Right–Size Your Dryer

By Darryl and Cheryl Dobie

An effective drying system is the final complement to an integrated, successful wash operation. Employing basic principles while considering variables unique to your facility will ensure selection of a properly sized drying system.

DRYER BASICS

Most drying systems use a combination of separate air producers, and their system horsepower (hp) reflects the total of all components. Therefore, a combination of three 15-hp air producers would yield a 45-hp system. The components are arranged in positions to offer strategic vehicle coverage. Chances of a perfectly dry vehicle could be increased by adding more air producers (and thereby more horsepower). However, most operators must weigh the economics of such a decision, and choose a reasonable approach to practicality and cost.

The measurement commonly used to describe a drying system is horsepower. While this is a useful measure — without the proper combination of air velocity and volume along with efficient delivery — horsepower only gives a very general idea of dryer capability. Increasing horsepower may not necessarily improve performance. Motor horsepower is determined by the amps required to turn the fan at a given speed on a pre-determined voltage — 1,800 rpm or 3,600 rpm are standard. The performance of a fan depends on the size, shape, and speed of the impeller.

DRYER TYPES

On-board dryers are attached to the wash equipment gantry and move over the stationary vehicle in the same way the gantry moves over the vehicle during the wash process. These are only available with in-bay automatic wash systems.

Standalone dryers are separate from the wash system and may be located either inside the tunnel or on the exterior. Standalone dryers allow some drip space between the wash system and the dryer. Configurations of standalone dryer models can be used with all types of in-bay automatic and conveyor car washes, provided adequate space is available.

CLIMATE AND GEOGRAPHY

Climate and geography are major influences in determining the proper horsepower configuration of an effective drying system. The effects of humidity, air temperature, altitude, and the prevailing wind direction through a car wash tunnel are all important considerations when sizing a dryer.

Cold air does not hold as much moisture as warm air. Generally, warm-climate car washes are aided by the partial evaporation of water into the atmosphere. However, high humidity levels prevent that partial evaporation because air laden with condensation cannot absorb additional water.

Air density is a variable of elevation and temperature and both variables affect the air production of a particular fan. A fan operating at a higher temperature and elevation will move the same volume of air as it would at lower temperatures and elevation with less total pressure and less horsepower.

If the prevailing wind in a car wash is from entrance to exit, it is possible that misted air from the washing and rinsing equipment may be pulled into the air dryers and deposited back on the vehicle.

CONVEYOR SPEED AND VOLUME

Although sometimes overlooked, conveyor speed plays an important role in the car wash process. Running the conveyor as slowly as is reasonable delivers a cleaner, drier car. It allows thorough cleaning, rinsing, and drying by serving as an adjustment to achieve complete vehicle coverage and optimum chemical dwell time. Rushing through any phase of the process ultimately affects the quality of the final product.

In-bay automatics and hand car washes generally install models ranging from 30 to 60 total horsepower. Conveyor car washes (express, flex, full-service) may start with an old industry rule-of-thumb: 1 hp/car/hour, then customize their system configuration once factors such as those discussed here, have been considered.

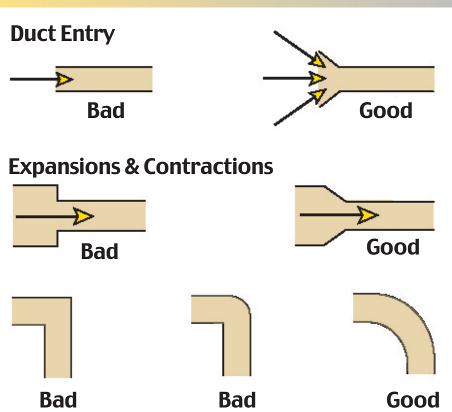
DRIP SPACE

Drip space between the rinse arches and the dryer should be maximized to allow some water to run off the vehicle before the produced air begins its process. Rinse arches located too close in proximity to the dryer will increase splash back and tunnel mist in the area dedicated to the drying process.

Drip space also acts as a "safe zone" to allow the occurrence of the natural reaction between two opposing, yet sequential steps in the car wash process. A water-repellent surface — such as a freshly waxed car — is hydrophobic. When the surface of water (hydrophilic) comes into contact with a hydrophobic surface, which it considers undesirable material, water will thrash about trying to get away.

If you have the equivalent of two dryer systems — each yielding, say, 45 hp —operate only the one closest to the exit during low volume periods. This will significantly increase your drip space, saving electrical costs at the same time.

AIR DUCT DESIGN



The ductwork designs shown are the "internal" shapes/designs, which may or may not be reflected in the appearance of the exterior.

AIR PRODUCER BASICS

In general, fan impellers work through the creation of a pressure differential; air moves from a higher-pressure environment to a lower-pressure environment. Airflow broadens as it leaves ductwork constrictions, but it follows a straight-line path. A volume of pressurized air aimed at the top of a vehicle flows along the surface to the widest point of that vehicle. It is at this point, that the straight-line path of airflow is interrupted and deflected away from the lower, tapered portion of the vehicle. Consequently, to effectively dry, airflow must also be directed at vertical surfaces in a slightly downward manner. Stripping moisture first from the top portion of the vehicle, followed by the sides, conforms to natural gravitational forces. It is important to note that proper direction of airflow and/or spacing of components within the drying system itself are essential to reduce turbulence.

Different fan types require dissimilar air delivery systems to achieve the required results.

Overall efficiency (maintaining air volume and speed with minimal friction loss) can best be achieved by utilizing the least amount of transitions between the air producer and outlet nozzle. Non-uniform airflow created by compact duct elbows or transitions, dampers, or other obstacles in the air stream may dramatically reduce fan performance (see the diagram, left).

Loss of pressure, defined as System Effect, results from restrictions or conditions within the system (ductwork design) which negatively affect performance. System Effect, which is sometimes difficult to quantify, not only robs the air-moving device of efficiency, but also increases noise and vibration. Higher fan speeds and greater horsepower used to overcome a design deficiency result in wasted energy. Therefore, properly engineered ductwork is as critical to the overall efficiency of the dryer as the fan itself.

OUTLET SIZE AND CONFIGURATION

Round outlet nozzles are more effective than square or rectangular nozzles. Discharge air follows a natural, circular rotation as it flows from the air producer toward the system exit. Square or rectangular nozzles break up the airflow, causing the air to disperse prematurely and lose velocity as it exits the ductwork confines. The goal is not just measuring high air velocity at the dryer outlet, but also to bring that high velocity air to the vehicle surface.

Axial-flow fans cause air to essentially flow directly through from inlet to outlet, and 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," when the backpressure reaches its maximum and the fan simply does not produce air with every rotation. Consequently, air production is not at peak efficiency.

Conversely, 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 backpressure and therefore lead to fan or motor failures.

PRESSURE VS. VOLUME

Neither pressure alone nor volume alone can effectively move fluid. The correct combination of both pressure and volume provides complete vehicle coverage with adequate force to remove properly treated rinse water. Only a small amount of pressure is necessary to break the surface tension allowing the volume, along with its accompanying weight, to effectively move the debris/water. This concept can be understood easily using the following example:

Using a zero-degree nozzle, attempt washing debris from the driveway. The narrow nozzle delivers water at a high pressure with little volume; therefore, it clears only a narrow path. The narrow stream is not effective in pushing a large quantity of debris forward. Adjusting the nozzle to a wider path increases water volume (and thereby the weight). Although the pressure is slightly decreased, the increased weight of the water — along with the increased path width — effectively carries more debris forward.

THE ADDITION OF HEAT

It is important to note that although they are typically referred to as dryers, most systems do not use heat. Therefore, they are not dryers, but are actually blowers that move water off the vehicles.

Today, some operators have chosen to add heat to that process and create a "dryer." Science tells us that heat will increase the evaporative rate of water and warm the tunnel, which potentially benefits the wash process. However, while heat may evaporate water droplets, any chemical residue encapsulated within the droplets does not evaporate, thus leaving dried spots on the surface of the vehicle. Additionally, air-drying utility costs may already account for a significant portion of a car wash's operating budget and attempting to heat a large, open-ended tunnel may not prove feasible. An operator must research local utility costs, consider climate, assess the total system, and most importantly, be aware of what pleases the customer before completing this upgrade.

Darryl and Cheryl Dobie own Aerodry Systems, LLC located in Denver, Colorado. They have successfully owned and operated car washes, as well as manufactured drying systems, since the mid-1980s. You can visit the company on the web at www.aerodrysystems.com.