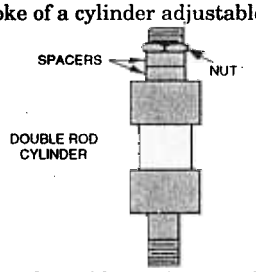
HELPFUL ANSWERS TO FREQUENTLY ASKED QUESTIONS

CYLINDERS; ADJUSTABLE STROKE

Question: Is it possible to make the stroke of a cylinder adjustable?

Answer: Yes. Double-acting cylinders (pages 10-23) may be ordered with a common rod that protrudes from both cylinder end caps. A nut may be placed on one rod end to retain spacers that will limit the stroke distance. Be sure to guard the spacer end because "pinch points" will be present.



Also, 1" bore single-acting cylinders with adjustable strokes are discussed on page 24.

CYLINDERS; AIR CONSUMPTION RATES

Question: How do I calculate the air consumption of a cylinder? Example: Determine the air consumption of a 2" bore cylinder with a 4" stroke operating 30 complete cycles (out and back) per minute at 80 PSI inlet pressure.

Answer:

1. Find the area of the piston by converting the bore diameter into square inches.

$$\left(\frac{\text{2 in. bore}}{2}\right)^2 \text{ x } 3.1416\ (\Pi) = 3.14 \text{ sq.in.}$$

2. Determine consumption per single stroke.

   3.14 sq.in. x 4 inch stroke = 12.56 cu.in.

3. Determine consumption per complete cycle (Disregard displacement of piston rod because it is generally not significant).

   12.56 cu.in. x 2 = 25.12 cu.in. per cycle

4. Determine volume of 80 PSI air that is consumed per minute.

   25.12 cu.in. x 30 cycles/minute = 753.6 cu.in./min. of 80 PSI air

5. Convert cu.in. to cu.ft.

$$\frac{753.6^{\text{cu.in./min.}}}{1728^{\text{cu.in./cu.ft.}}} = .436 \text{ cu.ft./min.}$$

6. Convert air compressed to 80 PSI to "free" (uncompressed) air.

$$\frac{80\text{PSI} + 14.7\text{PSI}}{14.7\text{PSI}} = 6.44 \text{ (times air is compressed when at 80 PSI)}$$

7. Determine cubic feet of **free** air used per minute.

   .436 cu.ft. x 6.44 compression ratio = 2.81 cu.ft. of free air used per minute

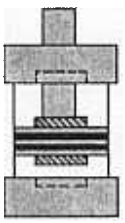
8. So, the consumption rate of a 2" bore, 4" stroke cylinder operating 30 complete cycles per minute at 80 PSI is **2.81 SCFM** (Standard Cubic Feet Per Minute) of free air. "Standard" means air at a temperature of 70°F and at sea level.

Also see questions regarding Cv (page 6) and cylinder size selection (page 5).

CYLINDERS; CUSHIONING

Question: How do I prevent a cylinder from impacting at the end of its stroke?

Answer: Generally, it is best to order your cylinders with built-in cushions if you anticipate unacceptable end-of-stroke impact. Cushions decelerate the piston rod through the last 11/16" of stroke. The degree of cushioning may be adjusted by means of a needle control in the cylinder head. See the Dynamation and HD Series cylinder sections on pages 10-21 for more information.



Centaur cylinders on pages 22-23 are all supplied with rubber bumpers at no extra charge. These bumpers eliminate the "clank" that occurs at stroke completion.

CYLINDERS; CUSHIONING, LOW COST

Question: Is there a low cost alternative to cylinder cushioning?

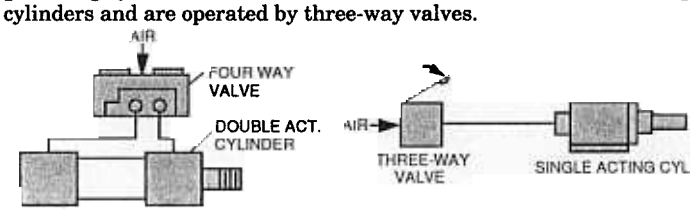
Answer: All Centaur cylinders, pages 22-23, are supplied with built-in rubber bumpers.

CYLINDERS; DOUBLE-ACTING -VS- SINGLE-ACTING

Question: What are the differences between double-acting and single-acting cylinders?

Answer: Double-acting cylinders provide power on both the "extend" and "retract" stroke. They require the use of a four-way directional control valve.

Single-acting or spring return cylinders provide power only on the "push" stroke. The piston rod is returned by an internal spring. Single-acting cylinders use about one-half as much air as double-acting cylinders and are operated by three-way valves.



CYLINDERS; FORCE OUTPUT CALCULATION

Question: How do I figure out the theoretical force output (in pounds) of a cylinder?

Answer: Follow these steps:

1. Calculate the area of the cylinder piston
   Area = Πr^2
   where $\Pi = 3.1416$
   r = 1/2 the bore diameter
2. Multiply the piston area (determined in Step 1 above) times the air pressure to be used.
   Area x Pressure = Force Output

Example: What is the theoretical force output of a 2-1/2" bore cylinder operating at 80 pounds per square inch air pressure?

Step 1. Area = Πr^2
Area = $3.1416 \text{ X } 1.25^2$
Area = 4.91 square inches

Step 2. 4.91 sq.in. x 80 PSI = 393 pounds of force

Note: The force output on the rod end of a cylinder will be slightly less due to the displacement of the rod.

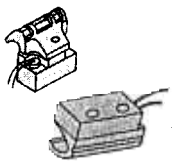
The real force output of a cylinder will be less than the theoretical output because of internal friction and external side loading.

It is best to use a cylinder that will generate from 25% to 50% more force than theoretically needed.

CYLINDERS; MID-STROKE POSITION SENSING

Question: How do I sense the position of a cylinder rod when it is somewhere between its limits?

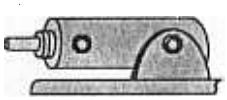
Answer: Order your cylinder with Hall Effect or Reed switches and a magnetic piston. Set the switches at the desired trip points. An electrical signal will be emitted when the magnetic piston passes a switch. See page 11 for details.



CYLINDERS; NON-LUBRICATED

Question: Are there cylinders available that do not require lubrication?

Answer: Mead Centaur cylinders, pages 22-23, have Teflon® seals that glide over the cylinder tube surface without the aid of lubricant. ®DuPont



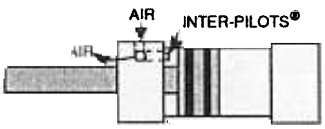
HELPFUL ANSWERS TO FREQUENTLY ASKED QUESTIONS

CYLINDERS; POSITION SENSING, END-OF-STROKE

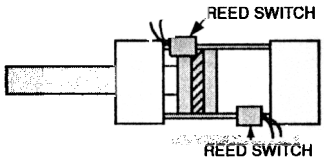
Question: How do I sense that a cylinder rod has reached the end of its stroke?

Answer: Use any of the following methods or external limit valves:

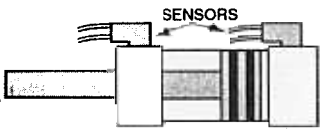
1. Order your cylinder with built-in "Inter-Pilots"®. Inter-Pilots® emit an air signal when the stroke limit is reached. See page 11 for details. Note: to use Inter-Pilots®, the full stroke of the cylinder must be used.



2. Order your cylinder with Hall Effect or Reed switches that emit electrical signals when the stroke limit is reached. See page 11 for details. Note: to use Hall Effect or Reed switches, the cylinder must be supplied with a magnetic piston.



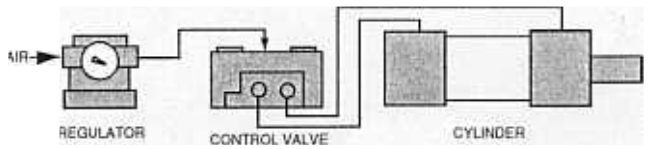
3. Use stroke completion sensors described on pages 11 & 42. These valves react to pressure drops so that an output signal will be generated even if the piston is stopped short of a complete stroke.



CYLINDERS; POWER OUTPUT BOOST

Question: How do I get more power out of a particular cylinder?

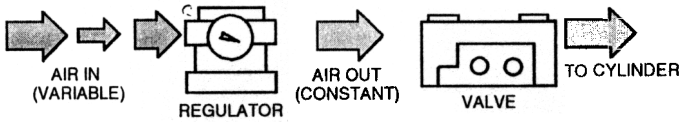
Answer: You should increase the pressure of the air that feeds the cylinder within the recommended limits.



CYLINDERS; PRESSURE MAINTENANCE

Question: How do I maintain a constant cylinder force output when my air pressure supply fluctuates?

Answer: Set an air regulator (page 54) ahead of your valve at a pressure that may always be maintained.



Example: Depending on the time of day and workload, a plant's air pressure fluctuates between 80 and 95 PSI. Set the regulator at 80 PSI and the cylinder power output through the plant will remain constant.

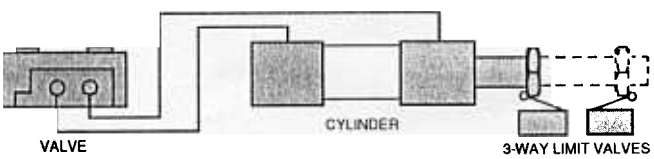
Also, an air reservoir (AR, see page 23) may be used to solve an air shortage problem. By mounting a reservoir close to a cylinder, an adequate amount of air will be supplied when needed.

CYLINDERS; RECIPROCATING

Question: How do I get a cylinder to reciprocate automatically?

Answer: Order your cylinder with Inter-Pilots® (page 11), Hall Effect or Reed switches (page 11), or stroke completion sensors (pages 11 & 42). These devices will send signals to double pressure or solenoid operated valves that will shift each time a stroke has been completed.

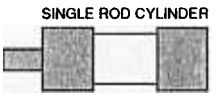
Reciprocation may also be achieved by having a cam, mounted on the cylinder rod, trip external limit valves.



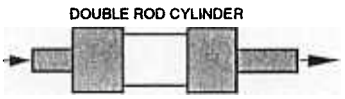
CYLINDERS; RODS, SINGLE AND DOUBLE

Question: What is the difference between a single-rod and a double-rod cylinder?

Answer: Single-rod cylinders have a piston rod protruding from only one end of the cylinder.



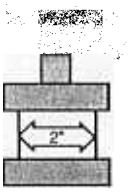
Double-rod cylinders have a common rod, driven by a single piston, protruding from both cylinder end caps. When one end retracts, the other extends. They are excellent for providing an adjustable stroke and for providing additional rigidity. Also, a double-rod with an attached cam may be used to trip a limit switch.



CYLINDERS; SPACE CONSERVING TYPE

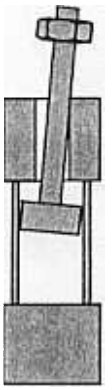
Question: I have a space problem and cannot fit a regular cylinder into the area available. What may I do?

Answer: Use an ultra-compact Mead "Space Saver"™ cylinder. See page 25 for details.



CYLINDERS; SIDE LOADING REDUCTION

Question: How may I minimize the adverse effects of cylinder side loading?



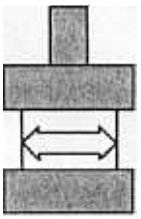
Answer: First, be sure that the object being moved is in exact alignment with the piston rod. If the cylinder is rigidly mounted and the rod is forced off line, the cylinder bearing will wear prematurely and a loss of power will occur. It may be helpful to use guide rails to keep the object being moved in proper alignment.

Second, don't use all of the stroke. Particularly on pivot and clevis models, it is wise to have the piston stop a few inches short of full stroke. This makes the cylinder more rigid and extends bearing life.

Third, order your cylinder with a Self Aligning Rod Coupler. See page 11 for details.

CYLINDERS; SIZE SELECTION

Question: How do I determine the correct cylinder bore size for my application?



Answer: Follow these four easy steps:

1. Determine, in pounds, the force needed to do the job. Add 25% to 50% for friction and to provide enough power to allow the cylinder rod to move at a reasonable rate of speed.
2. Find out how much air pressure will be used and maintained.
3. Select a **power factor** from the table below that, when multiplied by the planned air pressure, will produce a force equal to that which was determined in Step 1. Power factor is the amount of square inches for the cylinder bore.

Power Factor Table

Bore Diameter	¾"	1"	1⅛"	1½"	2"	2¼"	2½"	3"	3¼"	4"	6"
Power Factor	.4	.8	1.0	1.8	3.1	4.0	4.9	7.1	8.3	12.6	28.3

4. The bore diameter that you need will be found directly above the power factor that was determined in Step 3.

Example: Estimated force needed is 900 lbs.
Air pressure to be used is 80 PSI

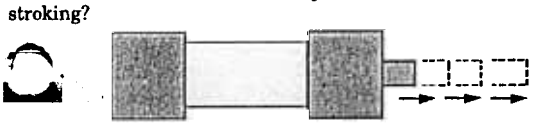
80 PSI x power factor = 900 lbs. Power factor = $\frac{900\text{lbs.}}{80\text{PSI}} = 11.25$

The power factor just above 11.25 is 12.6. Therefore, this job will require a 4" bore cylinder.

HELPFUL ANSWERS TO FREQUENTLY ASKED QUESTIONS

CYLINDERS; SMOOTHER MOTION

Question: What could cause a cylinder to move erratically during stroking?



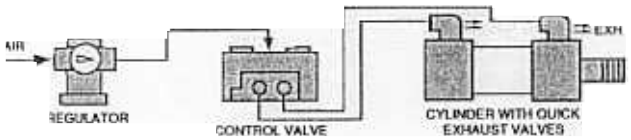
Answer: Irregular rod motion could be caused by:

1. Too low an input air pressure for the load being moved.
2. Too small a cylinder bore size for the load being moved.
3. Side loading on the cylinder rod caused by misalignment of the rod and load.
4. Using flow control valves to meter the incoming air rather than the exhausting air.
5. Flow control valves are set for too slow a rod movement.
6. An absence of lubrication.

CYLINDERS; SPEED BOOST

Question: How do I get more speed out of a cylinder?

Answer: You may increase the inlet pressure to within the recommended limits and/or you may place a quick exhaust valve in either or both cylinder port(s). See page 43 for information on the use of quick exhaust valves.

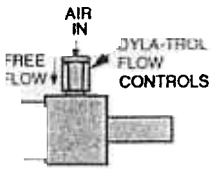


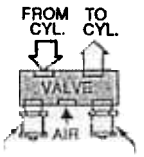
CYLINDERS; SPEED CONTROL

Question: How do I control the speed of my cylinder?

Answer: Use any of the following methods:

1. Place Mead Dyla-Trol® flow control valves (page 44) in each of the cylinder ports. Install them so that the air leaving the cylinder is controlled.
2. Use right-angle flow controls in the cylinder ports. These feature recessed screw driver adjustment and convenient swivel for ease of tubing alignment. See pages 10, 22.
3. Place speed control silencers (page 43) into the exhaust ports of the control valve that is being used to power the cylinder.
4. Purchase a directional valve that has built-in flow controls. See Mead Dura-Matic valves (page 32).



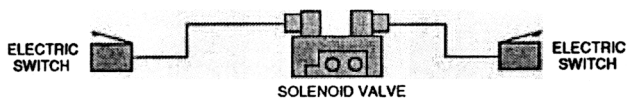


SPEED CONTROL SILENCERS

VALVES; AIR –VS– SOLENOID ACTUATION

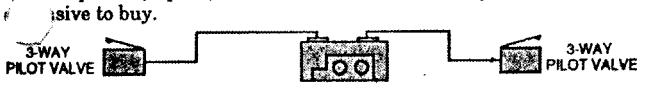
Question: What are the advantages of air actuation over solenoid actuation?

Answer: Solenoid actuation requires the presence of electric switches, wires, and all of the shielding necessary to reduce spark hazard and personal risk.



SOLENOID VALVE

Air actuation requires only 3-way air pilot valves and tubing. There is no explosion, spark, or shock risk and the components are less expensive to buy.

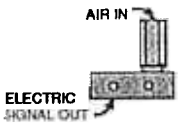


AIR PILOTED VALVE

VALVES; AIR-TO-ELECTRIC SIGNAL CONVERSION

Question: Is it possible to convert an air signal into an electrical signal?

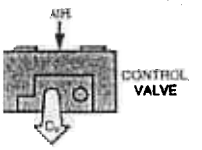
Answer: Mead MPE-B and MPE-BZ converters, shown on page 42, will turn an air signal into an electrical signal.



VALVES; C_v

Question: What does "C_v" mean?

Answer: Literally, C_v means coefficient of velocity. C_v is generally used to compare flows of valves. The higher the C_v, the greater the flow.



It is sometimes helpful to convert C_v into SCFM (Standard Cubic Feet per Minute) and conversely, SCFM into C_v. Although C_v represents flow capacity at all pressures, SCFM represents flow at a specific air pressure. Therefore, the following chart relates C_v to SCFM at a group of pressures.

To obtain SCFM output at a particular pressure, divide the valve C_v by the appropriate factor shown below.

C_v to SCFM Conversion Factor Table

PSI of Air Pressure	40	50	60	70	80	90	100
Factor	.0370						

Example: What is the output in SCFM of a valve with a C_v of 0.48 when operated at 100 PSI?

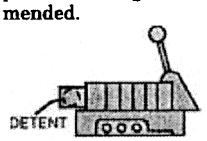
$$\frac{0.48(C_v)}{.0177(\text{Factor})} = 27 \text{ SCFM}$$

To convert SCFM into C_v, just reverse the process and multiply the SCFM times the factor.

VALVES; DETENTED

Question: What is a "detented" valve and how is it used?

Answer: A detented valve is one that holds its position by some mechanical means such as a spring, ball or cam. Most valves hold their position by means of the natural friction of the rubber seals. Where natural friction is low, such as in packless valves, or where it is not positive enough for safety purposes, detented models are recommended.

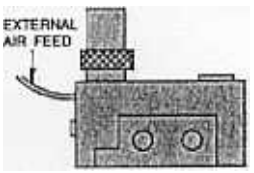


Also, detents are used to locate the middle position in three position valves. See the Capsula valve section on pages 30 and 31 and four-way valves section on page 38.

VALVES; EXTERNAL AIR SUPPLY FOR SOLENOIDS

Question: Under what conditions should an external air supply be used to feed the solenoids on a directional valve?

Answer: When the air pressure passing through the power section of the valve is insufficient to shift the spool, when the medium passing through the power section would be detrimental to the solenoid operator, or where the operating medium could not be exhausted to the atmosphere.



SOLENOID VALVE