GOOD PRACTICES IN SME

Limiting compressor air leaks

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Why is it cost-effective to limit compressed air leakage?

Limiting compressed air leaks has a significant potential for reducing energy consumption. Leakage leads to pressure drops in the system (which are strongly dependant on the air flow of the compressed air and therefore on the compressors efficiency), which decreases the performance of pneumatic devices and can lead to downtime and decreased quality of production. Compressed air leaks can force the purchase of a higher-powered compressor (which increases investment costs) and shorten its life span. Energy losses connected to escaping air in a compressor system can constitute up to 30% of its entire energy consumption. With regards to air leakage, a compressed air system is considered energy efficient, when energy losses due to leakage constitute less than 10% of the systems total energy consumption.

For this reason, it is important to regularly control the systems air tightness, allowing the detection of leaks and their size. The most effective method is employing ultrasound acoustic sensors (portable electronic devices which locate the leak based on the frequency of the leaking air).

The main places where air leakage takes place: connectors, hoses, pipes and fixtures, pressure regulators, open condensation traps and shut-off valves, pipe connections, pipe splitters and thread sealants. Decreasing or eliminating air leakage consists of air tightening connections or replacing parts such as the throttle, fixtures, pipe segments, hoses, connectors, outlets or traps.

Another method oof limiting air leakage is decreasing the compressor pressure, as lower differential pressure of the leak limits the leaks flow.

Source: based on „Dokument referencyjny na temat Najlepszych Dostępnych Technik w zakresie Efektywności Energetycznej" Komisja Europejska,2009

Pic. 1 energotech: Ultrasonic leak detector

Pic. 2 Festo: detecting air leakage using acustics

How to estimate financial loses of air leakage?

First define the share of losses resulting from air leakage. This requires the following measurements:

1. While the compressor is on first we increase the system's pressure from p_1 to p_2
2. Measure the time t_1 it takes the system to reach the higher pressure
3. While the compressor is on decrease the pressure from p_2 to p_1
4. Measure the time t_2 it trakes the system to reach the lower pressure
5. We define the share of losses from the formula: $\Delta Q = \frac{t_1}{t_1+t_2} \times 100\%$

To ensure the relationship is right, the difference between pressures p_1 and p_2 must be sufficiently small.

Next we define the financial loses using the formula:

$$k = P \times k_e \times t \times \frac{\Delta Q}{100}$$

where:

$k\ \left[\frac{PLN}{year}\right] - financial\ loses$

$P[kW] - power\ of\ the\ compressed\ air\ system\ (compressor)$

$k_e\ \left[\frac{PLN}{kWh}\right] - price\ of\ electricity$

$t\left[\frac{h}{year}\right] - working\ hours\ of\ the\ installation\ each\ year$

$\Delta Q[\%] - share\ of\ loses\ in\ the\ total\ energy\ consumption$

Potential savings connected to limiting air leakage in compressed air installations (assuming 120 kW and electricity costs at 0,55 PLN/kWh)

Annual financial losses due to air leakage in a compressed air system:

	Share of loses connected to compressed air leakage [%]						
Working hours in a year [h]	5	10	15	20	25	30	35
1500	4 950 PLN	9 900 PLN	14 850 PLN	19 800 PLN	24 750 PLN	29 700 PLN	34 650 PLN
2000	6 600 PLN	13 200 PLN	19 800 PLN	26 400 PLN	33 000 PLN	39 600 PLN	46 200 PLN
2500	8 250 PLN	16 500 PLN	24 750 PLN	33 000 PLN	41 250 PLN	49 500 PLN	57 750 PLN
3000	9 900 PLN	19 800 PLN	29 700 PLN	39 600 PLN	49 500 PLN	59 400 PLN	69 300 PLN
3500	11 550 PLN	23 100 PLN	34 650 PLN	46 200 PLN	57 750 PLN	69 300 PLN	80 850 PLN
4000	13 200 PLN	26 400 PLN	39 600 PLN	52 800 PLN	66 000 PLN	79 200 PLN	92 400 PLN
4500	14 850 PLN	29 700 PLN	44 550 PLN	59 400 PLN	74 250 PLN	89 100 PLN	103 950 PLN
5000	16 500 PLN	33 000 PLN	49 500 PLN	66 000 PLN	82 500 PLN	99 000 PLN	115 500 PLN
5500	18 150 PLN	36 300 PLN	54 450 PLN	72 600 PLN	90 750 PLN	108 900 PLN	127 050 PLN
6000	19 800 PLN	39 600 PLN	59 400 PLN	79 200 PLN	99 000 PLN	118 800 PLN	138 600 PLN
6500	21 450 PLN	42 900 PLN	64 350 PLN	85 800 PLN	107 250 PLN	128 700 PLN	150 150 PLN
7000	23 100 PLN	46 200 PLN	69 300 PLN	92 400 PLN	115 500 PLN	138 600 PLN	161 700 PLN

Source: KAPE