

Pneumatic pressures

IMPROVED HYGIENE AND THE ADVENT OF SERVO-PNEUMATIC SYSTEMS ARE CURRENTLY DRIVING THE DESIGN OF PNEUMATIC COMPONENTS WRITES SIMON MARSDEN.

With productivity pressures increasingly squeezing the time allotted to production line changeover, operators have to reduce line washdown times without affecting standards of food safety and hygiene. So machinery manufacturers are not only expected to deliver continuous performance improvements, but equally to innovate as far as hygiene is concerned.

Components such as pneumatic cylinders and actuators that come into direct contact with foodstuffs are selected not only according to their suitability for the application, but equally for their resistance to all types of cleaning processes. They function in areas subject to high pressures, widely fluctuating temperatures and abrasive cleaning agents that are highly acidic or alkaline, all of which can degrade their performance and integrity.

Pneumatic component suppliers are tackling these issues by ensuring their designs avoid the risks associated with using small angles, corners and radii, blind surfaces, or inaccessible empty spaces, and by addressing also the need for components to be either totally accessible or fully enclosed.

Different component ranges and variants are available to suit specific environments, while lubricants and materials employed comply with the standards for food hygiene.

Examples are USDA-H1 approved greases, exotic materials such as co-polymers used in valves and Teflon coatings to resist corrosion. Cylinder wiper seals can also be selected according to the conditions and the particular cleaning agents used.

Most manufacturers of pneumatics produce equipment to meet industry standards

such as ISO, VDMA and CETOP, and launch new ranges to comply with legislation as it is introduced, such as the new ATEX directive on explosion prevention (see next page).

This has resulted in a large increase in the range and number of component options being offered, allowing the user to choose from a variety of mounting arrangements, size, weight, flow, protection categories and so forth.

For example, control valves with increased flow rates and lower power consumption are now available, resulting in significant reductions in footprint, weight and power requirements. The benefit of smaller, lighter, more efficient components means the machinery manufacturer can mount them on dynamic parts of a machine, giving faster cycle times.

Logging air supply conditions

Improved diagnostics is an important quality assurance and validation tool which has become increasingly available. For instance, at the air preparation level the user can now log air supply conditions over time, obtain a warning of impending pressure problems or increasing water content and monitor the condition of components such as the air filters.

Furthermore, options now exist which allow remote interrogation and diagnosis of valve terminals to monitor and clear faults, as well as

tasks such as adjusting valve operating set points.

A good example of what can now be achieved is where the operator uses a hand-held organiser, such as a Palm, to connect remotely to the terminals.

When walking down the line all the valve terminals can be viewed in the local area and, by selecting an individual terminal, the operator can monitor and change values if required. Alternatively, a human-machine interface can be permanently connected to carry out the same functions.

Servo costs dropping

Pneumatics suppliers are increasingly venturing into electrical servo product areas, which may seem like a departure from their core business, but reflects the increasing pressure from electrical servo/stepper motor suppliers.

The cost per electrical servo axis has dropped dramatically in recent times and is likely to continue falling as volumes increase. This means that higher performance solutions are now available at similar costs to those of a pneumatic solution.

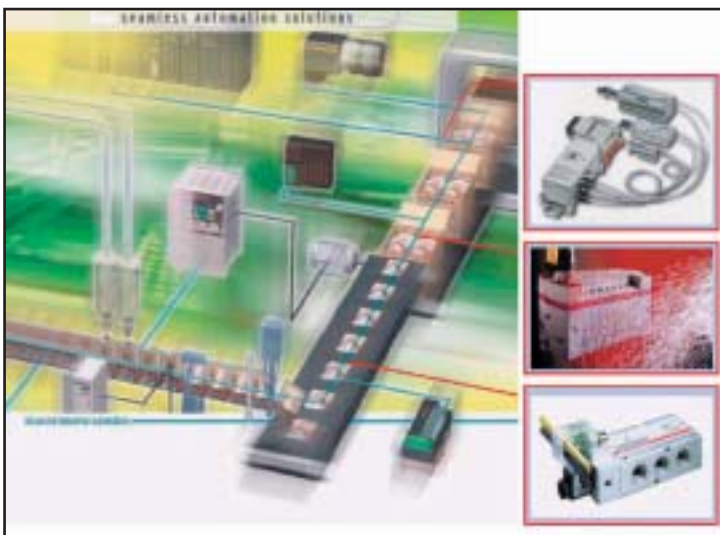
Indeed, this may well be a logical progression for pneumatics manufacturers – after all, they have a wealth of linear motion expertise. There are numerous examples of these developments:

- Interchangeable cylinders: Pneumatic cylinders and high performance servo cylinders with identical dimensions, allowing direct retrofitting at a later date should higher speeds and accuracies be required.

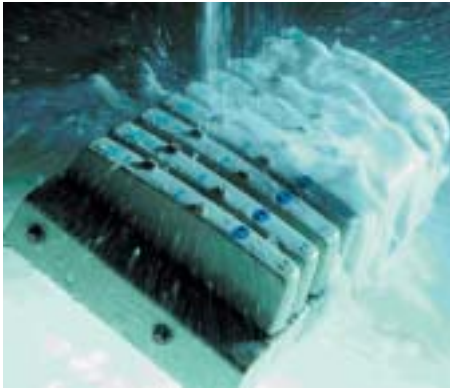
- Cylinders have improved axis control and performance with configurable end-of-travel cushioning. Damaging jolts and impacts during packing are therefore reduced.

- Servo-pneumatic solutions are seen in applications such as filling. Festo has its SPC200 closed loop controller, which is ideally suited to volumetric filling. It can lead to reduced over or under filling by automatically adjusting the filling heads to compensate for changing temperatures or product consistency.

- Other servo-pneumatic options include



Putting it together: Networking pneumatic components to an existing factory fieldbus



Ease of cleaning: Festo CDV1 valve block is able to withstand washdown

motor and controller packages to further extend their capability in handling more complex motion control applications.

Integrating pneumatic components into the electrical control systems over a fieldbus communications network has been possible for some time. For instance, cylinders and valve terminals are available with built-in communications protocols such as ASi, Profibus, and DeviceNet, allowing direct connection to a fieldbus master.

Common practice in Europe

This method is common practice amongst machinery manufacturers in Europe although in the UK the uptake of this technology is slow. Industry still has not apparently recognised the real advantages that fieldbus systems offer:

- For machine builders they offer a significant reduction in build time due to less wiring effort, improved diagnostics during machine development, and reduced time on site during installation and commissioning. Additionally, it is easy to cater for changes to machine design or functionality at a later date.
- For end-users it can offer increased line versatility: individual machines can be moved around and quickly connected into the existing line and its control system. Improved fault diagnostics is also provided.

As well as valve terminals capable of connecting electrically to locally mounted sensors and actuators, provision is made to control these devices locally using a logic module. Performing basic PLC functions, they can act as a slave to a master supervisory control system sited elsewhere in the plant using one of the fieldbuses mentioned earlier.

Hygiene is frequently a major consideration with all components for processing and packaging machinery. Indeed, the two basic considerations regarding food safety are the process for manufacturing the food, which must be a

hygienic, error free production process, and the machinery used within this production process, which must be fit for purpose and also easy to clean.

These two subjects have their own set of standards and directives, however one cannot be viewed in isolation of the other, since they are interdependent.

Operating zones defined

European Standards EN 1672-2: *Hygienic requirements for foodstuff production machines*, defines three operating zones and the requirements for all the equipment that operate within them. The basic zone descriptions are:

1. Food zone: Direct contact with foodstuffs and mounted within food flow.
2. Splash zone: Where equipment comes into contact with foodstuffs, but the food is not reintroduced to the food flow.
3. Non-food zone: Where there is no contact with foodstuffs.

With pneumatic components increasingly able to resist the rigours associated with wash-down procedures, reliance on enclosing components in expensive stainless steel guards, and therefore possible dirt traps, is greatly reduced.

The dilemma many machinery manufacturers face when designing a new machine is not only in the understanding of the various standards and the exemption that may apply, but also in ensuring the most suitable components are fitted to the machine to meet these standards.

However, from a commercial point of view, fitting high specification and expensive components may add unnecessary cost if the machine is not destined for zone 1 operation. In fact, a useful guide to selection of pneumatic components is provided by Festo in its booklet *Manual for the food processing and packaging industry*.

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Explosive atmospheres

The Potentially Explosive Atmospheres (ATEX) Directive is due to come into force on 1 July 2003, making it obligatory to carry out risk assessments of installed plant and machinery. Particular attention will need to be given to any pneumatic, electrical and mechanical equipment to ensure it meets the safety requirements laid out in the directive. Machinery manufacturers will have to review their existing designs to ensure they comply.

More information on ATEX is given by the DTI web site: (www.dti.gov.uk/strd/atex.htm).

Suction cup has its own vacuum pump

A suction cup with its own integrated vacuum pump has been developed by Piab to give quicker and more reliable gripper performance in decentralised vacuum systems, and with less energy consumption.

Piab points out that in traditional vacuum systems, with the vacuum pump centrally located, the installation must often be oversized to take account of possible pressure loss in the system. However, the new VGS (vacuum gripper system) avoids this problem since the integrated pneumatically driven pump is able to function even with feed pressure below 3 bar.

This increases reliability in case of temporary drops in air pressure and also overcomes the



Integrated pump: Piab VGS sidesteps problems associated with decentralised vacuum systems

potential for loss of vacuum in a centralised system as a result of a leak at a single cup.

The suction cups themselves are made out of specially developed polyurethane, Duraflex, which Piab says offers the same elasticity as rubber but the durability of polyurethane. Thanks to the large soft lips, the suction cup forms to the surface and, according to the company, can grip both porous and leaky materials as well as coarse and curved surfaces.

There is also a system to help reduce the cost of applications in which rapid lateral movement creates transverse loads capable of loosening the cups' grip, allowing air to enter and inhibiting lifting force.

Rather than the traditional solution of using extra suction cups, which increases capital cost and energy consumption, Piab's new concept features an accessory called a stabiliser, which prevents the cup coming loose, so retaining lifting force. This stabiliser also helps handle items that are difficult to grasp with a vacuum.

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