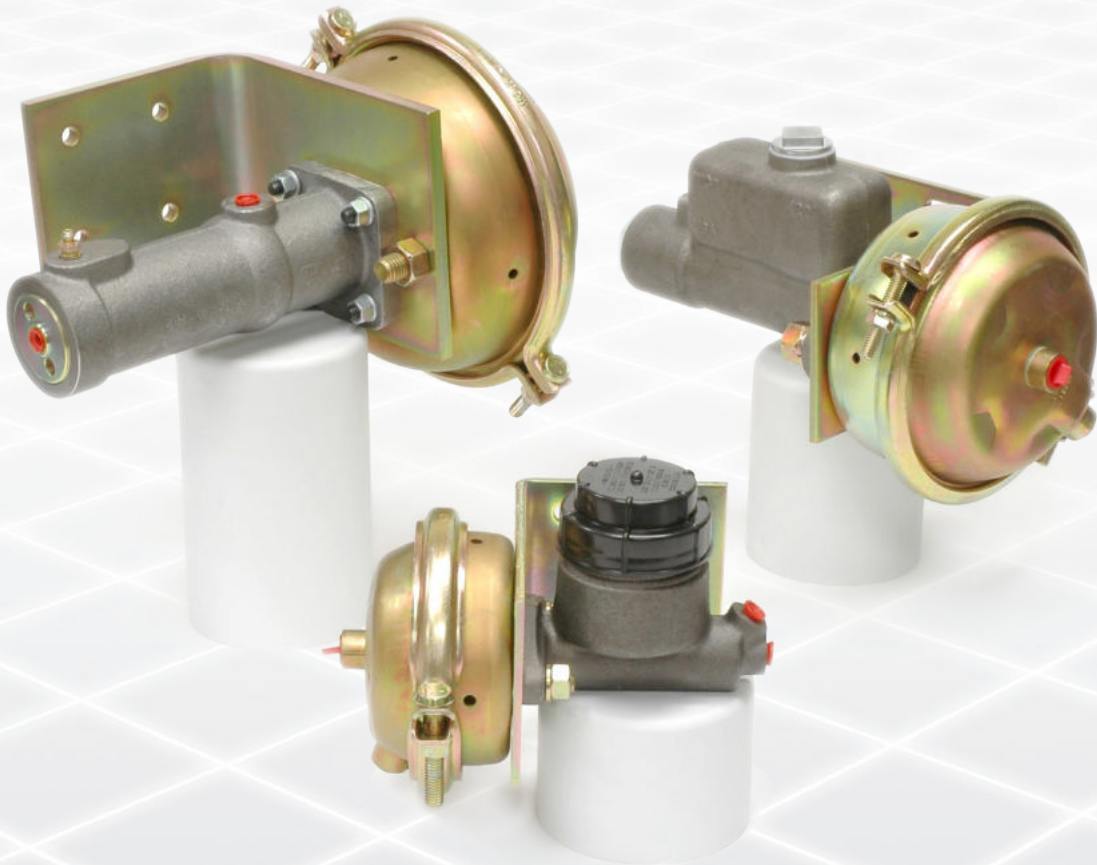




Innovative Braking and Controls Worldwide

## Air/Hydraulic Actuators

master cylinders, stem seal master cylinders, and  
stem seal actuators with air chambers



*Convert  
Air Pressure to  
Hydraulic Pressure*



# Air/Hydraulic Actuators

The same dependability and performance that goes into every MICO Braking System Product also goes into our versatile, high-performance Air/Hydraulic Actuators and their components. This is an important consideration when you select an actuator for a system requiring air/hydraulic power.

The MICO® Air/Hydraulic Actuators presented in this catalog are designed to take advantage of available pressurized air sources to produce high hydraulic pressures. This design feature is especially important for towing self-propelled hydraulically braked vehicles when towing vehicle is equipped with air. The towed vehicle's brakes are controlled by the air/hydraulic actuator when used with a remote air reservoir and relay emergency valve. These actuators can also be used for industrial applications.

Air chamber sizes are available from 12 to 36 square inches and hydraulic displacement from 1.4 to 5.9 cubic inches. Both remote or integral reservoir models are available for mineral base hydraulic oil or brake fluid.

System fluids other than DOT 3, 4, 5 or 5.1 brake fluid or mineral based hydraulic oils may require special seals. Consult MICO, Inc. for recommendations.

Combining the speed of air operation with the control and high force of fluid can result in an ideal circuit.

Air/Hydraulic Actuators are the combination of a fluid actuator and an air chamber. The air chamber is used to convert low air pressure to high hydraulic pressure. The conversion ratio is the ratio of the hydraulic output pressure to air input pressure.

There are three types of MICO® Air/Hydraulic Actuators to choose from; the Master Cylinder Type, the Stem Seal Master Cylinder Type with Integral Reservoir and the Straight Bore Actuator Type for use with a remote reservoir. Each has its own advantages to offer.

Complete the appropriate Application Data Sheet online, [www.mico.com](http://www.mico.com). The MICO Applications Department will analyze your specifications and based on your input recommend a air/hydraulic actuator suitable for your requirements.

This document is intended to provide general information about MICO Products. MICO, Inc. has attempted to present accurate information about MICO Products in its catalogs, brochures, and other printed materials. MICO, Inc. is not responsible for errors, inaccuracies, or inconsistencies that may exist in any catalog brochure or other printed materials or any damages arising from or related to reliance on information in them. Materials and specifications for MICO Products set forth in catalogs, brochures, and other printed materials are subject to change without notice or obligation. Refer to [www.mico.com](http://www.mico.com) for the most recent versions of our literature. If you have any questions concerning MICO Products, please contact MICO, Inc. All MICO Products and service are sold and provided subject to the MICO Warranty at [www.mico.com](http://www.mico.com) in effect on the date of sale or supply.

# Why choose MICO?

MICO, Inc. designs, manufactures and markets hydraulic components, controls, and brake systems primarily for off-road markets. We have manufacturing facilities in:

- North Mankato, Minnesota, U.S.A.
- Ontario, California, U.S.A.
- Empalme, Sonora, Mexico

Many of the world's largest off-highway OEMs value the knowledgeable staff at MICO and work with us to make their products better. Our custom-engineered products are designed with the customer requirements as the primary driver. It is our intent to help customers build their systems with our expertise in hydraulic components, braking systems and controls.

Our goal is to meet or exceed our customers' expectations in every aspect of our business.

Product lines we specialize in include:

- Actuators
- Brake Locks
- Brakes
- Controls
- Cylinders
- Electrohydraulics
- Master Cylinders
- Valves

MICO is proud to be ISO 9001 and ISO 14001 certified and continuously strive for improvement while remaining a quality leader in our field. We have been a successful business for over 60 years. Privately owned, customer driven. We look forward to working with you!

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## Applications



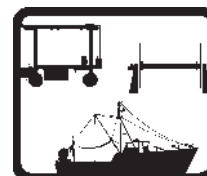
Forestry Equipment



Agricultural Equipment



Heavy Construction Equipment



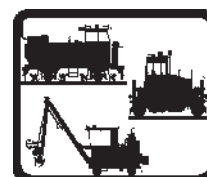
Marine Equipment



Multi-stop Vehicles



In-Plant & Warehouse Equipment



Railroad Equipment



# Air/Hydraulic Actuator

(master cylinder with air chamber)

## FEATURES

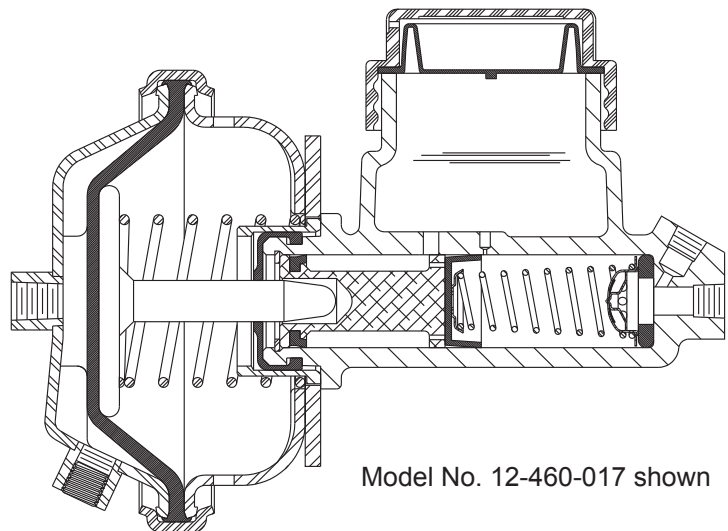
- Available with or without internal residual check valve
- Incorporates a conventional master cylinder
- Available for industrial and mobile applications
- Sealed diaphragm fluid reservoir



## DESCRIPTION

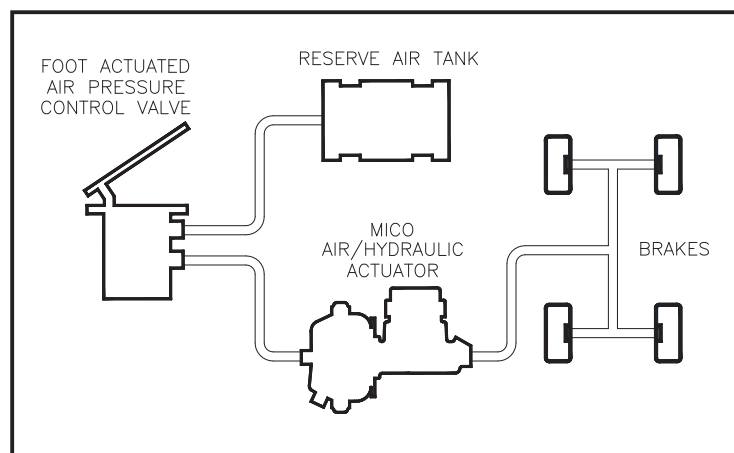
The MICO® Master Cylinder Type Air/Hydraulic Actuator is the combination of a conventional master cylinder and an air chamber. The master cylinder is a single acting type with one piston.

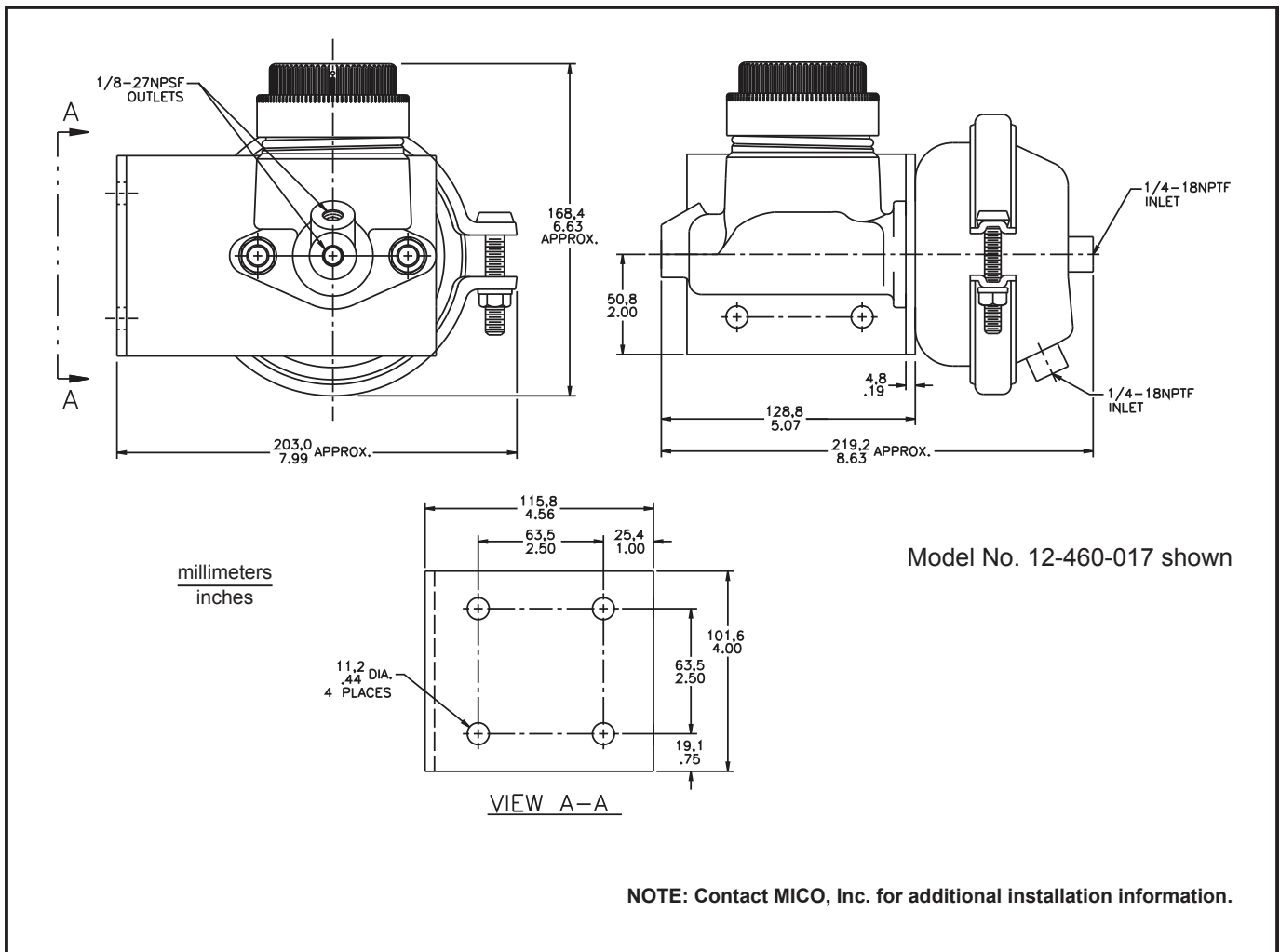
Air pressure is used to actuate a push rod in the air chamber. The push rod in turn moves the piston in the master cylinder which forces the hydraulic fluid into the system.



Model No. 12-460-017 shown

## Typical System Schematic





## SPECIFICATIONS

Model Number	Fluid Type	Internal Residual Check Valve	Air Chamber Size	Hydraulic Pressure @ 6.9 bar (100 PSI) Air Pressure	Effective Displacement	Effective Stroke	Bore Diameter
12-460-017	BF	Yes	30 cm <sup>2</sup> (12 in <sup>2</sup> )	83 bar (1200 PSI)	23.0 cm <sup>3</sup> (1.4 in <sup>3</sup> )	35.1 mm (1.38 in)	28.6 mm (1.125 in)
12-460-025	BF	No	30 cm <sup>2</sup> (12 in <sup>2</sup> )	83 bar (1200 PSI)	23.0 cm <sup>3</sup> (1.4 in <sup>3</sup> )	35.1 mm (1.38 in)	28.6 mm (1.125 in)

BF = DOT 3, 4, 5 and 5.1 brake fluid.

All model numbers have a maximum air pressure rating of 8 bar (120 PSI).

All model numbers have right side mounting brackets when viewed from the air chamber end of actuator.



# Air/Hydraulic Actuator

(master cylinder with air chamber)

## FEATURES

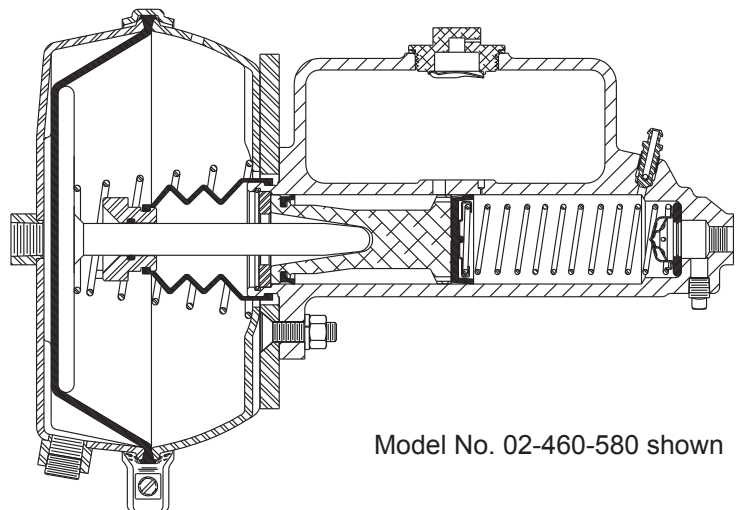
- Available with or without internal residual check valve
- Incorporates a conventional master cylinder
- Available for industrial and mobile applications
- Actuator components are protected from environmental contaminants



## DESCRIPTION

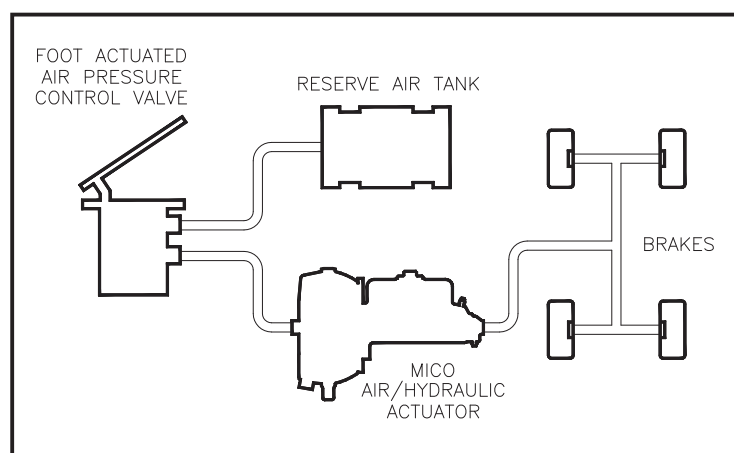
The Air/Hydraulic Actuators listed here are similar to those found in the previous section. The models in this section however, use a larger straight bore master cylinder for more displacement and a larger air chamber for more pressure.

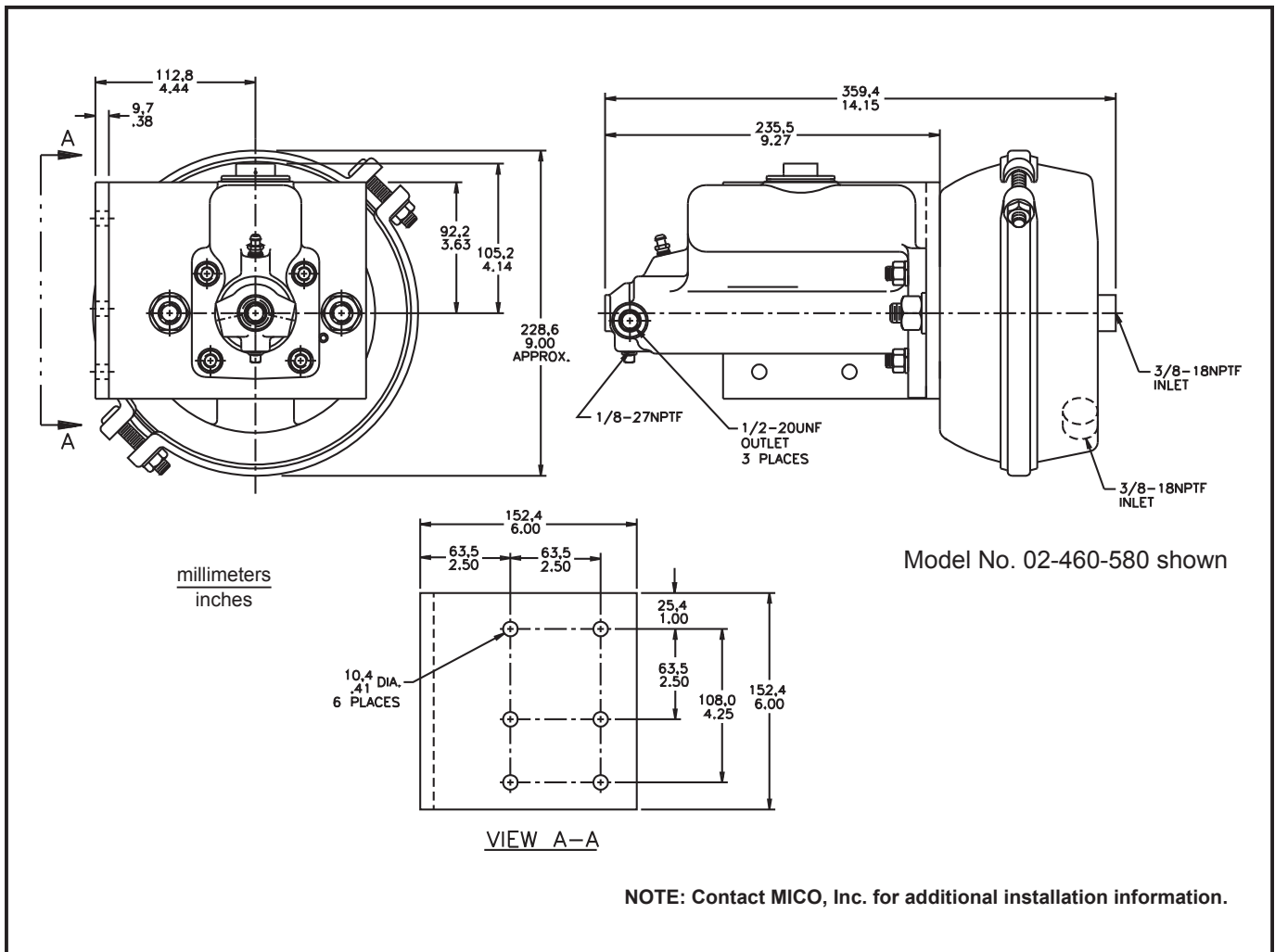
Like the models in the previous section, air pressure is used to actuate a push rod in the air chamber. In turn the push rod moves the master cylinder piston which forces hydraulic fluid into the system.



Model No. 02-460-580 shown

## Typical System Schematic





## SPECIFICATIONS

Model Number	Fluid Type	Internal Residual Check Valve	Air Chamber Size	Hydraulic Pressure @ 6.9 bar (100 PSI) Air Pressure	Effective Displacement	Effective Stroke	Bore Diameter	Filler Cap
02-460-580	BF	Yes	91 cm <sup>2</sup> (36 in <sup>2</sup> )	103 bar (1500 PSI)	96.7 cm <sup>3</sup> (5.9 in <sup>3</sup> )	62.2 mm (2.45 in)	44.5 mm (1.750 in)	Vented
02-461-580	BF	No	91 cm <sup>2</sup> (36 in <sup>2</sup> )	103 bar (1500 PSI)	96.7 cm <sup>3</sup> (5.9 in <sup>3</sup> )	62.2 mm (2.45 in)	44.5 mm (1.750 in)	Vented
* 03-460-437	BF	Yes	76 cm <sup>2</sup> (30 in <sup>2</sup> )	50 bar (720 PSI)	88.5 cm <sup>3</sup> (5.4 in <sup>3</sup> )	57.2 mm (2.25 in)	44.5 mm (1.750 in)	Ported / 1/2-20UNF

BF = DOT 3, 4, 5 and 5.1 brake fluid.

All model numbers have a maximum air pressure rating of 8 bar (120 PSI).

All model numbers have right side mounting brackets when viewed from the air chamber end of actuator.

\* Special mounting bracket. Contact MICO for more information.





# Air/Hydraulic Actuator

(master cylinder with air chamber)

## FEATURES

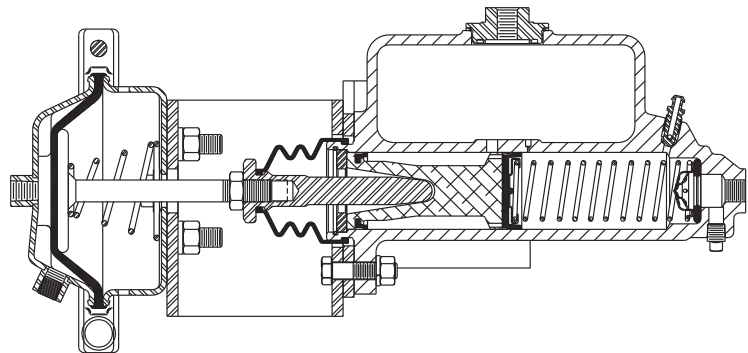
- Contains an internal residual check valve
- Incorporates a conventional master cylinder
- Available for industrial and mobile applications
- Actuator components are protected from environmental contaminants



## DESCRIPTION

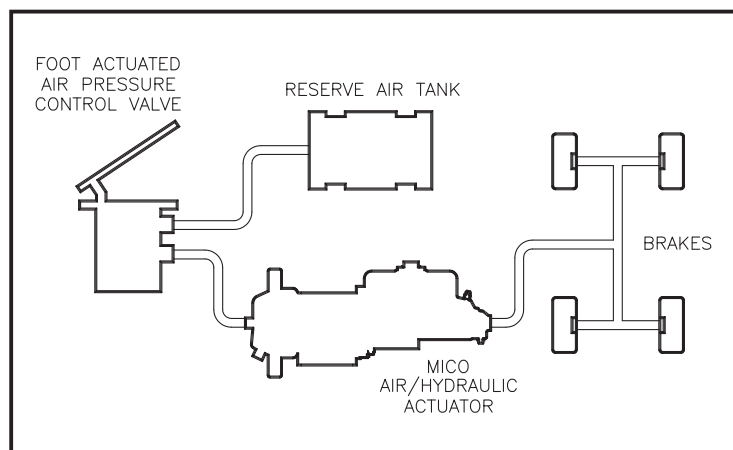
This actuator is also the combination of a conventional master cylinder and an air chamber. The model in this section uses a large straight bore master cylinder for greater displacement.

Air pressure is used to actuate a push rod in the air chamber, which moves the master cylinder piston and forces hydraulic fluid into the system.

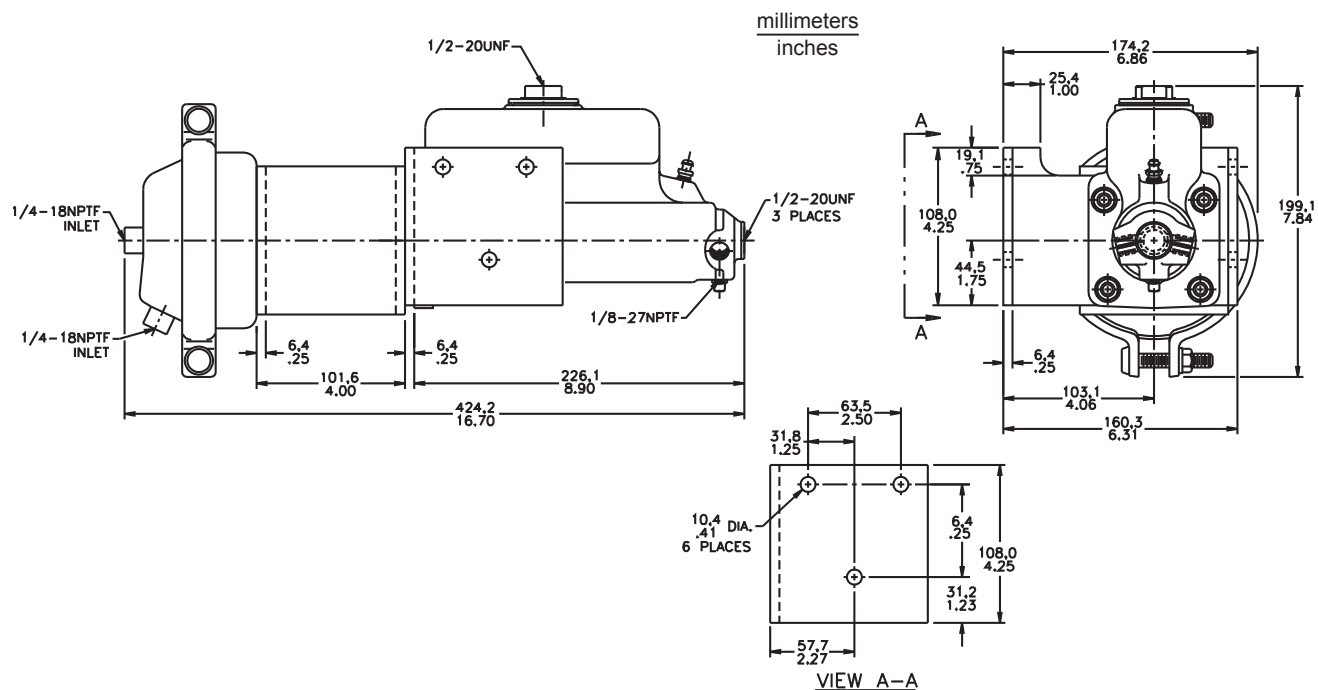


Model No. 02-460-436 shown

## Typical System Schematic







Model No. 03-460-436 shown

NOTE: Contact MICO, Inc. for additional installation information.

## SPECIFICATIONS

Model Number	Fluid Type	Internal Residual Check Valve	Air Chamber Size	Hydraulic Pressure @ 6.9 bar (100 PSI) Air Pressure	Effective Displacement	Effective Stroke	Bore Diameter
03-460-436	BF	Yes	30 cm <sup>2</sup> (12 in <sup>2</sup> )	31 bar (450 PSI)	85.2 cm <sup>3</sup> (5.2 in <sup>3</sup> )	44.5 mm (1.75 in)	44.5 mm (1.75 in)

BF = DOT 3, 4, 5 and 5.1 brake fluid.

Maximum air pressure rating of 8 bar (120 PSI).



# Air/Hydraulic Actuator

(stem seal master cylinder with air chamber)

## FEATURES

- Positive alignment of actuating components eliminates cup wear
- Actuator components protected from environmental contaminants
- Ideal for spring brakes
- Available for industrial and mobile applications using hydraulic oil or brake fluid
- Includes stroke indicator
- Internal valving enhances bleeding process and extends normal service life of primary seal

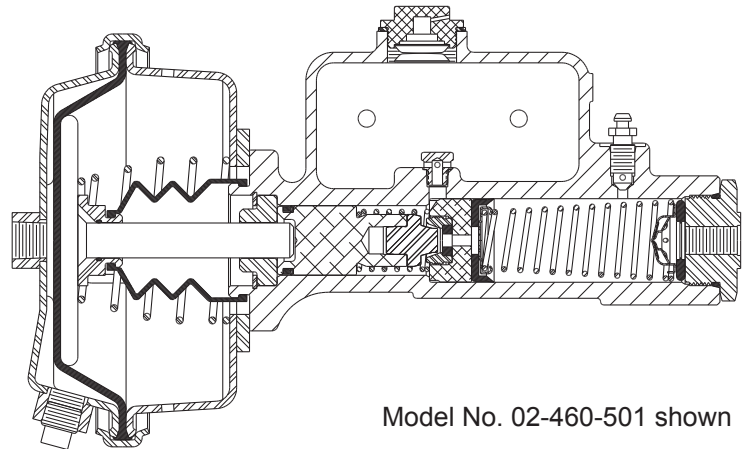


## DESCRIPTION

These MICO® Air/Hydraulic Actuators are a combination of a fluid actuator and an air chamber. They are designed to take advantage of available pressurized air sources to produce hydraulic pressure. This design feature allows them to be used in many brake applications in the construction, material handling, mining, forestry and farming industries as well as many industrial applications.

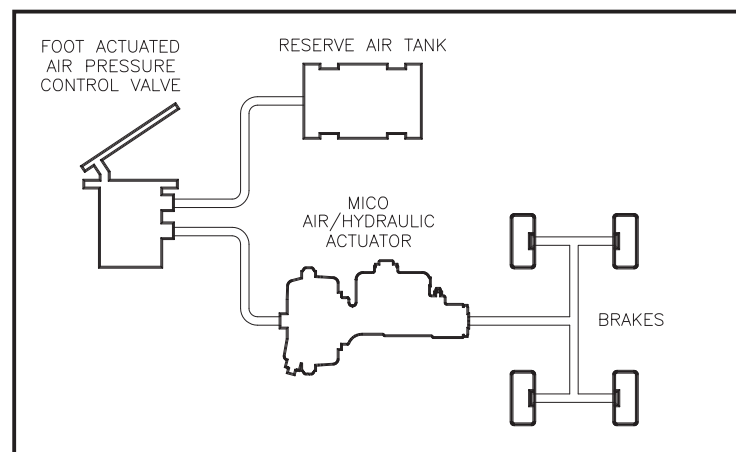
When sizing an air/hydraulic actuator to a particular application, the hydraulic displacement and required system pressure must be determined. The required system fluid depends upon the type of wheel brake system on the vehicle. These air/hydraulic actuators have a greater displacement output than the wheel brake system input plus an adequate reserve. Consult the brake or axle manufacturer for the needed displacement.

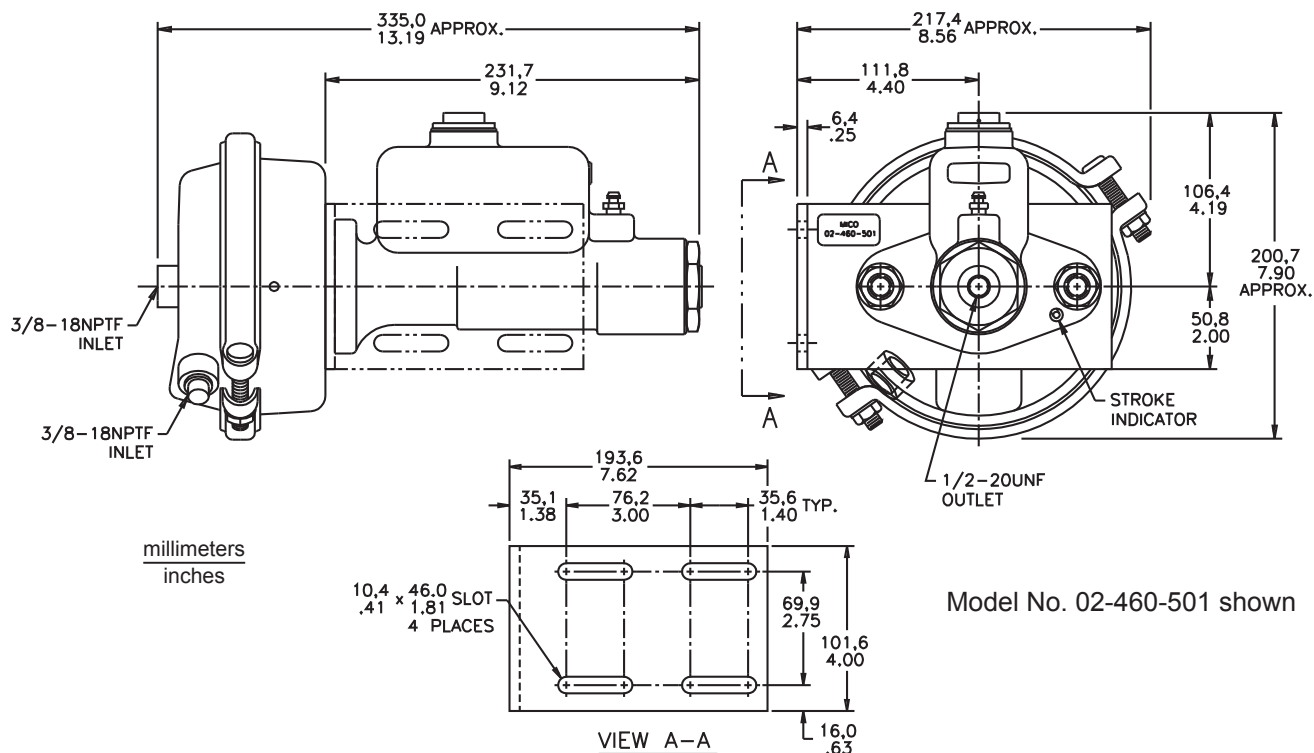
The stem seal master cylinder eliminates cup cutting by allowing the cups to move freely in the master cylinder without passing over any ports.



Model No. 02-460-501 shown

## Typical System Schematic





NOTE: Contact MICO, Inc. for additional installation information.

## SPECIFICATIONS

Model Number	Fluid Type	Internal Residual Check Valve	Air Chamber Size	Hydraulic Pressure @ 6.9 bar (100 PSI) Air Pressure	Effective Displacement	Effective Stroke	Bore Diameter	Filler Cap	★ Mounting Bracket
02-460-501	BF	Yes	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-460-502	HO	Yes	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-460-503	BF	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/4-18NPTF	Right
02-460-504	HO	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	138 bar (2000 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/8-27NPTF	Left
02-460-505	BF	Yes	76.cm <sup>2</sup> (30 in <sup>2</sup> )	117 bar (1700 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-460-506	HO	Yes	76.cm <sup>2</sup> (30 in <sup>2</sup> )	117 bar (1700 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-460-507	BF	Yes	91.cm <sup>2</sup> (36 in <sup>2</sup> )	138 bar (2000 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-460-514	HO	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	141 bar (2045 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/8-27NPTF	Left
02-460-515	BF	No	76.cm <sup>2</sup> (30 in <sup>2</sup> )	117 bar (1700 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Left
02-460-516	HO	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/8-27NPTF	Top
02-460-517	BF	No	76.cm <sup>2</sup> (30 in <sup>2</sup> )	117 bar (1700 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/4-18NPTF	Right
02-460-518	HO	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	138 bar (2000 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Left
02-460-519	BF	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	138 bar (2000 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/8-27NPTF	Right
02-460-521	BF	Yes	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Left
02-460-523	BF	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/4-18NPTF	Left
02-460-527	BF	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	138 bar (2000 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Ported / 1/4-18NPTF	Right
02-461-501	BF	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-461-502	HO	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-461-505	BF	No	76.cm <sup>2</sup> (30 in <sup>2</sup> )	117 bar (1700 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-461-506	HO	No	76.cm <sup>2</sup> (30 in <sup>2</sup> )	117 bar (1700 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Right
02-461-521	BF	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	93 bar (1350 PSI)	57.4 cm <sup>3</sup> (3.5 in <sup>3</sup> )	50.8 mm (2.00 in)	38.1 mm (1.500 in)	Vented	Left

BF = DOT 3, 4, 5 and 5.1 brake fluid.

All model numbers have a maximum air pressure rating of 8 bar (120 PSI).

★ When viewed from the air chamber end of actuator.



# Air/Hydraulic Actuator

(stem seal actuator with air chamber)

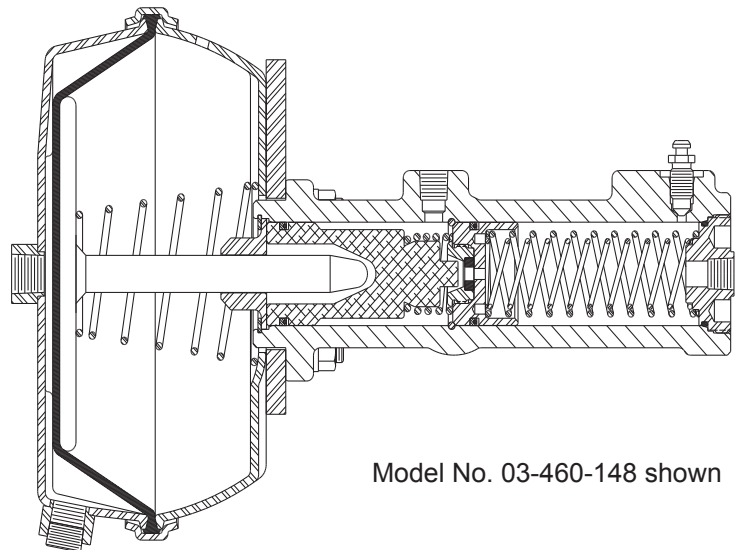
## FEATURES

- Allows towed vehicle's brakes to be controlled from brake pedal of towing vehicle
- Ideal for spring brakes - cup seals never pass over ports
- Available for industrial and mobile applications

## DESCRIPTION

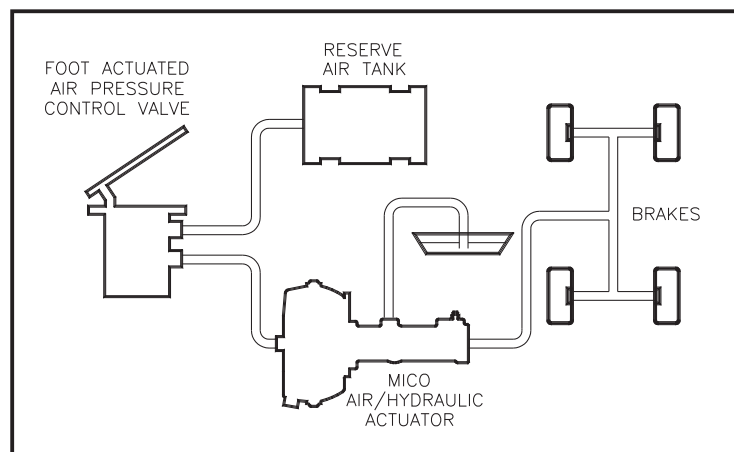
The MICO® Straight Bore Actuator Type Air/Hydraulic Actuator is also the combination of a remote actuator and an air chamber.

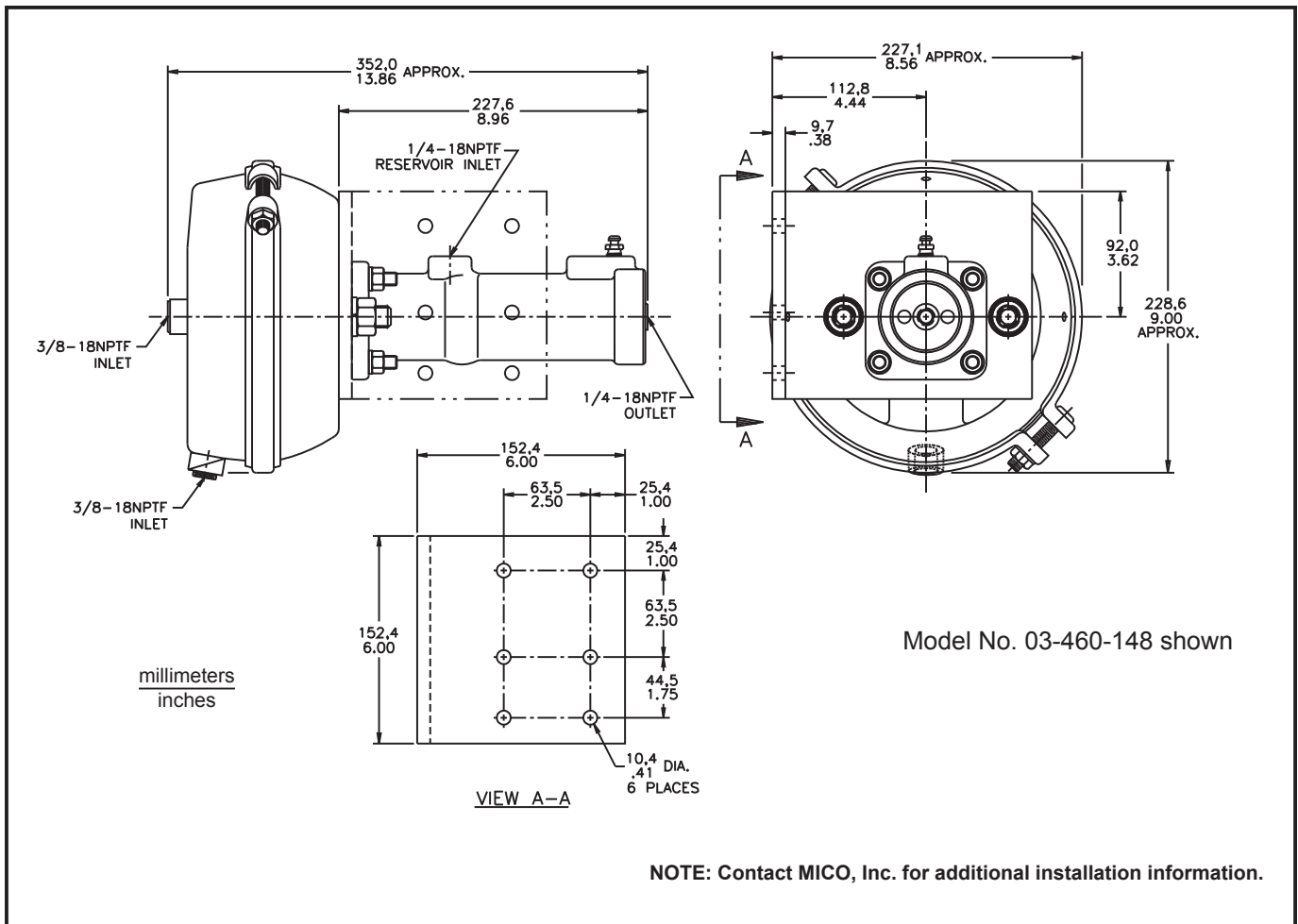
Air pressure is used to actuate a push rod in the air chamber. The push rod in turn moves a piston in the hydraulic chamber which closes the reservoir feed port of the high pressure piston. The continued movement of the hydraulic piston then generates high hydraulic pressures at the outlet port. The stem seal actuator eliminates cup cutting by allowing the cups to move freely in the actuator without passing over any ports.



Model No. 03-460-148 shown

## Typical System Schematic





## SPECIFICATIONS

Model Number	Fluid Type	Internal Residual Check Valve	Air Chamber Size	Hydraulic Pressure @ 6.9 bar (100 PSI) Air Pressure	Effective Displacement	Effective Stroke	Bore Diameter
03-460-147	BF	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	103 bar (1500 PSI)	96.0 cm <sup>3</sup> (5.8 in <sup>3</sup> )	62.0 mm (2.44 in)	44.5 mm (1.750 in)
03-460-148	HO	No	91.cm <sup>2</sup> (36 in <sup>2</sup> )	103 bar (1500 PSI)	96.0 cm <sup>3</sup> (5.8 in <sup>3</sup> )	62.0 mm (2.44 in)	44.5 mm (1.750 in)
03-460-338	HO	No	51.cm <sup>2</sup> (20 in <sup>2</sup> )	55 bar (800 PSI)	83.8 cm <sup>3</sup> (5.1 in <sup>3</sup> )	54.0 mm (2.13 in)	44.5 mm (1.750 in)

BF = DOT 3, 4, 5 and 5.1 brake fluid. HO = mineral base hydraulic oil.

All model numbers have a maximum air pressure rating of 8 bar (120 PSI).

All model numbers have right side mounting brackets when viewed from the air chamber end of actuator.



# Air/Hydraulic Actuator

(stem seal actuator with air chamber)

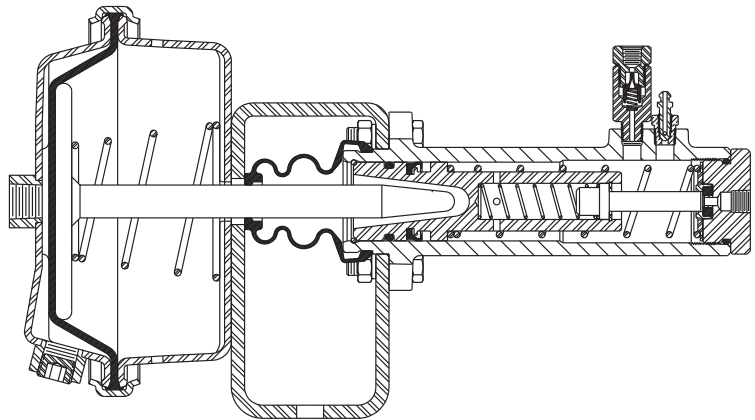
## FEATURES

- Allows towed vehicle's brakes to be controlled from brake pedal of towing vehicle
- Ideal for spring brakes - cup seals never pass over ports
- Available for industrial and mobile applications

## DESCRIPTION

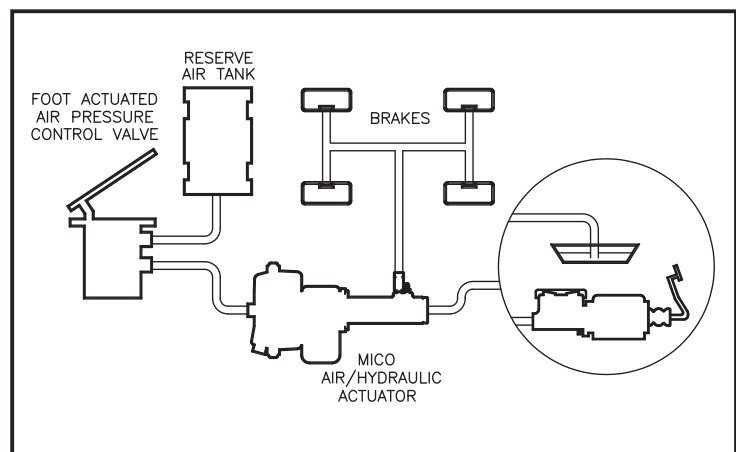
The MICO® Straight Bore Actuator Type Air/Hydraulic Actuator is the combination of a remote actuator and an air chamber. The remote actuator has a single acting piston with a stem seal. Air pressure is used to actuate a push rod in the air chamber. The push rod in turn moves a piston in the hydraulic chamber which causes the stem seal to close off the fluid reservoir port. The continued movement of the hydraulic piston then generates high hydraulic pressures at the outlet port. The stem seal actuator eliminates cup cutting by allowing the cups to move freely in the master cylinder without passing over any ports.

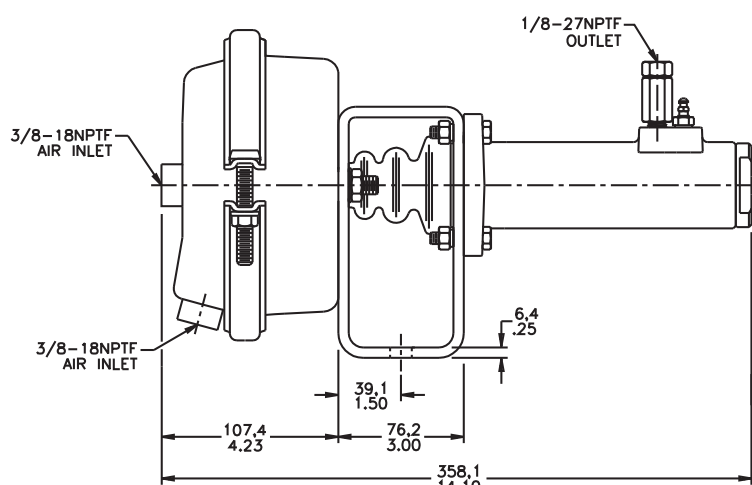
This Air/Hydraulic Actuator allows either one of two pressure sources to operate a slave cylinder, brake or other device. If connected to a remote reservoir this actuator can be used as a single source.



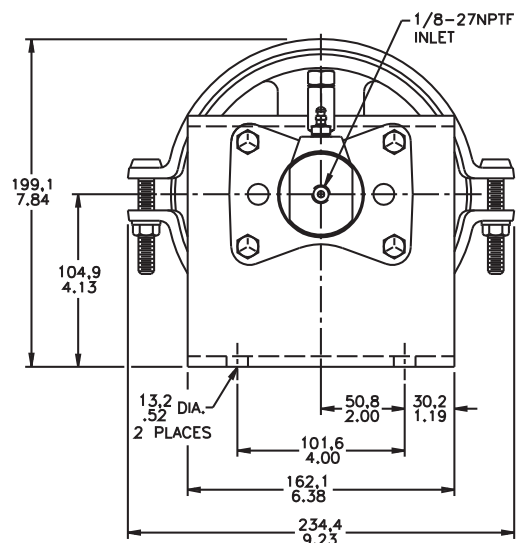
Model No. 12-460-031 shown

## Typical System Schematic





millimeters  
inches



Model No. 12-460-031 shown

**NOTE:** Contact MICO, Inc. for additional installation information.

## SPECIFICATIONS

Model Number	Fluid Type	External Residual Check Valve	Air Chamber Size	Hydraulic Pressure @ 6.9 bar (100 PSI) Air Pressure	Effective Displacement	Effective Stroke	Bore Diameter
12-460-031	BF	Yes	61.cm <sup>2</sup> (24 in <sup>2</sup> )	94 bar (1360 PSI)	41.6 cm <sup>3</sup> (2.5 in <sup>3</sup> )	36.6 mm (1.44 in)	38.1 mm (1.500 in)
12-460-032	HO	No	61.cm <sup>2</sup> (24 in <sup>2</sup> )	94 bar (1360 PSI)	41.6 cm <sup>3</sup> (2.5 in <sup>3</sup> )	36.6 mm (1.44 in)	38.1 mm (1.500 in)

BF = DOT 3, 4, 5 and 5.1 brake fluid. HO = mineral base hydraulic oil.  
 All model numbers have a maximum air pressure rating of 8 bar (120 PSI).  
 All model numbers have a maximum fluid pressure rating of 172 bar (2500 PSI).





# Fluid Reservoirs

For Direct or Remote Mounting



## POLYALLOMER RESERVOIR

- Translucent for easy view of fluid level
- Diaphragm seals out environmental contaminants
- Adaptable outlet fittings
- Sediment trap inherent to design
- Easy screw on and off filler cap
- 238 cm<sup>3</sup> (14.5 in<sup>3</sup>) usable fluid capacity
- For use with hydraulic oil or brake fluid (contact MICO regarding phosphate ester fluids)

## METAL RESERVOIR

- Rugged anodized aluminum housing
- Easy screw on and off filler cap with baffle and breather
- 54 cm<sup>3</sup> (3.3 in<sup>3</sup>) usable fluid capacity
- Compact design for ease of mounting
- Adaptable outlet fittings
- For use with hydraulic oil or brake fluid (contact MICO regarding phosphate ester fluids)

## SPECIFICATIONS

Poylallomer Reservoirs

Model Numbe <sup>z</sup> r	Fluid Type	Outlet Fitting	Mounting Bracket	Diaphragm Part Number
20-920-500	HO	9/16-18UNF-2A	Yes	32-490-009
20-920-520	HO	9/16-18UNF-2A	No	32-490-009
20-920-512	HO	1/4-18NPTF (internal)	Yes	32-490-009
20-920-514	HO	1/4-18NPTF (internal)	No	32-490-009
20-920-505	BF	9/16-18UNF-2A	Yes	32-490-010
20-920-509	BF	1/4-18NPTF (internal)	Yes	32-490-010
20-920-515	BF	1/4-18NPTF (internal)	No	32-490-010

HO = mineral base hydraulic oil.

BF = DOT 3, 4, 5 and 5.1 brake fluid.

## SPECIFICATIONS

Metal Reservoirs

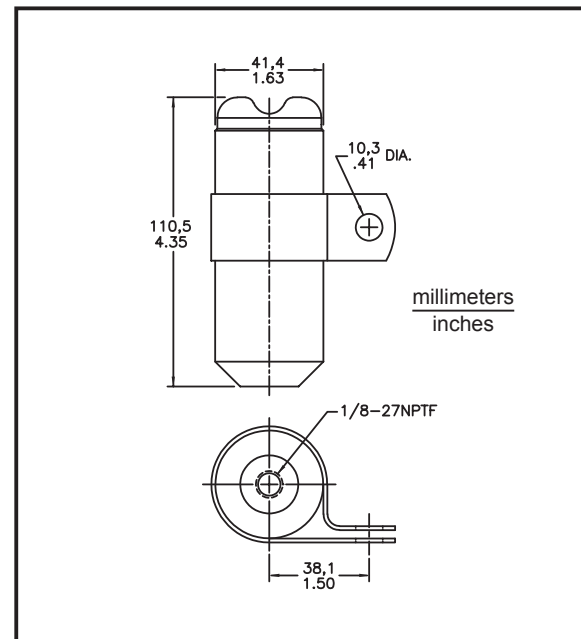
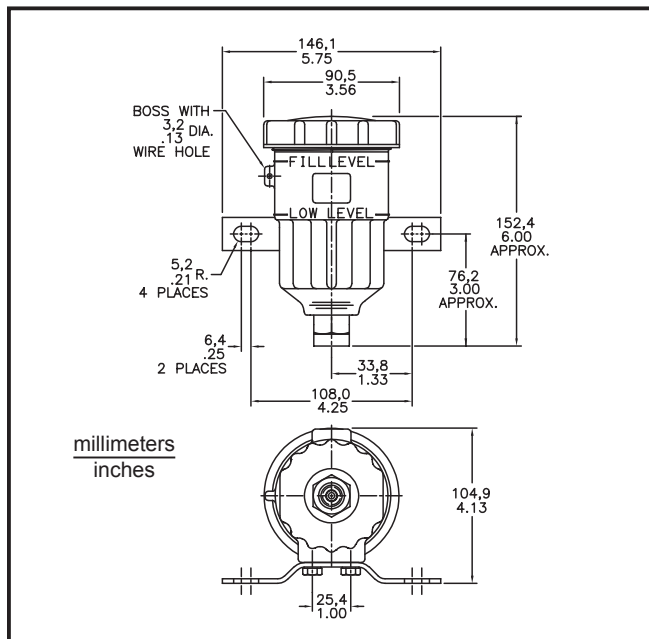
Model Number	Fluid Type	Mounting Bracket
* 20-920-002	BF or HO	No
** 20-920-006	BF or HO	Yes
20-920-009	BF or HO	Yes

\* Includes 1/8-27NPTF male 90° elbow fitting.

\*\* Includes two 1/4-27NPTF x 1/4 tube fittings.

HO = mineral base hydraulic oil.

BF = DOT 3, 4, 5 and 5.1 brake fluid.



# NOTES

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**MICO, Incorporated**

1911 Lee Boulevard

North Mankato, MN, U.S.A. 56003-2507

Tel: +1 507 625 6426 Fax: +1 507 625 3212

[www.mico.com](http://www.mico.com)

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**PRODUCT LINE:****Brakes**

Caliper Disc Brakes

Multiple Disc Brakes

**Brake Locks**

Electric

Mechanical

**Controls**

Electronic Controls

Hydraulic Throttle Controls

Pedal Controls

Switches

Transducers/Sensors

**Cylinders**

Drive Axle Brake Actuators

Slave Cylinders

Wheel Cylinders

**Master Cylinders**

Boosted Cylinders

Hydraulically and Air Actuated

Straight Bore Cylinders

Two-Stage Cylinders

**Valves**

Accumulator Charging

Electrohydraulic Brake

Park Brake

Pressure Modulating

**Miscellaneous Components**

In-line Residual Check Valves

Pump with Integrated Valves

Reservoirs