GOOD PRACTICES IN SME

Modernizing air compressors

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How to modernize a compressor?

An air compressor is a device used to increase the pressure of a gas or to force gas flow, in which the pressure increase of the medium in the compressor is larger than 2 bar. The cost of the energy required to power the compressor constitutes about 75% of the compressor's lifetime costs. Due to this, there is a significant potential for energy savings connected to modernizing compressors.

Choosing a compressor, it is important that the device is reliable, long lasting and of course energy efficient. The performance of the compressor should be chosen adequately to the demand and load, and its operation properly controlled. The possibilities of modernizing compressors to increase energy efficiency are:

- using variable speed drives,
- using geared devices (2 speed motors),
- using performance control thorough actively changing the volume of the compression chamber,
- replacing the compressor's motor,
- replacing an overpowered compressor with a lower powered one.

Source: KAPE based on „Dokument referencyjny na temat Najlepszych Dostępnych Technik w zakresie Efektywności Energetycznej" Komisja Europejska,2009; „Jak oszczędzać energię w systemach sprężonego powietrza?", Wojciech Halkiewicz, FEWE,2009

fot. 1 dlalakierni: sprężarka śrubowa

fot. 2 seger: sprężarka tłokowa

Variable speed drives (VSD)

Variable speed drives for compressors are primarily used in systems with variable compressed air demand. High frequency changes and long idling periods decrease the energy efficiency of the process. In variable speed compressors, the rotational speed of the motor is adjusted to the demand, which allows for decreased energy consumption. Using VSD's we can eliminate situations in which the compressor is idling. In classical compressors idling constitutes between 30% and up to 60% of the device's operation. When idling the device consumes between 18% and 40% of its nominal power. Therefore, minimizing idling limits unnecessary energy consumption.

Another advantage of VSD's is that their output can be widely controlled (20% -100%). The motor's start-up is also important. In VSD's this is a soft start without electrodynamic stress (due to thyristor circuits).

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How to define savings achieved by replacing an overpowered compressor with a lower powered device?

To estimate the savings which can be achieved by replacing an overpowered compressor we need to use the following formula:

$$\Delta k = \left(\frac{P_S}{\eta} - \frac{P_N}{\eta}\right) \times t \times k$$

where:

$$\Delta k - annual\ savings\ \left[\frac{PLN}{year}\right]$$

$$P_S - power\ of\ the\ old\ compressor[kW]$$

$$P_N - power\ of\ the\ new\ compressor[kW]$$

$$\eta - efficiency\ of\ the\ compressor's\ motor$$

$$t - work\ hours\ per\ year[\frac{h}{year}]$$

$$k - price\ of\ electricity[\frac{PLN}{kWh}]$$

Example of replacing an overpowered compressor

An overpowered (11 kW) compressor was replaced with a 7,5 kW compressor better suited to the demand. The efficiency of the motor is 85%, the installation is in operation for 5 000 hours a year on average. The average price of electricity is 0,55 PLN/kWh.

Energy savings:

$$\left(\frac{11\ kW}{0{,}85} - \frac{7{,}5\ kW}{0{,}85}\right) \times 5\,000\,\frac{h}{year} = 20\,588\,\frac{kWh}{year}$$

Electricity cost savings:

$$20\,588\,\frac{kWh}{year} \times 0{,}55\,\frac{PLN}{kW} = \ 11\,323{,}53\,\frac{PLN}{year}$$

Source: KAPE