By Darryl and Cheryl Dobie

Dryers

Select Quality Features

The fast-paced nature of car care requires dryer design elements to be functional as well as aesthetically pleasing. Synergy is achieved when a reputable manufacturer knows — from industry experience — the needs of car wash operators, and then consistently employs quality construction methods to ensure those needs are met.

FAN BASICS

Different fan types, as described below, require different air delivery designs to achieve the required results. Improper delivery of produced air robs the dryer of efficiency while increasing noise and vibration. Materials used in fan construction must be of high-tensile strength to withstand torque and back-pressure stress, which can lead to fan failure and serious damage. The most reliable fans are one-piece molded, not welded, and must be properly balanced.

Axial-Flow Fans

Air passes through the fan parallel to the drive shaft. An axial-flow fan is suitable for a larger flow rate (CFM) with relatively small pressure gain. The effective progress of the air is straight through the impeller at a constant distance from the axis. To accommodate the larger air volume exiting the apparatus, the outlets are larger than those of a centrifugal system. Because air essentially flows directly through from inlet to outlet, increasing the size of the inlet will — to the extent of the fan and motor capabilities — allow the size of the outlet to also be increased. Configuring the outlets too small may result in a fan "stall" whereas the back pressure has reached its maximum and the fan simply does not produce air with every rotation.

Centrifugal Fans

Often called "squirrel cage" fans, centrifugals operate on the principle of "throwing" air away from the blade tips. The air is led through an inlet pipe to the center of the impeller, which forces it radially (making a right-angle turn) outward into the volute from which it flows into the discharge pipe. A centrifugal fan has a comparatively smaller flow rate with a larger pressure rise — and because of this pressure rise, the likelihood of stress fractures and fan failures is increased. Improper sizing of ductwork or outlet assemblies may increase back pressure and therefore lead to fan or motor failures.

ENERGY EFFICIENCY AND VFDS

A common setup to control dryer motors is with across-the-line starters to bring them up to full speed as quickly as the motor will allow. This method of starting creates large amounts of inrush currents — as high as six times the running amperage — increasing electric consumption and demand. Utility companies base commercial electric rates on this starting current or "spike." It is therefore beneficial in dryers with multiple motors to stagger the starting time of each dryer motor so that "spike" is not multiplied by the number of motors. Also, rather than inefficiently stopping and restarting dryer motors between cars, the dryers are left to run at full speed or dampers are used to control airflow.

As the cost of electric power continues to increase, variable (adjustable) frequency drives (VFDs) — also know as variable speed drives (VSDs) — are becoming more popular in the car wash industry. The installation of variable frequency drives on dryer systems will reduce the total fan electricity consumption and demand, especially during standby or idle times. New technologies and designs within these drives have made adding VFDs a reliable and cost-effective option for electric motors within the car wash. In fact, adding VFDs to a car wash dryer system can often provide a return on investment within 14 months in electrical energy savings.

Any poly-phase motor can potentially benefit from a VFD. Blowers and dryer motors are a variable torque load, and benefit most from being controlled with a variable speed drive. Fan systems are generally designed to use a full-speed motor to drive a mechanical air mover. The outputs of these systems are controlled by mechanically constricting the flow with damping vanes or plates. A VFD allows precise control of motor output, and the power used. In the case of centrifugal fans, there is a significant reduction in the power required to handle the load at a lower speed, or reduced frequency.

SOUND LEVELS AND SOURCE CONTROL

Sound has become a major issue for the industry. Although there is no exact and universally-accepted point at which sound is perceived as noise, potential health problems due to noise are accepted and recognized hazards. Generally, the drying system is considered the major culprit in producing unacceptable sound levels.

Noise levels are measured and reported in decibels. However, the decibel system can be confusing because it is based on a logarithmic scale. For example, a 110-dB noise level is not 10 percent greater than a 100-dB noise level; it actually represents ***10 times*** the acoustical energy. For this reason, a small increase or decrease in the sound pressure level (measured in decibels) has a very significant effect on the noise intensity. A drop of just three decibels means the sound pressure level has been cut in half.

Because car washes have large entrance and exit doors, sound cannot be completely contained in the building. The most effective sound-absorption materials used in construction are porous and are not suitable for wet, harsh car wash environments. Consideration should be given to sound reduction when designing the building and premises. It is, however, more effective to contain and reduce the power of sound waves emitted at the equipment source.

Equipment Design and Construction

Some noise is created at the exit of the nozzle (where pressurized air meets still air), and some noise is created at the intake (where air is being forcibly pulled in and compacted). Cavitation created at the fan as it compacts or pressurizes the air creates additional noise. Turbulence from the air being twisted, turned, and re-directed from the blades creates yet another noise source. All of these factors will produce noise with every dryer. The level of noise created with each one and the ability to reduce the noise will, however, depend on the type of fan. Incorrect abatement methods can result in loss of air flow, overheating of motors, or fan failure by increasing back pressure on the fan itself.

Noise is transmitted via sound waves through the space (ductwork) that separates the source from the receiver. Altering the path of this transmission to reduce the amount of acoustical energy that will reach a receiver is an effective approach to noise control. This involves impeding the sound transmission by interfering with its reflected and direct paths.

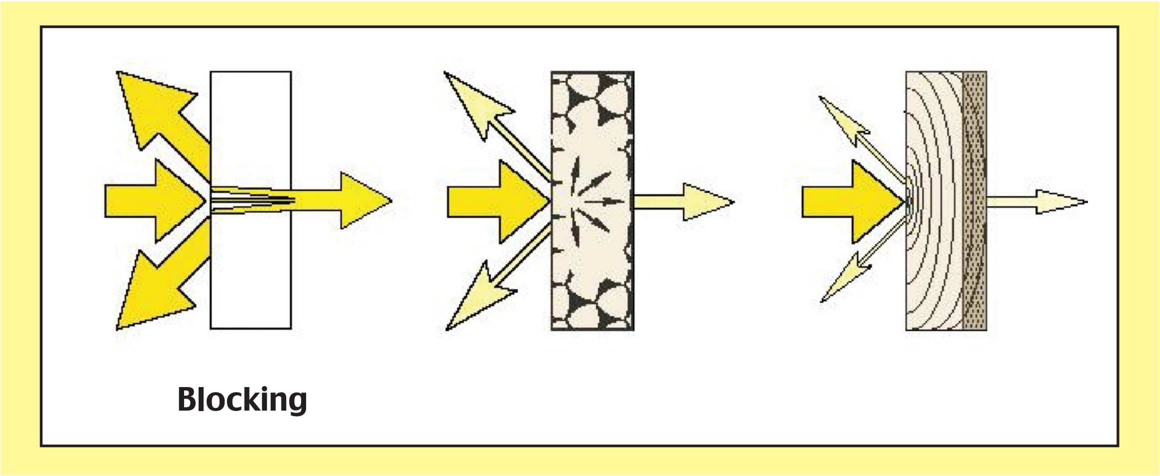
Increasing the length of ductwork both before and after the producer can significantly reduce noise transmission. While this concept is true for noise reduction, simultaneous management of airflow must also occur. Size of ductwork, choice of ductwork lining, number of corners or elbows and of course ductwork length can ultimately reduce airflow at the outlet. Therefore, manufacturers must conduct research and reach an appropriate balance suitable for the industry.

NOISE REDUCTION METHODS

Incorporating some or all of these basic methods (see graphic, right) serve to increase the construction quality of the system.

Blocking

Blocking materials provide a barrier to noise. Blocking materials do not absorb or deaden noise, but rather block the direct path of the noise by reflecting it away from the receiver. Performance is based on the mass and density of the material. The greater the mass and density of the material, the better the barrier. Blocking materials can be used as a barrier to enclose the noise source.



The housing walls that enclose the air producer act as the barrier or "blocking" mechanism by which noise is contained within the assembly. Dense materials such as steel in adequate thicknesses provide more blocking than porous materials such as plastics or fiberglass.

Additionally, blocking materials surrounding the fan assembly can act as a barrier in the event of fan failure. Materials of high-tensile strength, such as stainless steel, may serve to contain debris within the housing and provide a valuable safety feature.

Absorption

Noise radiates from a source. The most desirable approach to noise control is to reduce noise at its source by using absorbent materials to dissipate the sonic energy into small amounts of heat. All equipment emits sound within a wide range of frequency levels and abatement materials must be designed to treat those specific ranges.

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Materials that absorb noise have an open fibrous structure that allows sound to enter. The internal fibers of the material vibrate, and the resulting mechanical movement dissipates the energy in the form of a minute amount of heat. Absorbing materials are used to reduce the reverberant noise build-up from inside equipment housing.

Foam, mineral wool, and fiberglass are effective sound absorbers because their porous structure soaks up sound. Since each type of fan produces different sound frequencies, determination must be made as to the most appropriate absorption material. These materials are generally attached internally to ductwork or housings.

Exterior baffles lined with absorption material may mitigate noise levels at ear level, but if placed too close to the intake area will inhibit airflow resulting in poor dryer performance and motor overheating. Additionally, this optional equipment takes up valuable tunnel space while trapping dirt and debris.

Damping

Damping materials reduce noise radiation from metal surfaces by damping the vibration of the metal. The minute flexing of the damping material provides the energy dissipation to reduce noise by reducing the ringing sound of vibrating sheet metal. Combining damping with blocking and absorption materials significantly reduces sound levels.

Solid framework or ductwork constructed out of materials capable of supporting producer weight and torque is essential. If the support structure is relatively soft, inadequate isolation will be obtained and it may result in fatigue of the structure. Anchoring the structure as per manufacturer's instructions — i.e., number of anchors, length of anchors, into concrete as opposed to asphalt — is essential. Solid leveling of the structure prevents vibration and promotes proper air-producer performance. Rubber mats or cushions of similar material may be installed under the framework at the contact point with the concrete. Using material that is either too soft or too thick, however, may decrease structural stability.

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