Non Implemented Case Study– Energy Conservation Measure

Measure
Use of separate pressure settings when transferring the material to different sections
Equipment
Compressed air system
Industry / Sector
Cement
Year of Implementation
-
Cost Benefit Analysis
◊ Type of Measure: Short term
◊ Annual Energy Savings: 0.40 lakh kWh
◊ Actual cost savings: Rs.1.40 lakh
◊ Actual investment : Rs. 0.50 lakh
◊ Payback: 5 months
Implementation Highlights
⇨ The measure was simple but required frequent resetting of the pressures. The measure could not be continued due to: ☾ Manual resetting of the pressure setting every time was not possible hence the plant wanted to go for the automatic pressure controller. ☾ Installed pressure controller was not able to respond to the requirement and accordingly change the pressure settings. Hence the controller was bypassed and the settings were resorted to original mode. ☾ More over the plant was planning to replace the pneumatic conveying with mechanical conveying. After replacement the use of compressed air is avoided. This factor made the plant not to modify or rectify the controller.

Summary	Optimum use of compressed air pressure will reduce the energy consumption in compressor by avoiding the compressed air generation at high pressures than required.

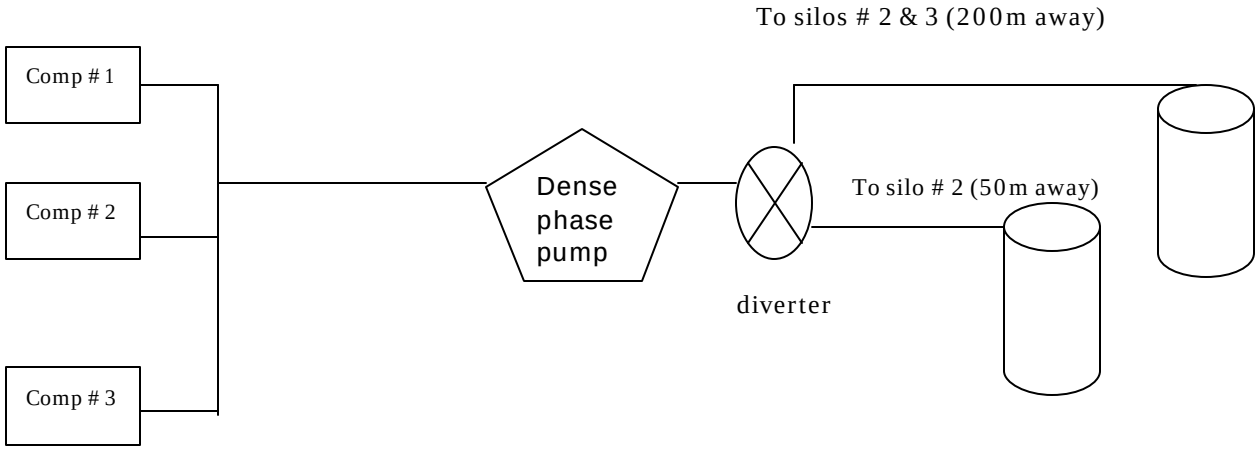
Background

One of the leading cement plants has three compressors of 1385 cfm each to transport of cement from the mills to the silos. The motor rating of these is 187 kW.

Cement is transported through a dense phase pump where compressed air is used for pumping the cement to silos. Required pressure of compressed air for pumping is 3.2-3.6 kg/cm^2 for silo # 1 and 3.4 –4.3 kg/cm^2 when transferring to silo # 2 and # 3.

During transfer to Silo # 1 one compressor is operated and during transfer to # 2 & # 3 two compressors are operated due to distance involved.

The schematic diagram of the puming of the cement



It can be seen that, for transferring cement to silo # 1 the pressure requirements are much lower than that of silo #2 & #3.

Suggestion:

In view of different pressure requirements, significant energy savings can be achieved by installing an automatic pressure setting regulator (APSR) to the compressors. The APSR automatically adjusts the compressor loading and unloading pressure settings based on selection of silo through existing DCS.

The proposed pressure settings after the implementation are:

- When the cement is transported to the silo # 1 then APSR should adjusts the compressor pressure setting to 3.3-3.7 kg/cm^{2}g (at lower compressed air generation pressures the power consumption will be low, hence the reduction in pressure settings will results in energy saving).
- When the cement is transported to the silo # 2 & 3 then the APSR should adjust the pressure setting to 3.4-4.3 kg/cm^{2}g.

Techno-economics:

Operation of cement mill	: 18 h/day
Operation of transfer line to silo # 1	: 9 h/day
Annual operating days of cement mill	: 330
Present power consumption of compressor at 3.4-4.3 kg/cm^{2}g	: 167 kW
Estimated power consumption of compressor at 3.3-3.7 kg/cm^{2}g	: 153.4 kW
Actual saving after considering the loading & unloading	: 13.6 kW
Operating hours of the silo # 1 line	: 3000 h/year
Annual energy savings	: 0.40 lakh kWh
Value of savings	: Rs. 1.40 lakh
Investment	: Rs. 0.50 lakh
Payback period	: 5 months

Principle

Many plant air compressors operate higher pressure than required. If the air compressor discharge pressure can be reduced (by meeting the required pressure at the user), significant savings can be achieved.

Reducing and controlling the system pressure downstream of the primary receiver can result in a reduction in energy consumption of up to 10% or more, even though the compressors discharge pressure has not been changed.

Reducing system pressure also can have a cascading effect in improving overall system performance, reducing leakage rates, and helping with capacity and other problems. Reduced pressure also reduces stress on components and operating equipment. However, a reduced system operating pressure may require modifications to other components, including pressure regulators, filters, and the size and location of compressed air storage.

Production engineers often specify end-use equipment to operate at an average system pressure. This results in higher system operating costs. Firstly, the point of use installation components such as hoses, pressure regulators, and filters will be installed between the system pressure and the end-use equipment pressure. Secondly, filters will get dirty and leaks will occur. Both result in lower end-use pressure. This should be anticipated in specifying the available end-use pressure.

When demand pressure has been successfully reduced and controlled, attention then should be turned to the compressor control set points to obtain more efficient operation, and also to possible unloading or shutting off a compressor to further reduce energy consumption.