TECHNICAL DATA SHEET for Automation Basic Cylinders

PRACTICAL HINTS

AUTOMATION BASIC CYLINDERS are manufactured with near perfect concentricity and squareness to reduce internally induced side load. Aligning a cylinder perpendicular and in- line with the work load will reduce externally induced side load and extend service life.

In pneumatic service, leaks return to ambient air almost unnoticed but should be avoided to improve overall system efficiency.

Use adequate line size for both inflow and outflow to avoid unnecessary restriction and low efficiency.

Use flow control valves (preferably port mounted) in the metering - out mode to control cylinder speed and to reduce shock for over-running loads.

Select a cylinder with ample force. Please see the section on cylinder sizing. Nothing is more frustrating than selecting a cylinder too small for the job. A rule of thumb is to select a cylinder which is at least 150% larger than calculated for the applied load. Another rule of thumb is to assume that no more than 80 P.S.I. will be available in all branch lines in the plant when drain is heavy on the overall system.

Normal aspiration (inflow & outflow) in all pneumatic devices tend to oxidize (dry out) internal lubricant. Two solutions to the problem are suggested: One is to service a cylinder (new service kit) at scheduled intervals and the other is to install an air-oil mist unit at the inlet. A properly maintained air-oil mist unit extends seal life by several orders of magnitude but has the disadvantage of reclassifying and coalescing oil vapor at the exhaust end. See Figure 2 under suggested CONTROL SYSTEMS.

Pneumatic actuators which incorporate diaphragms appear to be the only type which can operate long term without any lubricant, however, diaphragm actuators have inherent design and application restrictions.

Tubing which has self gripping braid as part of the molded structure and when attached to a barbed fitting may be used at 80 P.S.I. without clamps unless there is severe flexing at the joint or unless operating temperature is considerably above ambient. A clamp is recom- mended at these extreme conditions. For quick disconnect, split short portion of tubing over fitting and cut off about an 1/2 inch. Hose is ready for reconnecting by simply pushing up over barbs on fitting.

AUTOMATION BASIC CYLINDERS can operate on vacuum but applications may be limited because of the 15 P.S.I. pressure differential to ambient. Remove Flow Control Valves when used on vacuum.

FORCE TABULATION

CYL. BORE	EFFECTIVE PISTON AREA (SQ. IN.) FULL PISTON HEAD	PISTON HEAD LESS ROD	THEORETICAL CYLINDER FORCE (LB.) FULL PISTON HEAD @ 80 PSI	@150 PSI	@300 PSI	PSTON HEAD LESS ROD @ 80 PSI	@150 PSI	@300 PSI
0.656	0.338	0.228	27.0	50.7	101.4	18.2	34.2	68.4
0.938	0.691	0.495	55.3	103.7	207.3	39.6	74.3	148.5
1.188	1.108	0.801	88.6	166.2	332.4	64.1	120.2	240.3
1.500	1.767	1.325	141.4	265.0	530.1	106.0	198.8	397.5

SIZING CYLINDERS

In most cases, theoretical force from an Automation Basic Cylinder can be calculated with more precision than predicting the load requirements for it's application. A conservative "rule of thumb" is to select a cylinder which gives a theoretical force at roughly 1-1/2 times higher than the work load (F = 1.5 x L). In other words, work load should be about 2/3 of the calculated theoretical force (L = F x 0.67).
The theoretical force from a cylinder is constant over the full range of travel and is simply the product of operating pressure times the effective piston area, or

F = P x A where, F = THEORETICAL FORCE (LBS.)
P = PRESSURE (P.S.I.)
A = EFF. AREA (SQ. IN.)

EXAMPLE: Calculate the theoretical extending and retracting forces from a double acting, single ended cylinder with a piston head diameter of 1.500 inches and a rod diameter of 0.750 inches. The cylinder is to operate at 80 P.S.I.

EXTENDING FORCE (THEORETICAL)	RETRACTING FORCE (THEORETICAL)
F = P x A	F = P x A
F = 80 (PSI) TIMES 1.767 (SQ. IN.)	F = 80 (PSI) TIMES 1.325 (SQ. IN.)
F = 141.4 (LBS.) FORCE	F = 106 (LBS.) FORCE

The work load is 67% of the theoretical force, or

L = 0.67 x F where, L = WORK LOAD (LBS.)
F = THEORETICAL FORCE (LBS.)

EXAMPLE: Converting the theoretical forces above into practical work loads involves,

EXTENDING LOAD (APPLIED)	RETRACTING LOAD (APPLIED)
L = 141.4 (LBS.) x .67 (%)	L = 106 (LBS.) x .67 (%)
L = 95 (LB.)	L = 71 (LB.)

CONTROL SYSTEMS

For double acting Automation Basic Cylinders, the simplest form of control involves a conventional four-way valve with the inlet connected to plant air & with outlets plumbed thru flow control valves to each end of the cylinder. See Figure 1.
A more sophisticated version includes an air preparation unit where plant air is filtered, pressure regulated and a trace of oil is added to inlet flow. Also included are flow valves (one to each cyl. port) for adjustment in speed and shock control. In addition, exhaust outflow (with traces of oil) should be collected in a reclassifying chamber and vented outside. A further refinement would include a motion sensing device to document position and use in process step control. See Figure 2.

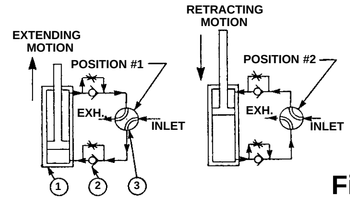


Figure 1

ITEM NO.	DESCRIPTION	QTY.
1	CYLINDER	1
2	FLOW CONTROL VALVES	2
3	FOUR WAY VALVE	1

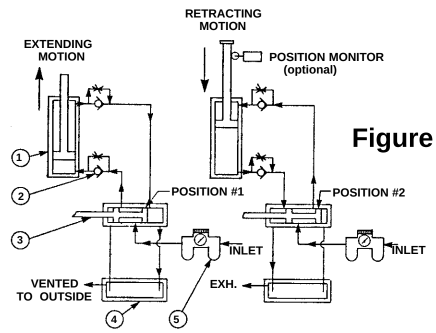
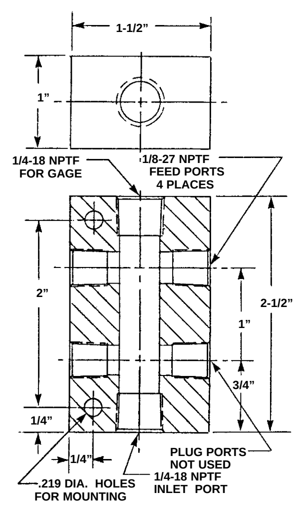


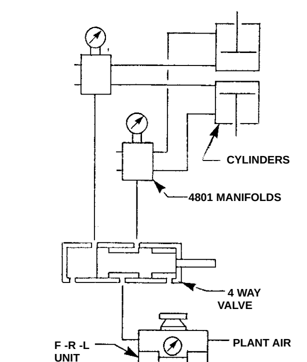
Figure 2

ITEM NO.	DESCRIPTION	QTY.
1	CYLINDER	1
2	FLOW CONTROL VALVES	2
3	FOUR WAY VALVE	1
4	EXHAUST COLLECTOR	1
5	FILTER / REG. / OIL MIST UNIT	1

MANIFOLDS



No. 4801 MANIFOLD
MATERIAL, ALUM ALLOY
(4) 1/8-27 FEED PORTS



MANIFOLD NO. 4801 PROVIDES EASY PLUMBING

DATA SHEET 9344

MACK CORPORATION