GEF - UNIDO - BEE PROJECT

on

"Promoting EE/RE in selected MSME Clusters in India"

COMPRESSED AIR SYSTEMS

Compressed Air

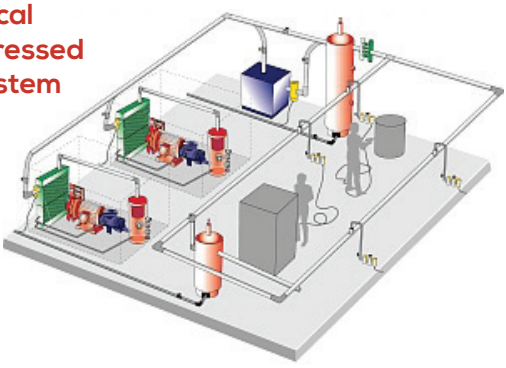
Fourth Utility, after
Electricity, Natural Gas & Water

10%

of industrial electricity used to power air compressors

400 TWh : Electricity consumption in compressed air systems worldwide equals the electricity production of 110 coal fired power stations of 600 MW each & producing CO_2 emissions of 400 Million Tonnes per year

A Typical Compressed Air System



Source: Energy efficiency report Finland

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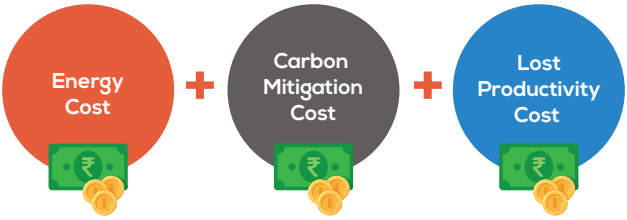
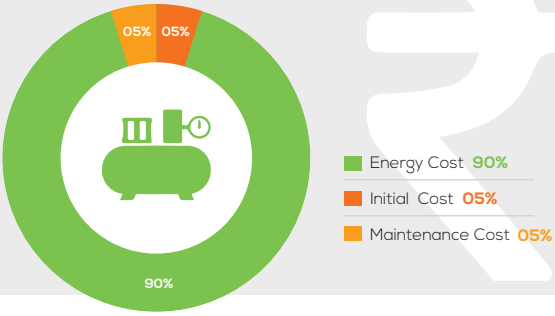
What does your Compressed Air Cost???

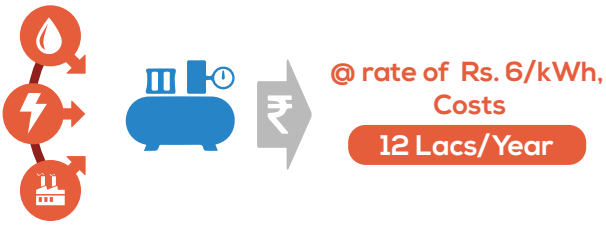


Life Cycle Cost For A Compressor

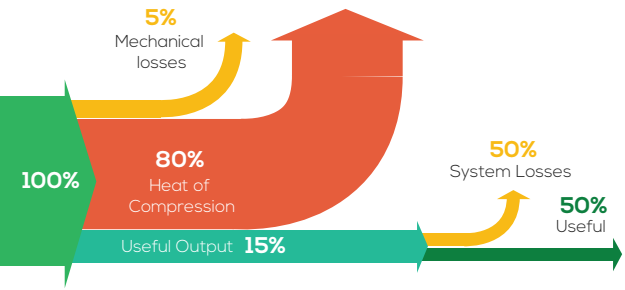


Energy Cost of Running Air Compressor

30 kW Compressor running continuously consumes~ 200,000 kWh annually



Sankey Diagram of Compressed Air System



7.5% of input energy is actually being used usefuly!

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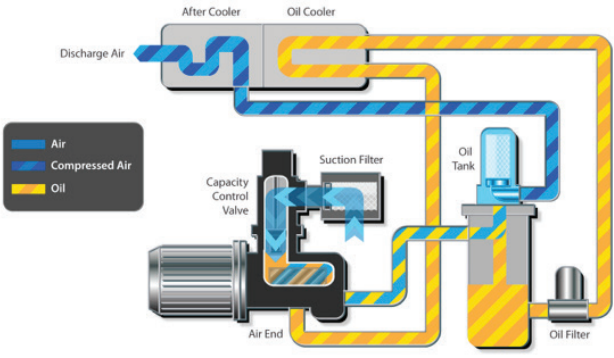
Air Compresser working



Type of Air Compressors

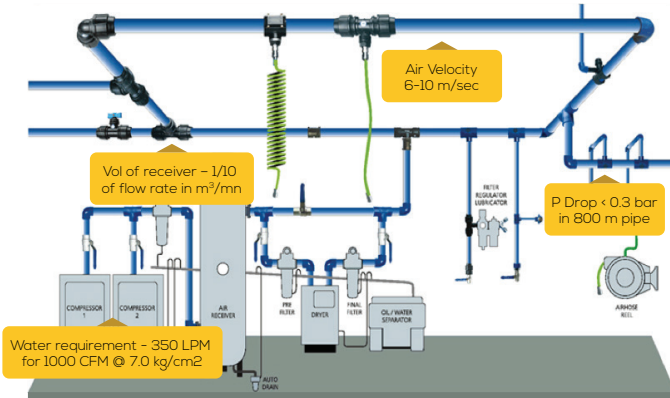
Positive Displacement

- Resiprocative type
- Rotary screw type

Centrifugal Type

- Radial flow
- Axil flow

Thumb Rules for compressed air system



Pipe Normal Bore (mm)	Pressure Drop (Bar) per 100m	Equivalent Power loss (kw)
40	1.80	9.5
50	0.65	3.4
65	0.22	1.2
85	0.04	0.2
100	0.02	0.1

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Capacity Test of compressors

(Pumping Method)

$$\text{Average Compressor Delivery} = \frac{P_1 - P_2}{P} * V_r * \frac{1}{\Delta t}$$

P_1 = Initial pressure in receiver

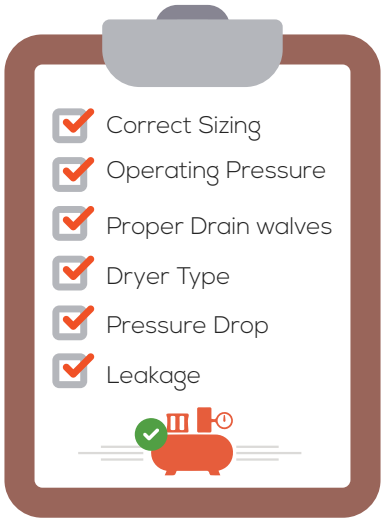
P_2 = Final pressure in receiver

P = Atmospheric pressure

V_R = Volume of air receiver

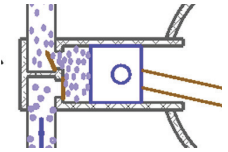
Δt = Time taken for charging the receiver from P_1 to P_{2v}

Check list for efficient operation of Compressor



Benefits of Dry Air Intake

Every 4°C rise in inlet air temperature results in a higher energy consumption by 1 % to achieve equivalent output



Effect of Air Tempreture on Power consumption

Inlate Tempreture	Relative air Delivery	Power Saved
10	102.00	+1.4
15.5	100.00	Nil
21.1	98.01	-1.3
26.6	96.03	-2.4
32.2	94.01	-4.0
37.7	92.8	-5.0
43.3	91.2	-5.8

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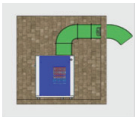
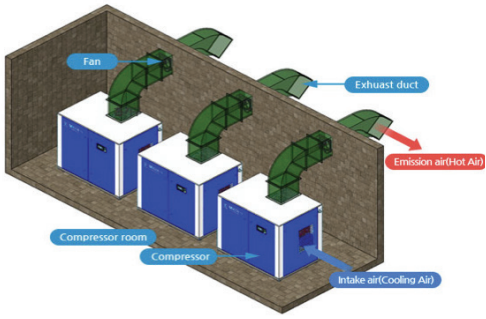
Benefits of Lees Compressor Room Temprature

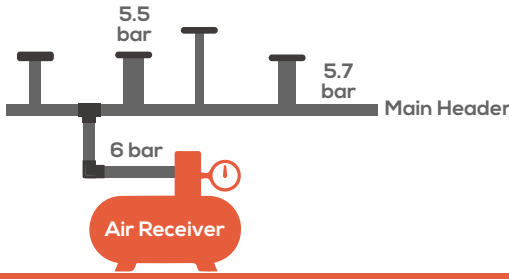
Side



Indoor tempreture of 40°c below



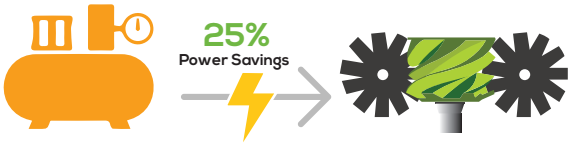
Pressure Settings



Typical energy wastage due to smaller pipe diameter for 170 m³/h (100CFM) Flow

Pipe Nominal Bore (mm)	Pressure drop (Bar) per 100 meters	Equivalent power losses (kW)
40	1.80	9.5
50	0.65	3.4
65	0.22	1.2
80	0.04	0.2
100	0.02	0.1

Replacement of Inefficient Compressor



SEC – 0.21 kW/CFM
Power Consumption – 21 kW

New Screw Compressor
SEC – 0.16 kW/CFM
Power Consumption – 16 kW

Always select compressor based on SEC (kW/CFM) not on kW and CFM separately

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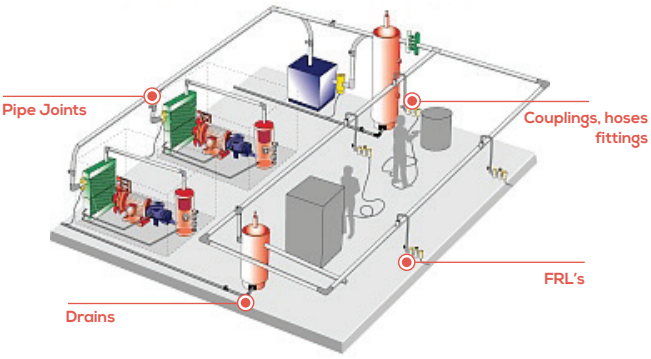
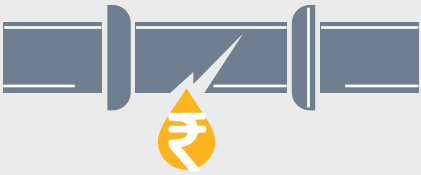
How Do We Define An Air Leak ?

Air that is compressed for the purpose of performing work but unadvertently escapes to atmosphere prior to use



Common Leak Locations

Cost of Leakage at 7kg/cm²



Orifice (mm)	Air Leakage (CFM)	Power Wasted (kW)	Annual Savings @ Rs 5/kWh
1.6	6.5	1.26	Rs 0.60 Lakhs
3.2	26	5.04	Rs 2.40 Lakhs
6.4	104	20.19	Rs 7.25 Lakhs

Leakage Test

- Close all user points
- Charge the lines

$$\text{Air leakage} \quad L = \left(\frac{T}{T+t}\right) * Q$$

$$\text{\% air leakage} = \frac{\text{Air leakage}}{\text{Compressor Capicity}} * 100$$

T = On-load time of compressor

t = Off-load time of compressor

Q = Capacity of compressor

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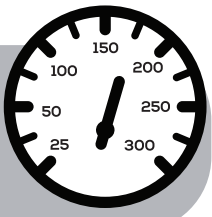
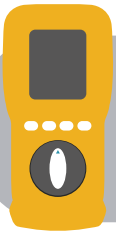
Common Moniterable Parameters



Pressure – Pressure variation leads to decrease in system efficiency and energy consumption

Specific Power Consuption (kW/CFM) - Comparison of this value with OEM's catalogue gives deviation in SEC



Temperature – Increased temperature of compressed air means decrease in efficiency

Loading and Unloading Time

List Of Energy Saving Ideas Compressed Air System

- Turn off compressors when not needed
- Select correct size air compressor
- Operate compressor at required pressure
- Install VFD
- Conduct leakage testing regularly and minimise system losses
- Replace compressed air with blower air for agitation
- Replace pneumatic tools with electric tools
- Provide ball valves at the user point to avoid compressed air wastage
- Use transvector nozzles in air hoses
- Cool inlet air to the compressor
- Provide sensors to sense unloading and switch off
- Replace inefficient compressors

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About Project

Promoting Energy Efficiency & Renewable Energy in Selected MSME Clusters in India

To develop and promote a market environment for introducing energy efficiency and enhanced use of renewable energy technologies in process applications in the selected energy-intensive MSME clusters under GEF UNIDO BEE project.
The main objective of the project is to increase the capacity building of suppliers of EE/RE product and service providers

Desclaimer

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