

Daily Investment on Pneumatic Conveyor

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Abstract:- Every pneumatic system, makes use of pipes or ducts called transportation lines that carry mixture of materials and a stream of air . These materials can be transported conveniently to various destinations by means of a stream of high velocity air through pipe lines. Products are moved through various tubes via air pressure, allowing for extra vertical versatility.

Pneumatic conveying is routinely used to move solids of all sizes within process plants. On account of the compressibility of the conveying gas, the pneumatic conveying of solids is quite different from the pumping of liquids or slurries. The selection of many of the components that comprise a conveying system such as rotary valves, feed chutes, conveying pipe, and air movers is examined, especially as it relates to reliable operation of a conveying system.

Energy is also required to move material through a pneumatic conveying system, but in this case the energy is supplied by pressure differential (in pounds per squareinch) and airflow(in cubic feet per minute).

In a pneumatic conveying system, the air pressure in the conveying line is changed by the system's air mover, which generates pressure or vacuum. Where the air mover is located in the system determines whether it generates one or the other. When located at the system's start, the air mover pushes air through the system and the system operates under pressure.

When located at the system's end, the air mover pulls air through the system and the system runs under vacuum. By controlling the pressure or vacuum and airflow inside the system, the system can successfully transfer materials.



Introduction:- There are some disadvantages of Pneumatic conveyor

1) Due to different mechanism system and installation of compressor the costing of conveyor get increase.

2) It require high maintainance.

3) proper lubrication and daily proper care is to be done for proper functioning of conveyor.

Due to all this Cost of Pneumatic Conveyor day by day goes on increasing. Its been like investing daily on conveyor. So instead of using pneumatic conveyor we can use gravity roller conveyor which is one time investment for industry.

Calculation:- The below calculation shows the cost investing daily on pneumatic conveyor.

Cost of compressor:- We have the given value of compressor

Volume of Compressor :- 600 CFM

HP of Motor:- 125 HP

Working hour of Compressor:- 20 Hrs

Motor Efficiency:- 85%

Electricity cost:- 9 rupess

Formula to Calculate daily investment on compressor :-

Electricity Cost=

$$\frac{[\text{Horsepower} \times 0.746 \times \text{Hours} \times \text{Electricity Cost}]}{\text{Motor Efficiency}}$$

$$= [125 \times 0.746 \times 20 \times 9] / 0.85$$

$$= 19,747.058824 \text{ rupess}$$

We are investing 19,747 rupess on compressor daily.

Cost of Pneumatic Cylinder:- As our model of Pneumatic Cylinder is A230501000, so we have the following data

Magnetic Cylinder

Piston Diameter:- 50mm = Radius:- 25mm = 0.984252 inches

Rod Diameter:- 20mm = Radius:- 10mm = 0.393701 inches

Stroke= 100mm = 3.93701 inches

Cycle per minute = 50

Formula to Calculate daily investment on Pneumatic air cylinder :-

$$\text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Force} \cdot \text{Displacement}}{\text{Time}}$$

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$$\text{Power} = \text{Force} \cdot \text{Velocity}$$

Formula to Calculate Air consumption of Pneumatic Cylinder in CFM:-

The formula for the air consumption of a double-acting pneumatic cylinder is as follows:

$$A = \text{Piston Area (Square Inches)} = \pi r^2 = 3.043424165 \text{ inches}^2$$

$$R = \text{Rod Area (Square Inches)} = \pi r^2 = 0.4869483611 \text{ inches}^2$$

$$S = \text{Stroke (Inches)} = 3.93701 \text{ inches}$$

$$C = \text{Cycles per Minute} = 50$$

$$q = \text{CFM (Cubic Feet per Minute)} = [(2 \cdot A - R) \times S \times C] / 1728$$

$$= [(2 \cdot 3.043424165 - 0.4869483611) \cdot 3.93701 \cdot 50] / 1728$$

$$= 0.6379300398 \text{ CFM}$$

Formula to Calculate Velocity of Pneumatic Cylinder in inches/sec:-

Velocity of an pneumatic cylinder can be calculated as

where

s = velocity (inches/sec)

$$q = \text{volume flow (cubic feet/min)} = 0.6379300398$$

$$A = \text{piston area (square inches)} = 3.043424165$$

$$s = 28.8 q / A$$

$$= 28.8 * 0.6379300398 / 3.043424165$$

$$= 6.036748133 \text{ inches/sec}$$

$$\text{Velocity in m/sec is } 0.1533334025782$$

Formula to Calculate Force (OUTSTROKE) of Pneumatic Cylinder in Newton:-

$$F = PA$$

$$P = \text{Pressure} = 4 \text{ bar} = 400000 \text{ N/m}^2$$

$$A = \text{Area of piston} = 0.001963495408 \text{ m}^2$$

$$F = 785.3981634 \text{ N}$$

$$\text{Therefore Power 1} = \text{Force(OUTSTROKE)} * \text{Velocity}$$

$$= 785.3981634 * 0.1533334025782$$

$$= 120.4277728 \text{ W}$$

Formula to Calculate Force (INSTROKE) of Pneumatic Cylinder in Newton:-

$$F = PA$$

$$P = \text{Pressure} = 4 \text{ bar} = 400000 \text{ N/m}^2$$

$$A = \text{Area of piston} - \text{Area of Rod}$$

$$= 0.001963495408 - 0.0003141592654$$

$$= 0.001649336143 \text{ m}^2$$

$$F = 659.734457 \text{ N}$$

$$\text{Therefore Power 2} = \text{Force(INSTROKE)} * \text{Velocity}$$

$$= 659.734457 * 0.1533334025782$$

$$= 101.1593291 \text{ W}$$

$$\text{Total Power} = \text{Power 1} + \text{Power 2} = 221.5871019 \text{ W}$$

$$= 0.2215871019 \text{ KW}$$

- In one cycle conveyor carry 6 Rotors and Total 2472 Rotors are carried out in a day. So their is 412 cycle in a day.
- In one minute Pneumatic Cylinder perform 50 Cycles. So 412 Cycles are performed in 8.24 minute. So Pneumatic Cylinder work only 0.1373333333 hours in a day.

- So the value of Power in KWH is **0.0304312953**.

Investment on Pneumatic Cylinder is = KWH * Electricity Cost

$$=0.0304312953*9$$

$$= 0.2738816577 \text{ rupess}$$

$$\approx 0.27 \text{ rupess}$$

Conclusion:- Instead of Pneumatic Conveyor we Can made a simple Gravity Roller conveyor. Their is huge amount of investment on air loses by industry, as compressor is producing 7 bar of pressure but only 4 bar of pressure is coming at the end. The investment in air loses is not in our hand. But instead of daily investment on Pneumatic conveyor we can do one time investment of 400 on simple gravity conveyor. Within upcoming 4.1 years we can take off the cost of Gravity conveyor. Pneumatic Cylinder also required lot of maintainance and care. The magnetic sensor and other child components cost a lot if they are damaged. Roller has very long life. They can easily be in Good working condition after 12 years. So this little investment on Gravity Roller conveyor can Pay back a Huge amount of money to company after 12 years. So Gravity Roller conveyor is seen to be best in all aspect.

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