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Getting it "precisely right":

Smart regulation boosts productivity

Optimised systems are the most productive. But how do you optimise an automated handling system that has to deal with a variety of items and conditions? To fully appreciate how smart regulation tools can help optimise a vacuum-based system, let's take a step or two back in time!

In the 1830s, Scotland's textile mills were state-of-the-art industries. For the machinery to operate optimally, they had to be running at a constant and steady temperature. The need for optimisation led to the development of the bi-metallic thermostat.

Although this particular application was a new one, records show that simple thermostats were in fact used already in the early 17th century to regulate the temperature of incubators for chickens. These first industrial uses of thermostatic regulation are also some of the first examples of feedback controlled systems.

However, what do textile mills and poultry incubators have to do with vacuum-based automated handling systems? Well, maybe not much, except that they all benefit from feedback regulation, as this helps to…

Maintain precisely the right level

A thermostat senses the temperature of a system, and then automatically regulates the system so that it maintains a certain desired temperature that is precisely "right" for, for instance, weaving machines or unhatched chickens. Similarly, the vacuum pressure can be kept at a constant level that perfectly suits the items handled in an automated handling system.

The smart regulating tool enabling this could be called a "vacuustat", although this would be something of an etymological hybrid; whereas *statos* is Greek for "standing" or "stationary" (and *thermos* is "hot"), vacuum derives from the Latin word for "vacant" or "void"- *vacuus.*

Anyway, whatever you call it, a smart vacuum controlled regulator will be able to sense the vacuum pressure, and then to automatically adjust the feed pressure to the air-driven vacuum pump in order to maintain a set and constant vacuum pressure. Now, let's return to the 21st century and vacuum-based automated materials handling systems where…

A steady vacuum provides a steady grip

Suction cups and air-driven vacuum pumps are an unbeatable combination for the automated gripping and handling of, for instance, cardboard boxes. Case or carton erectors and rotary carton machines are widely used throughout industry, and together with robot-driven applications such as palletising and de-palletising, these benefit greatly from the winning technology formula of suction cups and air-driven vacuum pumps or ejectors.



Palletising of cardboard boxes.

However, to keep a safe grip on the boxes, and yet not damage them, it is essential to keep the vacuum at precisely the right level for each individual box. This is easier said than done, because…

Cardboard boxes are porous and will leak

Corrugated cardboard is a porous material; it will leak, but not always at the same rate. The rate of air flow through the material will vary, even within a well-defined carton quality. When using suction cups, the air leakage will also depend on how well the lip of the suction cup seals onto the corrugated surface. This can vary from one box to another one, or from one production cycle to the next one.

Traditionally, vacuum handling systems for corrugated carton materials have been designed for the “worst case scenario” in terms of leakage, i.e. making sure that there is sufficient gripping force in every cycle, or for every individual cardboard box. As a result, many systems are substantially “oversized”, hence wasteful in terms of energy consumption, but also in terms of optimisation and productivity. Another serious drawback is that…

Too much force can damage the box

Suction cups provide a gentle grip compared with many other alternative solutions. The gripping/lifting force can be controlled by the size of the cup and the vacuum pressure, and the general rule is that it is best to keep the vacuum pressure as low as possible and the cups as large as possible.

Damage to the surface of cardboard boxes is related to the vacuum pressure. Hence, there is a balance between the lifting/handling force and the potential damage to the surface, and it is difficult to fine-tune this balance for each cycle or box.

The surface of a box can be damaged or marked if the vacuum pressure increases in the suction cup because the leakage flow through the cardboard of that box is lower than expected, i.e. lower than the average leakage flow of the boxes in a particular cycle. The solution is to maintain…

A constant vacuum irrespective of cardboard quality

If a fixed or constant vacuum level can be guaranteed irrespective of the cardboard quality of each box, any damage or marks can be avoided, whilst sufficient vacuum pressure will still be present to grip and lift the box, and to maintain maximum production speed.

The feed pressure for air-driven vacuum pumps is usually adjusted with a manually controlled air pressure regulator. This provides a set and constant air pressure to the air-driven pump irrespective of the air pressure flow – but, not a constant vacuum level.

What is needed is a vacuum feedback controlled air pressure regulator, where a constant vacuum level has to be set by the operator only once. Tailor-made for air-driven vacuum pumps or ejectors, a smart regulator of this kind will sense the vacuum from the system on a sensing port, and then regulate to maintain a constant vacuum level by momentarily increasing or decreasing the air pressure to the vacuum pump.



piSAVE optimize automatically adjusts the vacuum pumps supplied pressure based on the application. Only the amount of compressed air required will be used without sacrificing speed or performance.

Getting it ”precisely right” pays off

The 19th century mill engineers and the 17th century incubator designers used smart feedback controlled regulation in the form of thermostats to automatically achieve precisely the right conditions in their systems, enabling these to be optimised. In the 21st century, materials handling engineers are now able to use similar feedback controlled regulation to optimise automated systems based on vacuum ejectors, and to boost their productivity in the process.

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