Air is all around us...

Air. It is all around us. It is vital for life. It has mass and density, and can be compressed and expanded. We harness these properties to make the air do work for us. We use it for flight, we use it for conveying materials, we use it to pick things up and to place them down. We use it to hold things so that we can do work on them, and we can use it to alter the physical properties of other elements. Steven Plane reports.

To carry out these tasks we change the pressure of the air in our systems. The shape of an aircraft wing reduces the air pressure above the wing relative to the pressure below and lift is generated. Differential pressure is doing the work. Differential pressure causes air to flow through a pipe, carrying material in the air flow – we give energy to the air to do this work. Differential pressure allows machines to pick things up or to hold them in place whilst we work on them. We call this 'pick and place' or 'vacuum chucking'. We carry out chemical distillations and solvent drying processes at reduced pressures to allow them to occur at low temperatures.

We use machines called compressors to change the pressure of the air, and in doing so we give the air additional energy. Energy costs money, so it is important that we do not give the air more energy than necessary for the work to be done.

A compressor is any machine that changes the pressure of the air passing through it. The pressure at the outlet is higher than the pressure at the inlet. It is the scale of the difference which partly determines the energy required, but also the type and design of the compressor has a big influence. A vacuum pump is also a compressor, the pressure at the inlet is below the pressure at the outlet. In general terms, we can only use these machines to raise pressure, not to reduce it.

To reduce energy consumption (and operating cost) to a minimum, the importance of correct machine selection should be clear. The greater the pressure increase, the greater the costs (capital and operating). There is no advantage in using high pressure air regulated down for a low pressure application when there are numerous alternate machine types available to deliver low pressure air. Typically, for each 1 bar of excess air pressure created above the required pressure for the application, the cost of energy alone rises by 7%. If the application requires a pressure rise of less than 1 bar, use a side channel blower. If a 2 bar air pressure increase is required, use a claw compressor, and so on.

The same applies to vacuum applications. Some processes need only a small differential pressure so consider a side channel pump or maybe an oil free rotary vane pump. Higher degrees of vacuum can be achieved with oil sealed rotary vane, screw, or claw type pumps.

The cost penalties for running at excessive vacuum level are considerable. Not only is the wrong type of pump being used (pumps used for high vacuum are usually more expensive to purchase and maintain than those selected for low vacuum) but the pump must also be larger in capacity than the application truly requires. If the air passing through the application is reduced only a little in pressure (low vacuum) then the expansion of the air volume is similarly small. If however the same volume of air passing through the machine is expanded to a higher vacuum, the expansion is much greater and the volume of air to be pumped is correspondingly increased. A bigger pump and a more expensive pump type.

Whether a compressor or a vacuum pump or blower, the need for a detailed specification and correct selection of equipment is clear. An understanding of the application and duty is the starting point, then discussing these parameters with an experienced supplier having a product portfolio covering all pump types will culminate with the best option being offered for the lowest capital and operating cost.

Current legislation governing energy efficiency is nearly all based around improvements to electric motor design, yielding small percentage improvements. Little, if any obligation has been placed upon consumers to address the huge benefits available (particularly reductions in energy consumption and environmental pollution) by the correct selection of modern pump technologies and their efficient control and management.

Climate change remains very much in the forefront of everyday life. The air that we breathe and use for processes served by vacuum pumps and compressors is at risk from increasing contamination which results from the burning of fossil fuels to generate energy. We all have a duty to reduce energy consumption as far as possible, and not only for the purpose of relieving the strain on profit margins.