Selecting a Pump for Your Car Wash

Whether you are a new operator, updating, or simply repairing existing equipment, one of the most important decisions you will have to make for your Car wash is which pump you are going to use. While price is always a factor, there are several things to consider when you make this decision. It may surprise you to know that the most expensive pump is not always the best. This article will focus on the technical aspects of the application, proper selection of a pump for various vehicle wash applications and identify the needs that should be satisfied in the selection process. Finally, we will discuss maintenance and technical information to consider when you install the pump.

Ask any car wash operator which part of their operation gives them the most headaches and after the bill changers, it would probably be the pumps. Why is it that a pump always seems to fail when the wash is busy? For the sake of this article, let's work with the assumption that all pumps are created equal. The most important thing to consider the type of use the pump will get. Then we can choose a pump that was specifically designed to withstand the rigors of the application.

Load on the pump comes from three places; pressure (psi), volume (gpm), and cycles (off-on-off). Volume and pressure translate into horsepower and the cycles affect the service level of the application. As the required pressure, flow, or cycles increase so must the durability of the pump. If any two or more factors increase, the size of the pump required increases as well. Flow and pressure can be translated to horsepower with the formula (GPM x PSI)/1460. For example, a system that is pumping 4gpm at 1200psi will use 3.3hp (4 x 1200)/1460 = 3.3. Cycle load, which is a little more subjective, can be broken down into two classifications: duty cycle and service level.

As a general guideline, duty cycle is either intermittent or continuous. An intermittent duty cycle is characterized as less than one and one-half hours continuous running. Fitting a pump to a continuous duty application requires that the pump's standard ratings be 50% greater than the requirements of the application. This allows the pump to be run slower and at lower pressure than rated to facilitate longer pump life. Most vehicle wash applications fall into the intermittent duty cycle category. Although intermittent duty cycles might seem less demanding for a pump, often the result is quite the opposite.

An intermittent duty cycle brings into play the concept of service level. Service level is related to the number of starts and stops a pump will see in a given period of time. The service level categorizes the application into one of three types of service: moderate, heavy, or severe. A moderate service level would be few starts and stops (cycles), normally in the range of one to five cycles every two hours. A heavy service level would be starting and stopping five to ten times every two hours, and severe duty would be starting and stopping more than ten times in a two hour period. Just as the majority of all automobile engine wear occurs at start-up, the majority of all pump wear also occurs at start-up. Service level is the aspect most often overlooked when choosing a pump for an application. To illustrate the concept of the service level, consider the normal operation of a typical self-service car wash bay.

If a typical self-service wash cycle is eight minutes long, the maximum number of cycles on the pump could be as high as seven times per hour or fourteen times per two hours. Of course demand fluctuates due to shorter or longer cycles and some bays being more heavily used than others, so it is important to plan for the worst case scenario. The efforts of starting and stopping a pump frequently cause cumulative damage in the form of accelerated wear on bearings, plungers, packings, and other drive components. In many systems cavitation on start-up is a real problem and often results in washed out manifolds and prematurely worn seals and valves.

Every vehicle wash operator dreams of sunny Saturdays with customers lined up to the curbs to wash their cars. Imagine that this long awaited Saturday arrives. You've got clear blue skies and the weather report is favorable all week long. People are ready to wash their cars and the lines are already forming by mid-morning. This is going to be a great day! Car after car goes through your bays, in dirty and out clean. Now imagine that you stop by the wash that day, just in case the bill changers are giving you trouble, and you spot a garbage barrel blocking off one of the bays. You know what happened…another pump problem, just like the last time it got busy! You think to yourself, "That's it! I'm replacing those blippin' pumps!"

The natural reaction to a chronic pump problem is to buy a better one, right? Classic logic tells us if it costs more it has to be better. Remember earlier when I said the most expensive pump might not be the best pump? Let me put it this way…if a St. Joseph's aspirin won't cure your headache chances are a Bayer won't either. Spending more money on a pump with identical ratings won't solve anything; you just bought yourself a more expensive problem.

How the pump is used is probably the single most important factor in determining which pump to choose. The question is this: Are you going to run at the very edge of the pump's performance envelope or well within it? So, why do pumps always seem to fail when it gets busy? It is because the service level was left out of the equation. Choosing a pump designed for the service level of your application is key to performance and life.

If a pump is placed in a severe duty application like a vehicle wash, it must be sized accordingly. The frequent cycles, high temperatures, and condensation that forms in the crankcase must be factored into your buying decision. There are specific things you must look for when choosing a pump for your wash. How is the pump constructed? Is the manifold forged brass or cast? Is the crankcase completely anodized or just partially protected? What about the seals? Are they designed for my application?

Let's start with the front of the pump. When comparing manifolds, forged brass manifolds are better than cast brass as forging yields a stronger, denser manifold. Forged brass manifolds resist pitting and erosion better than cast brass manifolds and are often better able to withstand certain chemicals as well. Many options exist but if you need additional chemical resistance look for a nickel plated, forged brass manifold. Nickel plating offers additional protection against the effects of aggressive chemicals. Check

with your chemical supplier to make sure that the chemicals you are using will be compatible with the pump materials.

The manifold houses the packings and valves. Most vehicle wash pumps use Buna-N (NBR) materials for the packings and o-rings. Ask if the packing system was designed for vehicle wash applications. The seals must be able to withstand temperature fluctuations and allow the pump to draw water in without premature wear or hardening. The check valves are as important to the life of the pump as the seals. The check valves should be stainless steel for long life and durability.

The back end of the pump should be as tough as the front. Look for anodized aluminum crankcases. The anodizing process protects the aluminum from corrosion from water and chemicals; in the harsh environment of a vehicle wash equipment room this is very important. Anodized crankcases also dissipate heat very well, keeping the pump cooler. Insist that the manufacturer of your pumps anodize after the machining process. Some manufacturers anodize prior to machining then remove the protection of the anodizing during the final machining of the crankcase.

Next, does the pump have premium bearings? For high stress applications tapered and straight roller bearings are better than standard ball bearings. Roller bearings are the style of bearing used in car and truck axles to distribute load more evenly. They are pre-loaded in the pump to reduce end-play (side to side movement) so they withstand the side load generated by a belt drive system better than ball bearings. Roller bearings are also more resistant to contamination than ball bearings because they can flush themselves clean. Ball bearings have a place in some pumps, but not in your vehicle wash pump. Having the proper bearings is essential to a long service life.

What is the oil capacity of the pump? More oil is better. Look for large crankcases that facilitate cooling. The crankcase should have a sight glass and a dipstick to make easy work of checking the oil. Use the sight glass for quick daily inspections and the dipstick to check for water or other contamination of the oil.

Once you have decided on a pump for your wash, you have to consider the needs of the pump when it is installed in your application. In any new or existing application there are conditions for the pump that must be satisfied. The pump needs an adequate water supply, a properly designed and sized drive system, and regular maintenance. Satisfying these basic needs will help guarantee satisfactory performance, pump life, and minimize downtime.

Positive displacement pumps require a water supply that is sized to twice the pump’s rated flow. This means that the four gallon per minute pump you install needs a supply of eight gallons a minute to satisfy its water demand. This requirement can be explained by considering the back and forth movement of a piston on a crankshaft. When the crankshaft has the piston at the Top or Bottom Dead Center (TDC or BDC) of its stroke there is very little movement in the piston, but when the piston is 90 degrees off TDC or BDC it is moving about 70% faster than its average speed. That means in our pump each

cylinder requires 70% more water than its average demand for each revolution of the crankshaft. When we total the flow at the nozzle we get an average of the pump's performance. So, a four gallon per minute pump actually needs 6.8gpm to satisfy its demand at any given point in its cycle. To this we add 30% as a safety margin to guarantee that the pump is able to get everything it requires. Feeding a pump this way will help to minimize problems caused by cavitation damage.

Cavitation is the number one pump killer. Cavitation is described as "the rapid conversion of the liquid to a vapor, followed by the sudden collapse of the vapor bubble to the liquid phase." In less clinical terms, it is the boiling of a liquid in the pump. Did you know cool water will boil? If the pressure at the inlet of a pump drops low enough water will begin to boil. The boiling of the water creates air pockets in the inlet water so the pump is no longer pumping just water; it is pumping a mixture of water and water vapor. When the pressure in the pump increases, these bubbles collapse at such a high rate of speed that the implosion, if it occurs against a surface, can actually cause the erosion of that surface. The speed of an imploding cavitation bubble has been estimated to exceed the speed of sound and calculated at approximately 32,000psi of force. Most pump noise is a result of cavitation. How do you prevent cavitation? Make sure you have enough water at the inlet of the pump to satisfy its requirement.

The drive system is also a very important piece of equipment and must be sized according to the type of use you anticipate. Undersized belts and pulleys lead to overtightening to prevent slippage and excessive heat. This will lead to premature oil failure and possibly catastrophic pump damage. Owners of existing washes have an advantage over new operations in that they usually know their expected level of business. It is important to provide this information to anyone that is quoting components for your wash. Share it with your suppliers; it will help them make an educated decision regarding your needs.

Maintenance is the last part of our discussion. Proper maintenance involves more than changing the oil and packings. It is the total caretaking of your equipment. Maintenance includes adjusting chemical concentration, controlling water quality and supply, drive system adjustment, replacing worn nozzles, oil changes, and packing changes. It is recommended that operators keep a maintenance log for each pump stand that tracks the date, type of repair or maintenance, and any observations about the systems such as current operating pressure, leaks or anything else that may be notable. This log book can be used as a tool to make improvements or track trends.

Chemical concentration, water supply and quality must be maintained to keep pumps working properly. Check filters and strainers daily at first, then you can put a plan in place based on your particular application. Maybe checking filters every two or three days is adequate for your use. Start with frequent intervals and develop your own plan. Drive systems should be checked weekly to make sure that the belts are not worn, loose or slipping. Adjust belts to manufacturer's specifications. An inexpensive deflection gauge can be purchased to make this check a simple task. The nozzle should be the first thing you inspect when you notice a loss in pressure. Inconsistent spray patterns may

indicate a clogged nozzle and a sloppy spray pattern, a damaged or worn nozzle. Nozzles should be inspected daily for clogging or damage.

Oil changes are the cheapest insurance for a long pump life. I recommend changing the oil in your pump after the first fifty hours of operation, then at three-hundred hour intervals. If your equipment room is exceptionally humid or hot you may need to change the oil more frequently. Use the sight glass on the pump to watch for cloudy oil. Make this inspection daily after the pump has had time to sit for a while. Sometimes agitated oil will look milky because of air trapped in the oil. The oil should be clear with a light amber or red color. If after sitting the oil still looks milky or cloudy, change the oil and inspect the system for leaks.

Packing changes are an “as needed” repair. Predicting packing failure is as tough as predicting the weather. Pulsation, a loss of pressure that cannot be corrected by changing the nozzle, and/or water leaks are indications that the pump’s packings may have failed. Contact an authorized repair center or your distributor for parts and assistance.

The pump is the heart of your car washing equipment and choosing a pump is an important decision. When deciding on a pump, consider the application and the pump construction. Look for quality, not price.