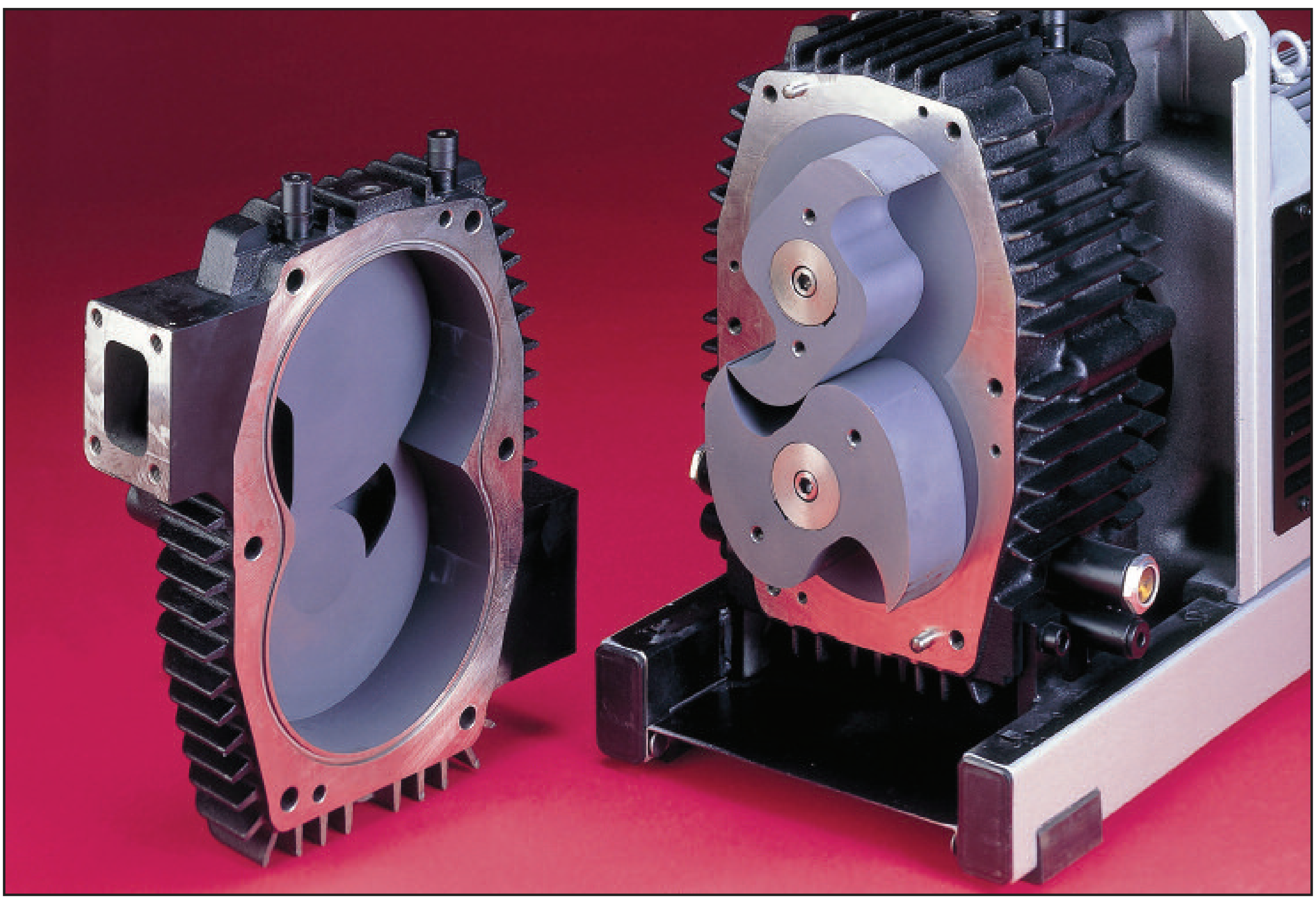
MOVE it FOR LESS

Low Pressure and Low Vacuum Equal Low Cost

BY DAN BOTT

Open blowing of compressed air can be one of the most wasteful applications in a printing facility. Compressed air is used to assist movement of product along production lines and to keep paper within the confines of production equipment. The upside to this handy tool is ease of installation and the ability to fit small compressed air nozzles in hard to reach locations. The downside is the significant and mostly unrealized cost of using plant air for this task. Most people are generally



Elmo Rietschle Zephyr Claw Pump

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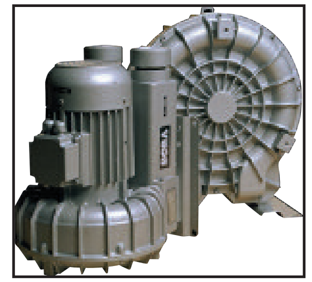
aware that there is a higher cost associated with using compressed air in this manner, but it is apparent that few are aware of how high that cost really is. Making a technology change from compressed air nozzles to low pressure, blower/air knife systems, for the motive air supply mechanism, can make a huge difference in the financial bottom line.

Open blowing applications come in many forms. From simple ⅛" diameter copper tubing, bent to the direction of production machine flow, to elaborately configured compressed air "trees" that perform multiple functions. One of the most wasteful is the ¾" diameter pipe drilled with a dozen holes and placed over a paper application. It is not uncommon for these devices to use over 100 scfm of compressed air flow and be online whether the production machine is operating or not! It is also common to see compressed air nozzles blowing into the open air — nowhere near the intended location and performing no useful function. There can be 1,500 scfm, or more, in open blowing applications in any moderately sized printing facility. Performing a pneumatic systems audit or compressed air systems audit, provides an opportunity to evaluate all types and configurations of these applications. Findings from an audit will typically reveal that there are better and more cost effective methods of doing these jobs. When the cost analysis is complete, rarely is there a question about the efficacy of making a change.

The first step in the evaluation process is to determine the cost of generating, drying, cleaning, and distributing plant air at pressures of 90 to 125 PSIG. This is an important step in that typical site compressed air headers operate at supply pressures of 100 PSIG, for example, and the typical open blowing application utilizes plant air at pressures less than 2 PSIG. A convenient way to compare efficiencies is an analysis done in SCFM output (standard cubic feet per minute) from the compressed air system per input energy in kilowatts (KW). Typical compressed air systems provide efficiencies in the range of 4 SCFM per KW to 5.5 SCFM per KW with an average of 4.75 SCFM per KW. This takes into account factors such as part loading of compressors, the cost of drying the air, inefficiencies in the distribution system and other non-optimal issues in any supply system. Of course there are some systems with higher efficiency and many systems with lower efficiencies but this is a good representation of what may be found in the printing industry.



The second step is to determine the efficiency of low pressure, high volume blower/air knife systems that can be used to replace compressed air nozzles in open blowing applications. Low-pressure blowers are available in several different technologies and many configurations. Examples of industry offerings are rotary lobe, regenerative, centrifugal, vortex, side channel and many others. These blowers are typically operated at pressures of no more than 1 PSIG to 5 PSIG but can attain higher pressures depending upon the design configuration. They also provide for very high airflow rates. For example, a typical side channel blower for a point of use application will develop 1.4 PSIG and deliver 30 SCFM of air with only 0.3 KW of input energy required. This equates to an efficiency of about 100 SCFM per KW. Compare this to the compressed air system efficiency of about 5 SCFM per KW and it is easy to see how to save money by modifying these applications. Table 1 shows how much cost can be eliminated, by replacing compressed air devices, with a low-pressure blower/air knife systems.

COST COMPARISON: OPEN BLOWING VS. LOW PRESSURE BLOWERS

AIR FLOW IN SCFM	COMPRESSED AIR ANNUAL ELECTRIC COST	LOW PRESSURE BLOWER ANNUAL ELECTRIC COST	ANNUAL SAVINGS
50	$4,611	$219	$4,392
100	$9,221	$438	$8,783
150	$13,832	$657	$13,175
200	$18,442	$876	$17,566
300	$27,663	$1,314	$26,349
500	$46,105	$2,190	$43,915
750	$69,158	$3,285	$65,873

Note: 8,760 hours/year and $0.05/KWH

Note that this is a general comparison to illustrate the magnitude of the cost difference between these two approaches. The reality is that there may or may not be a 1:1 replacement ratio between compressed air SCFM and low pressure blower SCFM. In other words, an application may require higher airflow with a low pressure blower system than with the original configuration. Nonetheless, the savings are significant enough to warrant an immediate evaluation.

There are several additional cost savings that can be realized. If enough compressed air demand can be shed from the system, it is likely that compressors and dryers can be shut down and placed in standby. Maintenance costs will be lower, there will be less demand on cooling air/water systems and high cost compressed supply equipment will have longer service life. There may also be a cost avoidance if new compressors do not have to be purchased. Note that point of use blowers are designed as dry compression technologies and require very little maintenance. Generally, the only maintenance items are inlet filter elements.

Determining the potential savings at a facility will first require that the total compressed air demand from open blowing be determined. One easy way to do this is to measure a representative number of open blowing applications with a simple, inexpensive in-line flow meter and extrapolate the total demand requirement. Take care to measure each application type and ensure that the supply pressures are similar. Higher pressures will of course result in higher airflow rates. Once the total demand is known, determine if a compressor can be taken off-line or if the system can be operated in a more efficient manner so that the savings can be attained.

Replacement of compressed air nozzles with low pressure blower/air knife systems will require flexibility in the philosophy of how the job gets done. There will be visible changes on production machinery and the task area will not look or be the same as it was. With either method, the goal is the same. Provide production with the most reliable and effective tool to enhance throughput. If the job can be completed effectively and reliably either way, there is good reason to choose the most cost effective solution.

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There are several issues to consider regarding changes in technologies. The first is the fact that the blower will have to be mounted in close proximity to the point of use. Blowers are typically small enough to be mounted on production machinery but if space limitations exist, there will be a necessity to use precious floor space for the blower. The second issue is sound. Smaller blowers generate only 50 to 70 dBa but larger units can be significantly higher. Sound enclosures may be necessary for large blowers in environments where there is close proximity to production personnel. Finally, electrical service must be provided for blower operation. The costs for modifying electrical service should be included in the project ROI if adequate local service is not available.

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If open blowing applications cannot be retrofitted with blower/ air knife systems there is an alternative. In those applications that are not suitable for blower systems it is recommended that engineered compressed air nozzles be utilized. These nozzles reduce air consumption by using an ambient air assist. For example, instead of a specific nozzle consuming 20 SCFM of compressed air, it is designed to use only 5 SCFM of compressed air and will pull in enough ambient air to achieve the same velocity and force as the original nozzle. They provide for an excellent alternative and still achieve the goal of reducing compressed air consumption.

There are also opportunities to save money by changing technologies in vacuum supply systems. Vacuum pumps are used widely in the printing industry and this provides an excellent opportunity to save on energy costs. Utilizing a vacuum technology that can attain high vacuum for low vacuum service is similar to using high pressure compressed air nozzles where low pressure blower/air knife systems can be used. A common practice is to pull high vacuum in a central header and then regulate down to the required vacuum level at the point of use.

What makes a vacuum system analysis a bit more difficult is that vacuum is utilized in many different printing and paper applications at every level of vacuum. In addition, while there are excellent choices for equipment, not all vacuum technologies are created equal — meaning technologies that can attain similar vacuum levels do not require the same power input. In some technologies, power input increases or decreases as vacuum level increases or decreases. In addition, when compressed air generated venturi vacuum pumps are thrown into the mix, the confusion becomes enormous.

Sorting out these factors can be cumbersome but some general guidelines can be illustrated. In typical installations, efficiencies of "high" vacuum pumps range from 18 to almost 30 ACFM per KW input. ACFM or actual cubic feet per minute is the volume flow to the inlet of the vacuum pump as opposed to the mass flow at the discharge of the vacuum pump. Low vacuum blowers can attain efficiencies of 60 to 200 ACFM per KW input. In many cases, changing technologies to low vacuum blowers will save at least 50% of the power input. This is quite remarkable considering there are additional maintenance savings and an elimination of issues around cooling water and lubrication.

A real life example of this is a site that was using six 50 horsepower reciprocating vacuum pumps in a system supplying vacuum at 23" HgV to a central header. The system was set up with a main distribution header and several sub headers with drop legs to production equipment. After measuring vacuum at the point of use it was found that 50% of the production machinery required vacuum at only 2" HgV to 4" HgV. While this may seem like an extreme example, the reality is that many systems are operating under these conditions. The solution in this example is to separate the low vacuum production machines and utilize a vacuum blower. Making this change will save over $40,000 in electrical and maintenance costs per year.

Whether it is compressed air or vacuum, it is critical to choose and utilize the correct technology for each production application. The stakes are high and competitive pressures are forcing manufacturing operations to eliminate waste and operate at the highest level of efficiency. It is quite probable that most of the low hanging fruit for cost savings have already been picked so it is time to go higher and harvest the remaining items. Evaluate the pneumatic supply arrangement at each production machine to ensure optimal service and lowest cost performance. The benefits are higher profits and better reliability.

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