

Reduction in Air Compressor Electrical Energy Consumption by 20 % through Auto Modulation of Speed

Background:

A forging & Heat treatment industry near Pune manufacture forged components for various industrial sectors. The operation of process utilities and machineries required variable flow of compressed air. Two no. of screw type air compressor with rated capacity of 100 cfm each operates parallel in the pressure range of 6 to 7 bar.



Baseline parameters & diagnosis:

The study of operation of air compressor revealed that one of the compressors was frequently getting load & unload to meet the fluctuating requirement of the plant. The full load power consumption measured was 17 kW where as unload power consumption was around 6 kW.

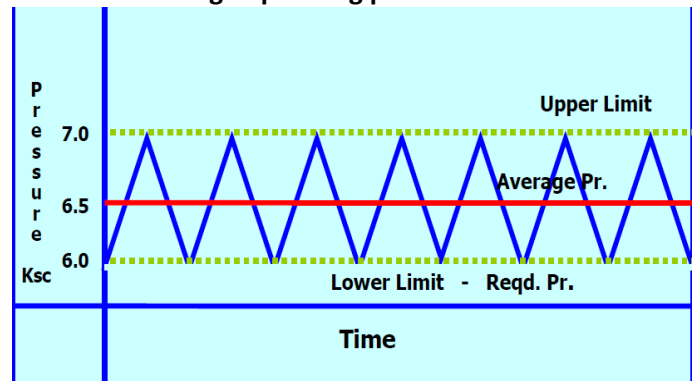
Running Mode	Power Consumption, kW	% Duration	Motor Capacity Utilization
Load	17	60-65%	75-85%
Unload	6	35-40%	30-40%

After the detailed study of the system, the variable frequency drive (VFD) was recommended & installed on one air compressor to control the motor speed so that the compressed air will generated in the pressure range of 6 to 6.5 bar to meet the fluctuating requirement.

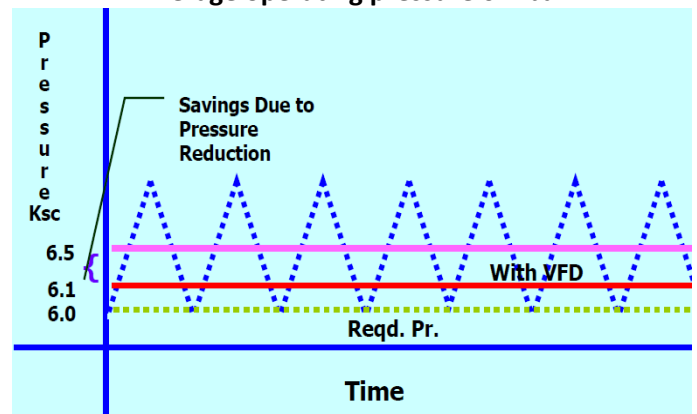
Installation of VFD on air compressor has following benefits:

- Reduction in electrical energy consumption by 20 %
- Operation of compressor at lower average pressure of 6.1 bar
- No. unloading and reduction on unload power consumption
- Less compressed air leakages in the system because of lower generation pressure
- Improved motor operating efficiency

Scenario Without Speed Modulation: Average operating pressure 6.5 bar



Scenario after installation Speed Modulator Average operating pressure 6.1 bar



Life cycle cost of technology / equipment:

VFD has an operating life of more than 15 years. Actual capacity and suitable location are two important points must be considered before installation of VFD

Equipment Delivery/Installation lead time

No process down time is envisaged as installation of VFD is additional and will take 2 to 3 hours for installation

Overall Impact after Implementation:

- Reduction in power consumption
- Reduction in leakages
- Smooth operation of compressor, increase in self life
- Reduced maintenance

Skills Requirements:

Few hours training provided on various function of VFD, operating mechanism etc to the operator.

Brief details of Variable Speed Drives:

A Variable-Frequency Drive (VFD) is a type of adjustable-speed drive used in electro-mechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage. Other names for a VFD are variable speed drive, adjustable speed drive, adjustable frequency drive, AC drive, microdrive, and inverter. Frequency (or hertz) is directly related to the motor's speed (RPMs). In other words, the faster the frequency, the faster the RPMs go. If an application does not require an electric motor to run at full speed, the VFD can be used to ramp down the

frequency and voltage to meet the requirements of the electric motor's load. As the application's motor speed requirements change, the VFD can simply turn up or down the motor speed to meet the speed requirement. Induction motor rotates near synchronous speed, the most effective and energy-efficient way to change the motor speed is to change the frequency of the applied voltage. VFD s converts the fixed frequency supply voltage to a continuously variable frequency, thereby allowing adjustable motor speed.

Applications of VFD:

VFD can be used in wide range of applications i.e. Induced Draft Fans, Force Draft Fan, Primary Air fan, Blowers, pumps, Air compressors, conveyors, extruders, lifts etc.

Limitations:

The waveforms delivered by a VFD to the motor are not perfectly sinusoidal and generate Harmonics (wave form with are multiple of fundamental frequency). Harmonic level above acceptable range may have adverse effect on other operating equipments performance. However, harmonic filters can be installed to remove the distorted wave forms from the system.

- Allows Load Shedding
- Controlled acceleration and deceleration
- Eliminates Motor Voltage Imbalance

About the Project

The World Bank (WB), with support from the Global Environmental Facility (GEF), is executing a project titled "FINANCING ENERGY EFFICIENCY AT MSMEs". The project aims to identify, design & implement Energy Efficiency (EE) solutions in 500 MSMEs in 5 clusters with potential of EE investment of more than Rs. 100 crore and reduction in GHG emissions equivalent to 1.2 million tonne CO2. Majority of the MSME units completing implementation have reported significant energy and cost savings. This project is being co-implemented by Small Industries Development Bank of India (SIDBI) and Bureau of Energy Efficiency (BEE)

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