Compressed Air System

Economics

Delivering compressed air to a manufacturing facility is an expensive operation. Delivery requires costly equipment that consumes significant amounts of electricity and needs frequent maintenance. In spite of this, many facilities have no idea how much their compressed air systems cost on an annual basis, or how much money they could save by improving the performance of these systems.

Electricity costs are by far the largest expense of owning and operating a compressed air system. The annual cost of electricity to operate a 100 HP compressor is between $15,000 - $30,000 depending on the hours of operation. Added to this are annual maintenance costs, which can be 10% or more of the initial cost of the system.

Due to the relatively low initial cost of the compressor when compared to lifetime electricity expenses, users should utilize life-cycle cost analysis when making decisions about compressed air systems. In addition, a highly efficient compressed air system is not merely a system with an energy-efficient motor or efficient compressor design. Overall system efficiency is the key to maximum cost savings. Too often users are only concerned with initial cost and accept the lowest bid on a compressed air system, ignoring system efficiency.

Thorough analysis and design will be required to obtain an efficient system. Many compressed air system users neglect these areas, thinking they are saving money, but end up spending much more in energy and maintenance costs.

This Fact Sheet presents a simple calculation to estimate annual electricity costs.

(Motor full-load brake horsepower) x (0.746 Kw/Hp) x (1.11 efficiency factor) x (Annual hours of operation) x ($ / KWH electricity cost) = Annual Electricity Cost

For example:

Motor full-load = 20 bhp

Annual hours of operation = 2,000 Hrs (single shift continuous operation)

Hourly Cost of Electricity = ($0.047 / KwH)

Peak Load Electricity Charge = $8.10 / Kw / Month

20 Hp x 0.746 Kw / Hp x 1.11 Efficiency Factor x 2000 Hours x $0.047 / KwH $1,557

20 Hp x 0.746 Kw / Hp x $8.10 / Kw x 12 months $1,450

Total Annual Electricity Cost $3,007

Compressed Air Data

Conversion Factors: US Standards to Metric

Air flow:

Cubic Meters per hour (m3/hr)	Cubic Feet per minute (cfm)	multiply by 0.5885
Cubic Meters per minute (m3/min)	Cubic Feet per minute (cfm)	multiply by 35.31
Liters per minute (lt/min)	Cubic Feet per minute (cfm)	multiply by 0.03531

Pressure:

PSI (pounds per square inch)	Bar	multiply by 0.0689
Bar	PSI (pounds per square inch)	multiply by 14.5

Volume:

Liter	Gallons US	multiply by .2642
Gallons US	Liter	multiply by 3.79

Power:

Horsepower	KW	multiply by .0746
KW	HP	multiply by 1.341

Time to fill a tank is: (Reservoir Capacity/Compressor Output) x (Final Pressure required + 14.5/Starting Pressure + 14.05)

i.e. 32 Cu Ft receiver, 20 cfm compressor 100 psi final receiver pressure:

Time = (32/20) x (100 + 14.05/ 0 + 14.05) = 12.63 mins = 12 mins and 38 secs

Pipe sizes and pressure drop

100 psi (7 Bar) base pressure with 100 foot (about 30 meters) of galvanized pipe with up to 10% pressure drop in 1/2", and up to 5% pressure drop in other sizes to 2"

1/2" good for up to 50 cfm, 1.4m3/min

3/4" good for up to 80 cfm, 2.3m3/min

1" good for up to 150 cfm, 4.2m3/min

1 1/4" good for up to 300 cfm, 8.5m3/min

1 1/2" good for up to 450 cfm, 12.7m3/min

2 good for up to 900 cfm, 25.5m3/min

These are only 'rule of thumb' figures; and elbows, joints and quality of the pipe itself will affect flow and pressure drop.