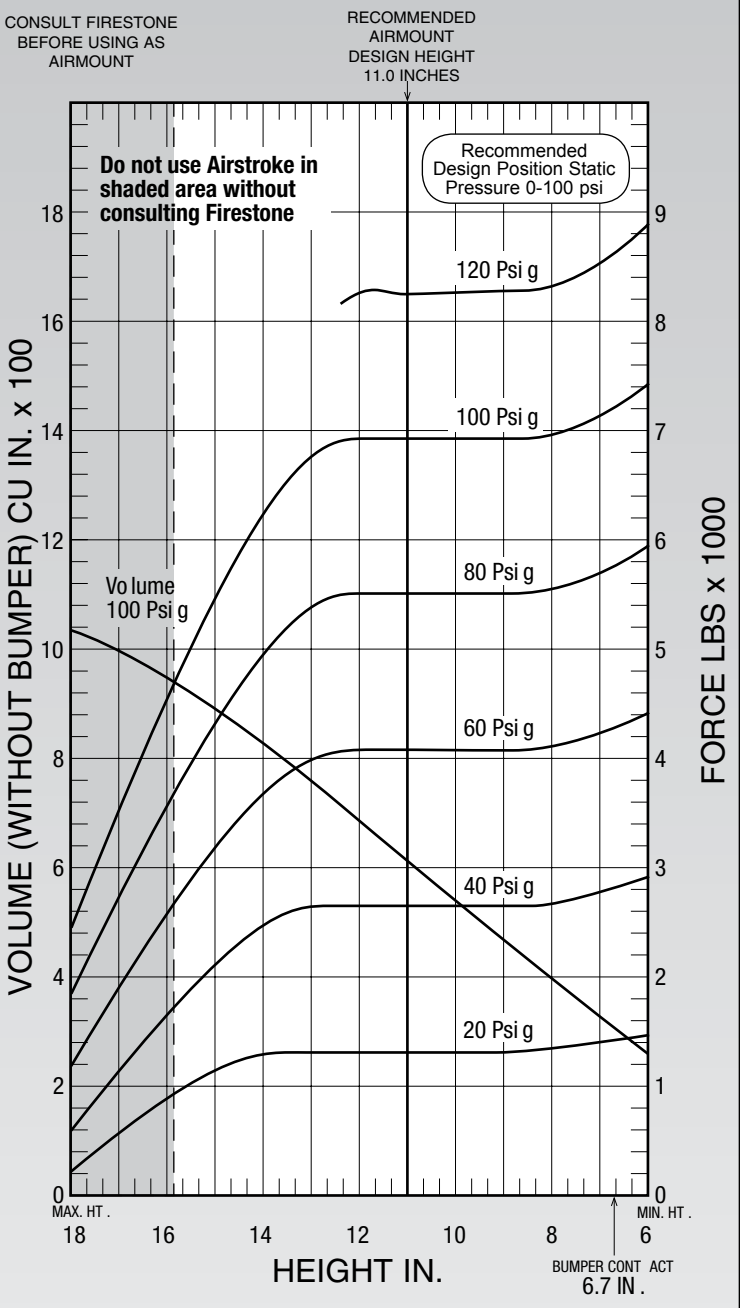
1T15L-4 Firestone AIRSTROKE ACTUATORS AIRMOUNT ISOLATORS

Description		Assembly Order No.
Style 1T15L-4 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9414
Assembly weight..... 13.5 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.

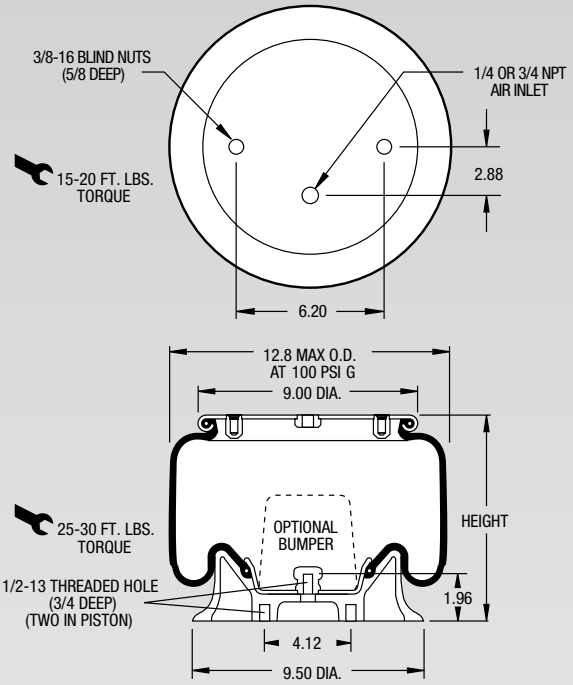


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 11.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 625 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,650	583	88	1.47
60	4,080	823	84	1.40
80	5,510	1,055	82	1.37
100	6,930	1,281	81	1.34

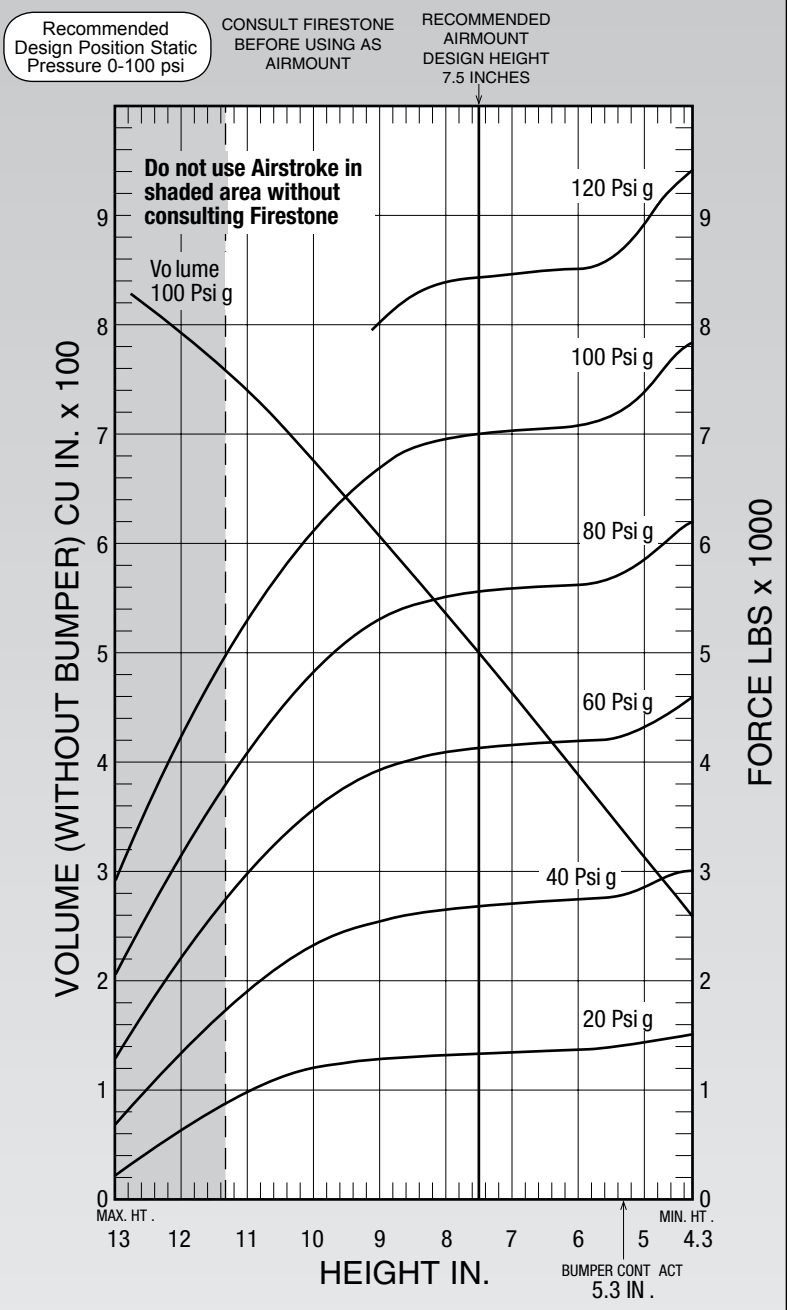
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
15.0	898	1,120	2,110	3,150	4,300	5,440
13.0	768	1,310	2,630	3,970	5,360	6,720
11.0	625	1,310	2,650	4,080	5,510	6,930
9.0	479	1,310	2,650	4,080	5,500	6,920
7.0	333	1,390	2,780	4,210	5,690	7,120

	Description	Assembly Order No.
Style 1T15M-0 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9030
	Blind nuts, 1/4 NPT, rubber bumper	W01-358-9031
	Blind nuts, 3/4 NPT	W01-358-9034
	Blind nuts, 3/4 NPT, rubber bumper	W01-358-9036
	Countersunk steel bead ring, 1 3/8 bolts, nuts, washers	W01-358-9038
	Integral studs, 1/4 NPT	W01-358-9035
Assembly weight..... 11.5 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

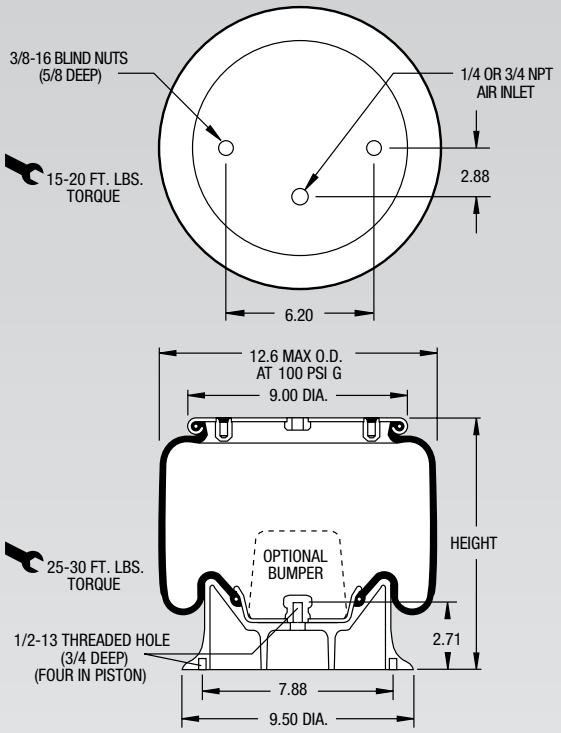
Dynamic Characteristics at 7.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 498 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,670	793	102	1.71
60	4,120	1,105	97	1.62
80	5,540	1,399	94	1.57
100	6,990	1,690	92	1.54

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
11.0	737	980	1,920	2,980	4,120	5,300
10.0	675	1,180	2,310	3,550	4,810	6,130
9.0	606	1,270	2,540	3,910	5,290	6,710
8.0	534	1,300	2,630	4,080	5,500	6,950
7.0	462	1,320	2,690	4,140	5,570	7,010
6.0	389	1,350	2,730	4,170	5,610	7,070
5.0	314	1,410	2,840	4,310	5,840	7,370

1T15M-2 Firestone

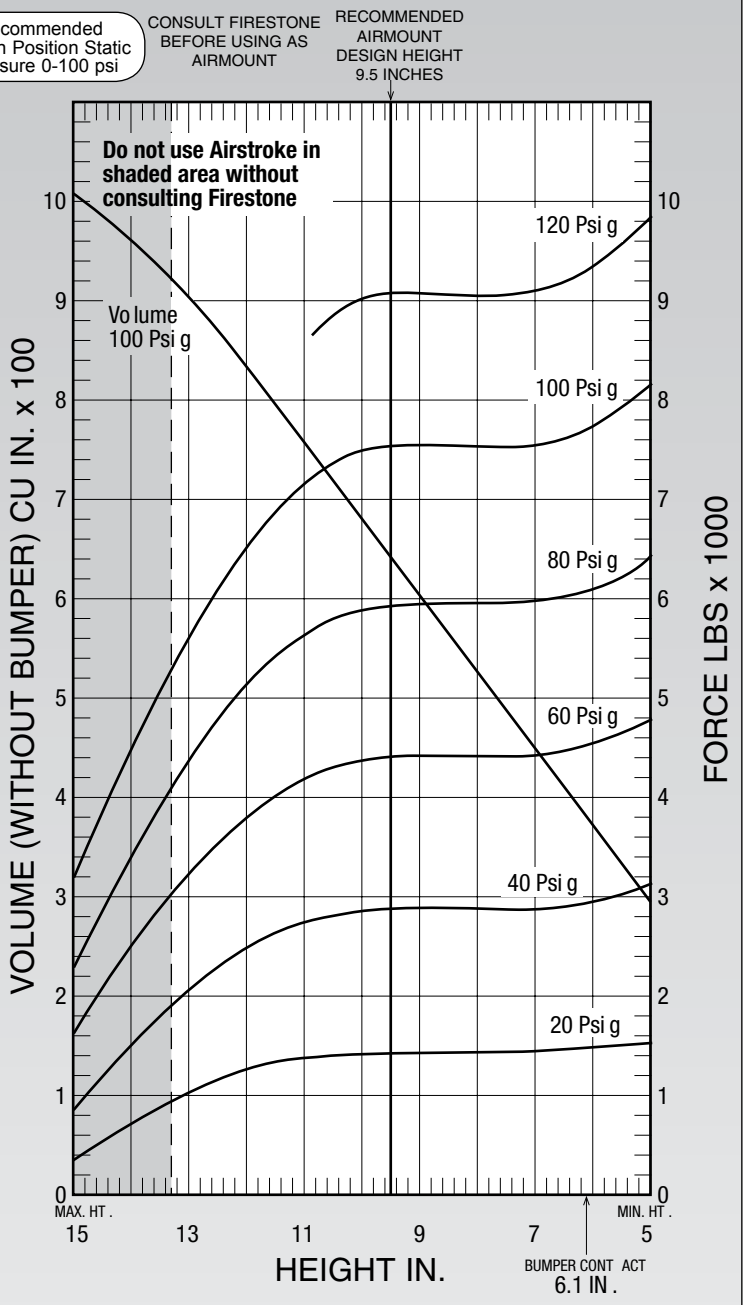
AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

Description		Assembly Order No.
Style 1T15M-2 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9042
	Blind nuts, 1/4 NPT, bumper	W01-358-9053
	Blind nuts, 3/4 NPT	W01-358-9054
	Blind nuts, 3/4 NPT, bumper	W01-358-9099
Assembly weight..... 12.5 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.

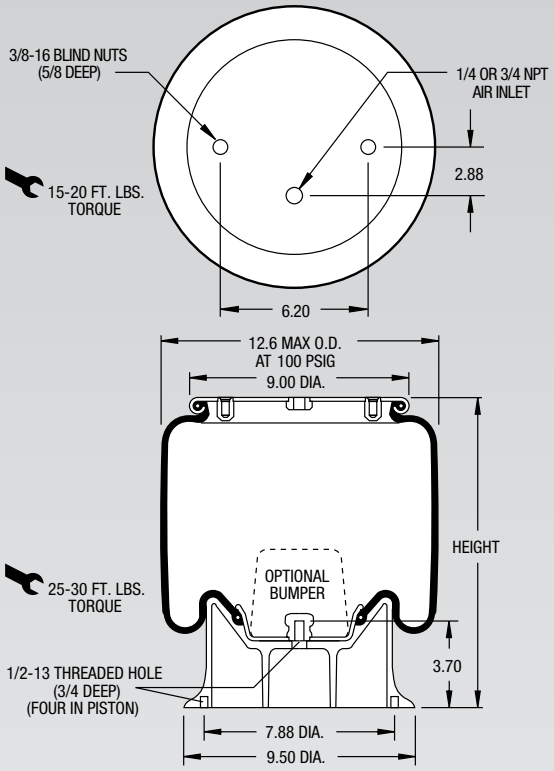


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 9.5 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 648 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,850	693	93	1.54
60	4,370	965	88	1.47
80	5,900	1,238	86	1.43
100	7,510	1,510	84	1.40

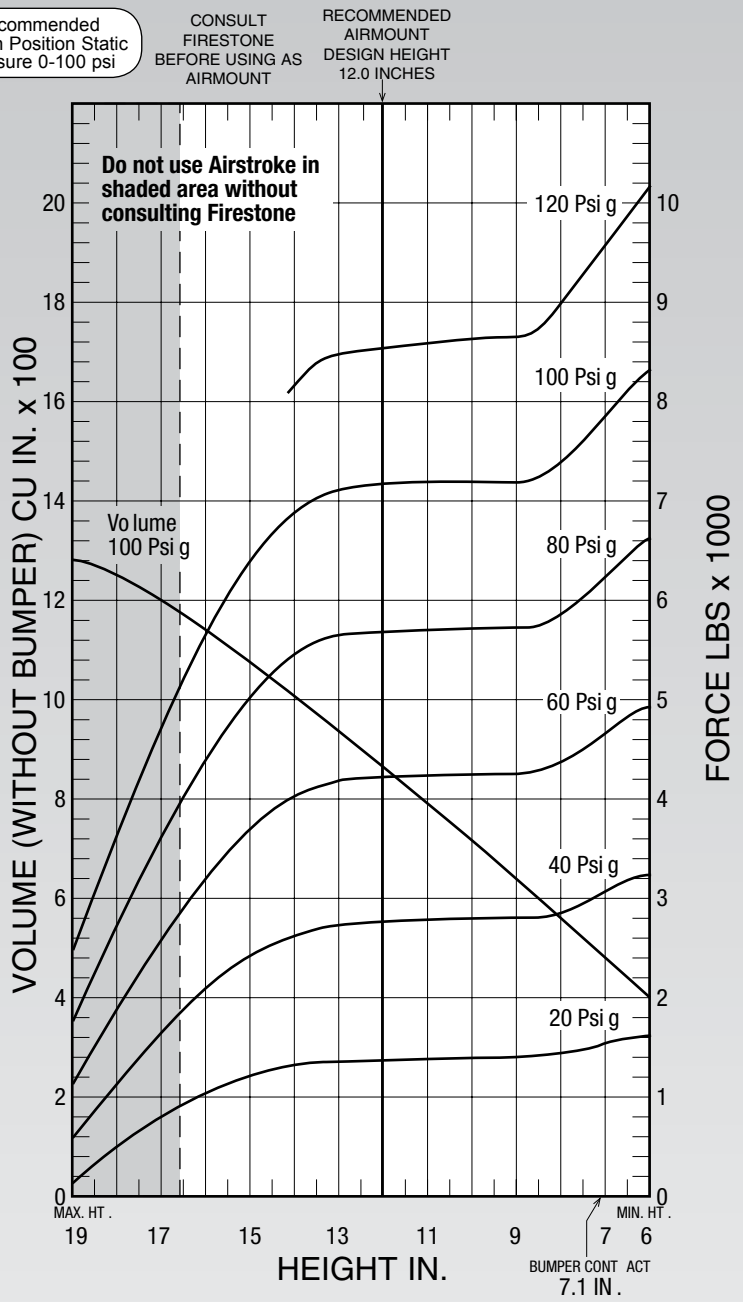
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
13.0	900	1,000	2,030	3,170	4,320	5,580
12.0	835	1,210	2,420	3,720	5,040	6,440
11.0	763	1,330	2,680	4,120	5,570	7,100
10.0	687	1,380	2,820	4,330	5,850	7,460
9.0	609	1,400	2,860	4,390	5,920	7,530
8.0	531	1,400	2,850	4,390	5,930	7,510
7.0	453	1,410	2,860	4,410	5,950	7,530
6.0	374	1,440	2,930	4,530	6,080	7,730

	Description	Assembly Order No.
Style 1T15M-4 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9056
	Blind nuts, 1/4 NPT, bumper	W01-358-9057
	Blind nuts, 3/4 NPT	W01-358-9062
	Blind nuts, 3/4 NPT, bumper	W01-358-9060
Assembly weight..... 13.7 lbs		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

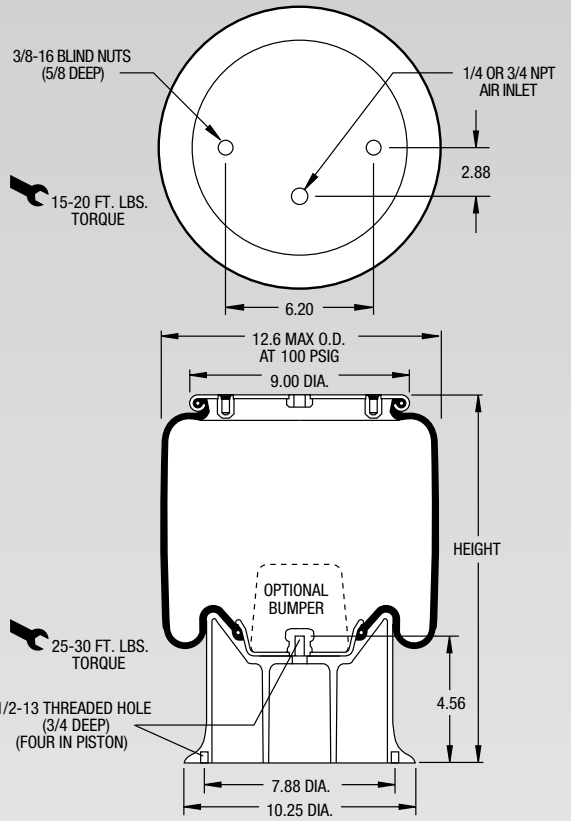
Dynamic Characteristics at 12.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 861 in^3			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,770	459	77	1.28
60	4,210	620	72	1.20
80	5,690	803	71	1.18
100	7,190	986	70	1.16

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in^3)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
16.0	1,146	1,060	2,110	3,240	4,410	5,680
14.0	1,010	1,330	2,650	4,050	5,460	6,910
12.0	861	1,380	2,770	4,210	5,690	7,190
10.0	711	1,390	2,790	4,230	5,720	7,190
8.0	561	1,440	2,880	4,370	5,860	7,400

1T15M-6 Firestone

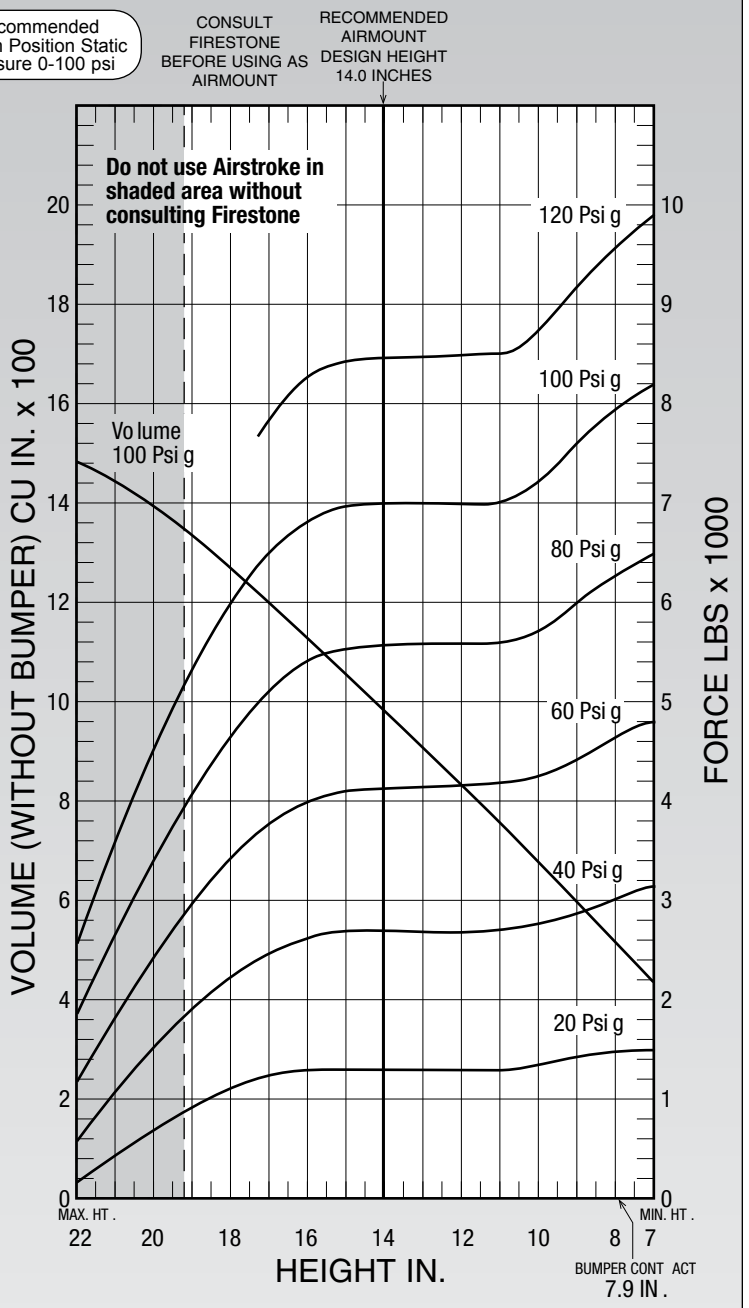
AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

Description		Assembly Order No.
Style 1T15M-6 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9079
	Blind nuts, 1/4 NPT, bumper	W01-358-9096
	Blind nuts, 3/4 NPT	W01-358-9089
	Blind nuts, 3/4 NPT, bumper	W01-358-9088
	Blind nuts, 3/4 NPT (piston not included)	W01-358-0730
Assembly weight (bead plate version, no bumper) .... 13.0 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.

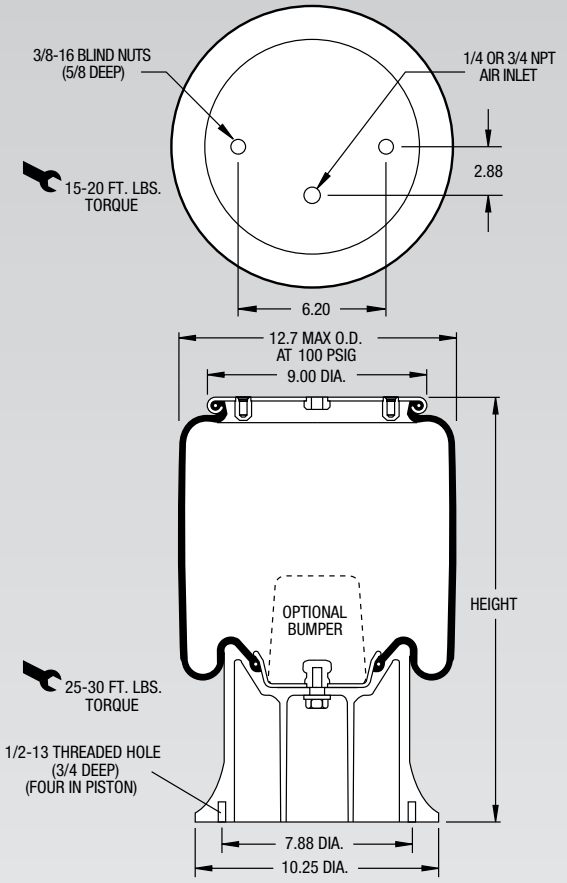


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 14.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 987 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,730	395	71	1.19
60	4,130	541	68	1.13
80	5,590	707	67	1.12
100	7,030	852	65	1.09

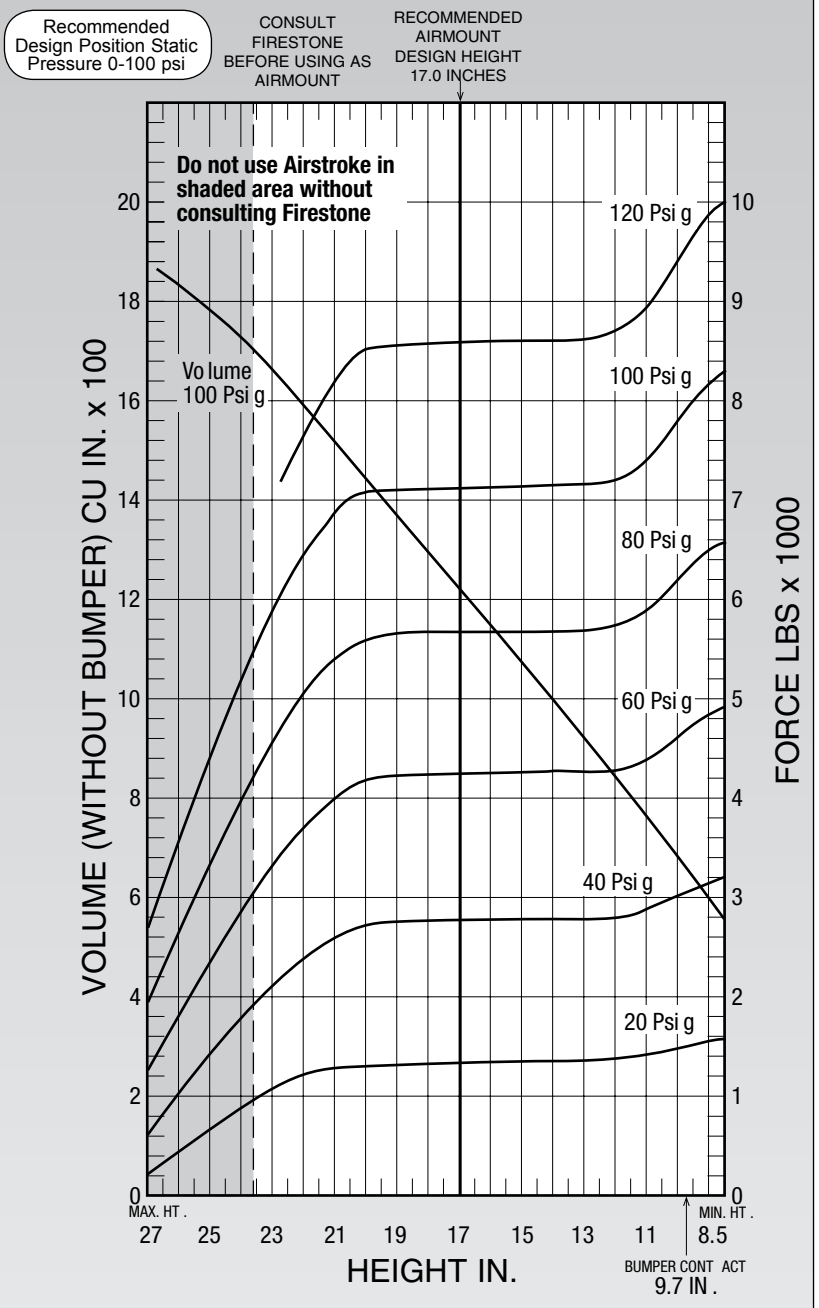
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force				
		@20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
18.0	1,274	1,100	2,220	3,420	4,670	5,980
16.0	1,134	1,290	2,640	4,000	5,410	6,840
14.0	987	1,330	2,730	4,130	5,590	7,030
12.0	841	1,330	2,710	4,170	5,590	7,010
10.0	693	1,380	2,790	4,270	5,730	7,240
8.0	533	1,500	3,060	4,670	6,280	7,950

	Description	Assembly Order No.
Style 1T15M-9 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9108
	Blind nuts, 1/4 NPT, bumper	W01-358-9104
	Blind nuts, 3/4 NPT	W01-358-9106
	Blind nuts, 3/4 NPT, bumper	W01-358-9117
Assembly weight..... 14.9 lbs.		



NOTE: Bellows will not compress properly with less than 10 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.



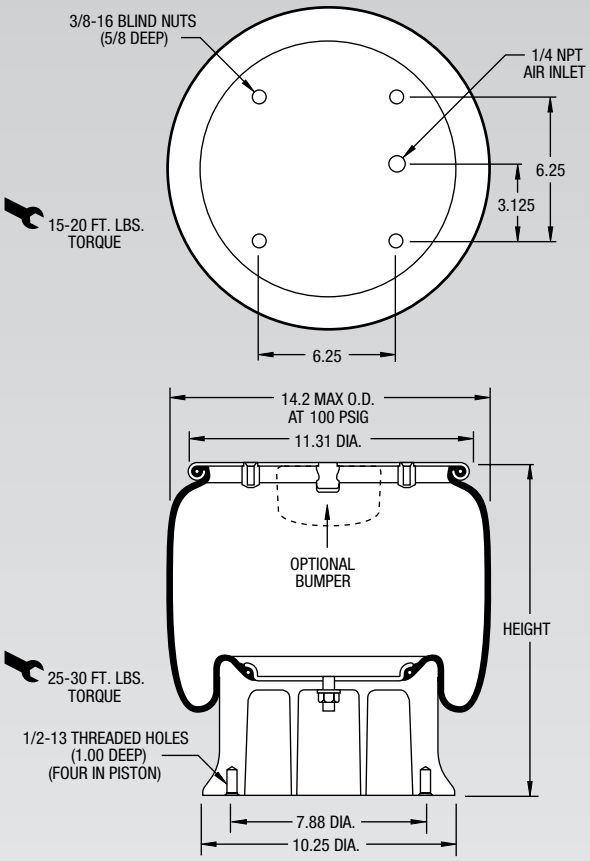
See page 12 for instructions on how to use chart.

Dynamic Characteristics at 17.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,217 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	2,770	287	60	1.01
60	4,250	425	59	.99
80	5,680	546	58	.97
100	7,140	659	57	.95

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
23.0	1,658	1,090	2,150	3,340	4,560	5,850
21.0	1,517	1,290	2,600	4,020	5,380	6,860
19.0	1,368	1,340	2,780	4,240	5,660	7,110
17.0	1,217	1,370	2,770	4,250	5,680	7,140
15.0	1,067	1,380	2,810	4,290	5,690	7,150
13.0	916	1,390	2,810	4,280	5,700	7,170
11.0	760	1,460	2,950	4,430	5,940	7,500
9.0	596	1,580	3,200	4,880	6,550	8,230

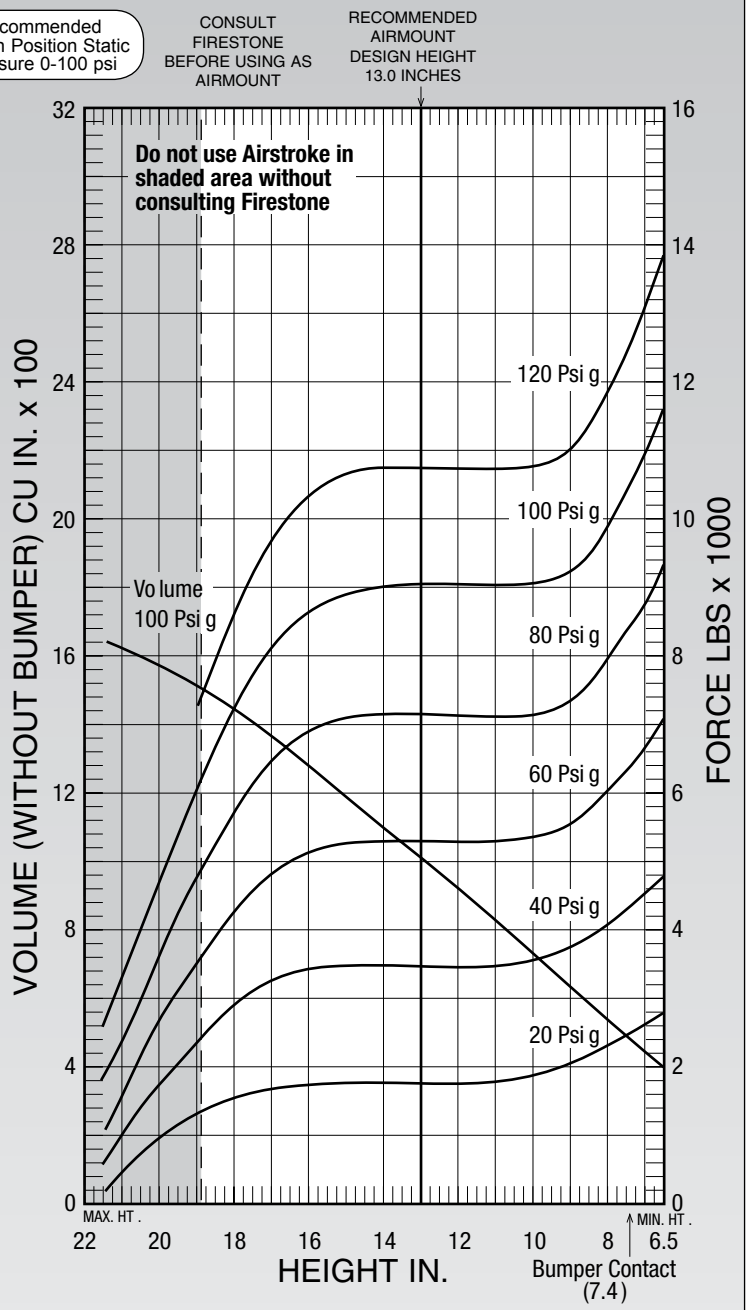
1T19L-7 Firestone AIRSTROKE™ ACTUATORS AIRMOUNT ISOLATORS

	Description	Assembly Order No.
Style 1T19L-7 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9148
	Blind nuts, 1/4 NPT, bumper	W01-358-9149
	Blind nuts, 3/4 NPT	W01-358-9172
	Blind nuts, 3/4 NPT, bumper	W01-358-9160
	Countersunk steel bead ring 1 3/4 bolts, nuts, washers	W01-358-9165
Assembly weight..... 20.9 lbs.		



NOTE: Bellows will not compress properly with less than 20 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.

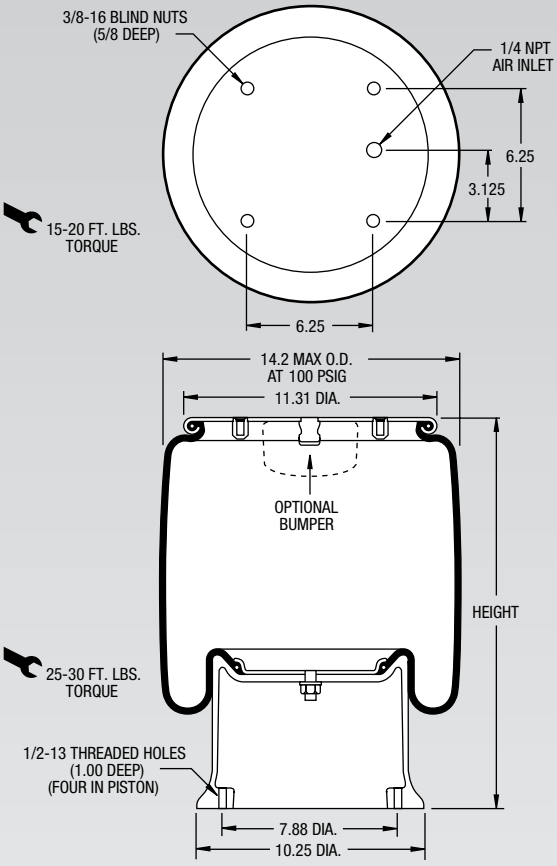


See page 12 for instructions on how to use chart.

Dynamic Characteristics at 13.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 921 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,482	532	73	1.22
60	5,297	777	72	1.20
80	7,101	982	70	1.17
100	8,984	1,227	69	1.15

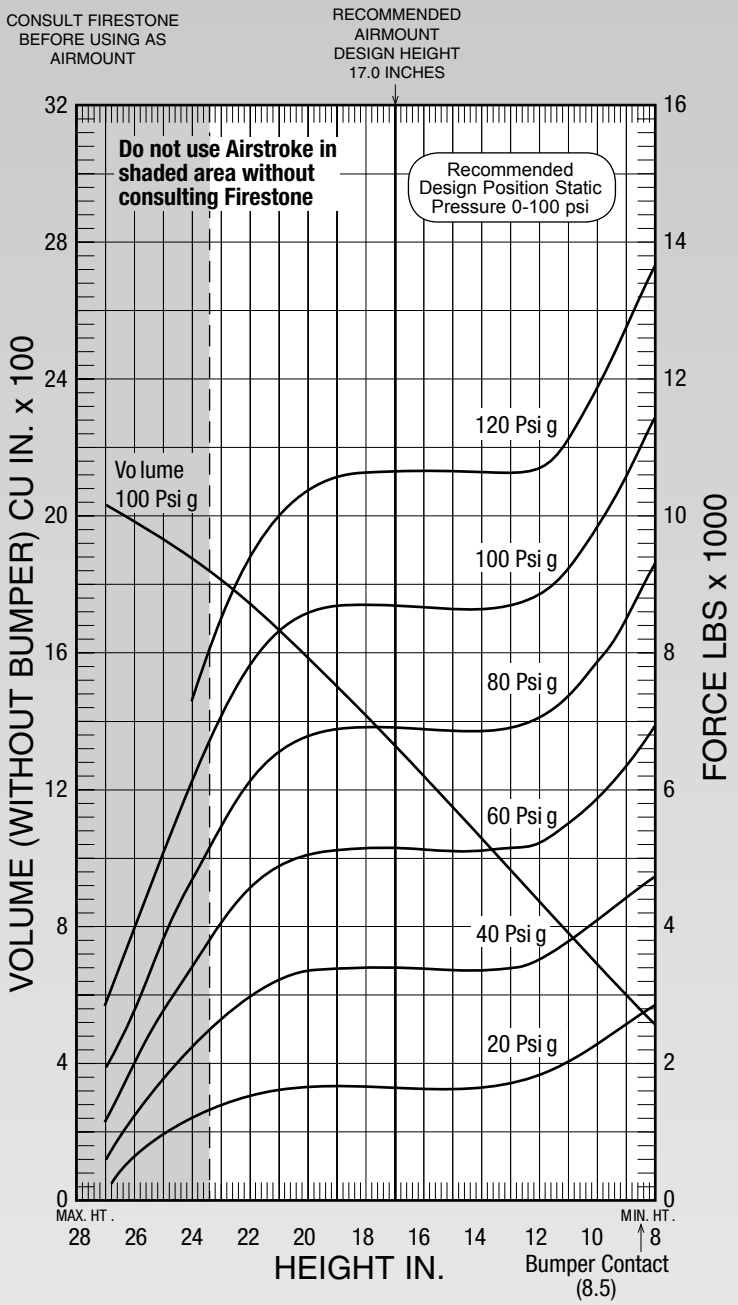
Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
18.50	1,480	1,398	2,605	3,859	5,194	6,645
16.50	1,328	1,705	3,309	4,952	6,624	8,350
14.50	1,155	1,760	3,482	5,293	7,095	8,964
12.50	969	1,760	3,482	5,297	7,101	8,984
10.50	778	1,760	3,482	5,297	7,101	8,984
8.50	591	2,126	3,876	5,748	7,597	9,515

	Description	Assembly Order No.
Style 1T19L-11 Two Ply Bellows	Blind nuts, 1/4 NPT	W01-358-9155
	Blind nuts, 1/4 NPT, bumper	W01-358-9156
	Blind nuts, 3/4 NPT	W01-358-9153
	Blind nuts, 3/4 NPT, bumper	W01-358-2132
	Countersunk steel bead ring 1 3/4 bolts, nuts, washers	W01-358-9162
Assembly weight..... 20.4 lbs.		



NOTE: Bellows will not compress properly with less than 20 PSIG internal pressure.

NOTE: A bead plate part is shown. This part is also available with a bead ring. Bolts are not included. See pages 8-10 for explanation.



See page 12 for instructions on how to use chart.

Dynamic Characteristics at 17.0 in. Design Height (Required for Airmount isolator design only)				
Volume @ 100 PSIG = 1,337 in³			Natural Frequency	
Gage Pressure (PSIG)	Load (lbs.)	Spring Rate (lbs./in.)	CPM	HZ
40	3,411	428	67	1.12
60	5,151	602	64	1.07
80	6,911	765	63	1.05
100	8,711	927	61	1.02

Force Table (Use for Airstroke™ actuator design)						
Assembly Height (in.)	Volume @ 100 PSIG (in³)	Pounds Force @20 PSIG	@40 PSIG	@60 PSIG	@80 PSIG	@100 PSIG
20.0	1,597	1,650	3,341	5,068	6,843	8,619
18.0	1,427	1,650	3,411	5,151	6,911	8,711
16.0	1,247	1,650	3,411	5,151	6,911	8,711
14.0	1,060	1,650	3,411	5,151	6,911	8,711
12.0	872	1,830	3,510	5,278	7,101	8,903
10.0	688	2,283	4,100	5,960	7,946	9,911

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AIRSTROKE™ ACTUATOR DESIGN PARAMETER WORKSHEET

1. FORCE REQUIRED:

2. STROKE REQUIRED:

3. AVAILABLE AIR PRESSURE:

4. ANGLE OF MOTION (PLEASE SKETCH):

5. LATERAL SPACE AVAILABLE FOR AIRSTROKE ACTUATOR(S):

6. ENVIRONMENTAL CONDITIONS:

7. CYCLE RATE:

8. RESPONSE TIME REQUIRED:

SPECIAL REQUIREMENTS:

DATE

PLEASE SKETCH WITH DIMENSIONS

REMARKS

NAME

COMPANY

ADDRESS

CITY/COUNTRY/CODE

TELEPHONE

Please return to your local stocking distributor, or send directly to:
Firestone Industrial Products Company, 250 W. 96th Street, Indianapolis, IN 46260 U.S.A.
Phone: 1-800-888-0650 • Email: NAIndustrial@firestoneip.com

PLEASE CUT ALONG DOTTED LINE

AIRMOUNT™ ISOLATOR DESIGN PARAMETER WORKSHEET

FOR VIBRATION ISOLATION

A) TO PREVENT OUTGOING VIBRATION TRANSMISSION (INTO THE SURROUNDING AREA), OR

B) FOR ISOLATING DELICATE EQUIPMENT FROM INCOMING VIBRATIONS, PLEASE COMPLETE THE FOLLOWING:

1. DESCRIPTION OF EQUIPMENT:

_____

_____

_____

2. TYPE OF DISTURBANCE TO BE ISOLATED (FORCED FREQUENCY OF VIBRATION):

_____

_____

3. MAXIMUM WEIGHT (lbs.) _____
4. WEIGHT DISTRIBUTION (PLEASE SKETCH ON GRAPH).
5. DESIRED NUMBER OF MOUNTING POINTS: ____
6. POSITION OF MOUNTING POINTS (PLEASE SKETCH ON GRAPH).
7. SPACE (DIAMETER) AVAILABLE FOR AIRMOUNT ISOLATORS (inches): _____
8. AIR PRESSURE AVAILABLE: _____
9. DIMENSIONS: HEIGHT (inches) _____
   LENGTH (inches) _____
   WIDTH (inches) _____
10. POSITION OF CENTER OF GRAVITY (C.G., ⊗ , mm UP FROM BASE) _____
11. DISTURBING FREQUENCY(f_f)
    a) FOR A) ABOVE, MACHINE SPEED, (rpm) _____
    b) FOR B) ABOVE, FREQUENCY OF INCOMING VIBRATION (H_z) _____
12. PERCENT ISOLATION DESIRED (%): _____

FOR ISOLATING AN UNBALANCED MASS

13. PLEASE COMPLETE 1 THROUGH 12, AND ALSO INCLUDE:
14. TYPE OF MOVING COMPONENTS (UNBALANCED MASS):

_____

15. WEIGHT OF UNBALANCED MOVING MASS (lbs.):

_____

16. RADIUS OF MOVEMENT (inches): _____
17. DIRECTION OF MOVEMENT (PLEASE SKETCH ON GRAPH).

FOR SHOCK IMPACT ISOLATION

18. PLEASE COMPLETE 1, AND ALSO INCLUDE:
19. WEIGHT OF MOVING OBJECT (lbs.): _____
20. SPEED OF MOVING OBJECT (in/sec): _____
21. DISTANCE OF FREE FALL (inches): _____
22. DESIRED STOPPING DISTANCE (inches): _____
23. SPACE (DIAMETER) AVAILABLE FOR SHOCK IMPACT ISOLATOR(S) (inches): _____

DATE _____

NAME _____

COMPANY _____

ADDRESS _____

CITY/ COUNTRY/CODE _____

PHONE _____

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PLEASE CUT ALONG DOTTED LINE

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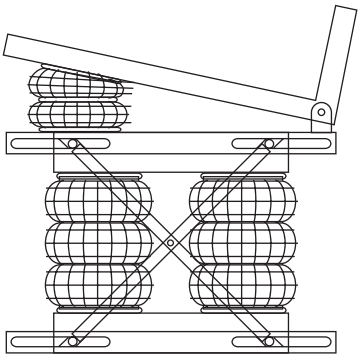
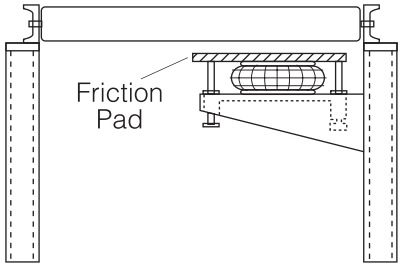


SCISSORS LIFT AND TILT TABLE



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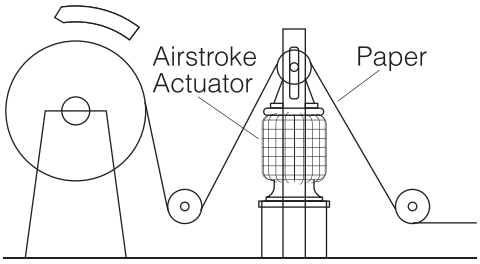

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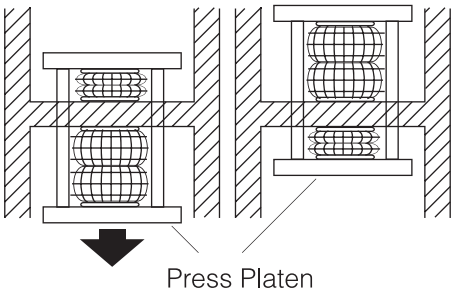

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