SELECTION OF PNEUMATIC CYLINDERS

Single or Double acting

- Dimensional standards like ISO, VDMA, CETOP, AFNOR.
- Constructional details like – Piston rod, tie rod, square tube, Mickey mouse tube, rodless etc.
- Force to be exerted (Bore dia)
- Distance to be moved (stroke)
- Surrounding medium (special material of construction / type of seals)
- Air pressure available.
- Cushioned / Non cushioned.
- Ambient temperature for selection of seal material.
- Speed of actuation
- Position detection (Reed switch type)
- Mountings
- Stop tube length for long stroke cylinders.

SPECIFICATION OF PNEUMATIC CYLINDERS

Following points need to be considered while selecting a pneumatic cylinder.

- Cylinder thrust.
- Air consumption.
- Piston velocity.
- Type of mounting.
- Couplings

Cylinder Thrust

The cylinder thrust is a function of :

- F = Cylinder thrust in Kg.
- D = Dia of piston in cm
- D = Dia of piston rod in cm.
- p = Operating air pressure in “bar”.
- f = Spring force in Kg.
- fr = frictional resistance.(Though in case of static thrust, the frictional resistance is zero.)

Thrust exerted by various type of Cylinders:

1) Single acting push type:

$$F = \{\frac{\pi}{4} \times D^2 \times P\} - f$$

2) Single acting pull type:

$$F = \{\frac{\pi}{4} \times (D^2 - d^2) \times P\} + f$$

3) Double acting in forward stroke

$$F = \{\frac{\pi}{4} \times D^2 \times P\}$$

4) Double acting in return stroke

$$F = \{\frac{\pi}{4} \times (D^2 - d^2) \times P\}$$

AIR CONSUMPTION

The air consumption data for a cylinder is required to estimate the compressor capacity. The calculations include air consumption during forward as well as return stroke.

The free air consumption for forward stroke is calculated as follows:

Free air consumption = piston area x (operating pressure + 1.013) x stroke

The free air consumption for return stroke is also calculated similarly and added to arrive at total free air consumption of cylinder during one complete cycle.

Theoretical air consumption calculations:

Let

D = Dia of piston in cm.

d = piston rod dia.

L = stroke in cm.

P = Air pressure in bar

Free air consumption in litres for forward stroke

$$C = \{\pi/4 \times D^2 \times (P+1) \times L\} / 1000$$

Free air consumption in litres for return stroke

$$C = \{\pi/4 \times (D^2-d^2) \times (P+1) \times L\} / 1000$$

Mounting types

- Front plate mounting.
- Rear plate mounting.
- Double trunion mounting.
- Centre trunion mounting.
- Neck mounting.
- Leg mounting.
- Hinge mounting.

Couplings

- Fork
- Rod eye end.
- Universal coupling

Selection of valves

The following parameters need to be considered for selection:

- Internal construction and other features
- Valve capacity

Pneumatic valve selection

To select a valve, following details need to be taken onto account:

- Cylinder bore (D cm)
- Stroke of cylinder (L cm)
- Required stroke time (T sec)
- Pneumatic pressure available (P)

Referring to tables shown in next slide, constant "M" compression factor can be substituted in the formula below:

$$Cv = \frac{\text{Cyl. Area x stroke x M x compression factor}}{475 \text{ x stroke time in sec.}}$$