As the parts-cleaning industry advances in technology and application, standards are becoming tighter in all industries. Increasing expectations and accountability from automotive manufacturers have led to cleanliness specifications becoming more strict, resulting in cleaner parts. While clean parts are always good, diminishing returns are a concern with strict specifications. At some point, parts are "clean enough" for their designed use, and increasing cleanliness beyond this range raises costs significantly with little benefit. Practicality and function take a backseat, and the outcome is higher costs, more time, and wasted resources for all parties involved. To combat this wastefulness, it is necessary to craft a cleanliness specification and process that achieve a quality standard without overreaching and becoming inefficient. There are five steps and issues to think about when designing a specification: part size, contamination, necessary cleanliness, the process, and validation.

Part size is the basic first step in designing an efficient cleaning process. The washer manufacturer works with the customer and knows the exact part dimensions and material composition. This includes what type of metals the part is constructed of, which is helpful in determining the tolerance of the part to various processes that may be employed for cleaning. The material cannot be overlooked, as dimensions of the part can be changed due to heat expansion, or erosion caused by the cleaning chemistry or material handling method used.

After the specifics of the part have been accounted for, the next issue is the contamination that will be cleaned. The full nature and quantity of contamination are important variables. The part should be tested, with a method such as gravimetric testing or laser particle counting, to determine how much contamination is present before the cleaning process. If the correct amount is not accounted for, the washer will have difficulty handling the part. For instance, a washer with a 50-gallon wash tank will become over-run with soluble coolant in less than 1 hour if each part is contributing 1 measuring cup of coolant at a cycle time of 10 parts per minute. Knowing the amount of contamination will prevent this problem, as the washer can be designed with a larger tank in order to avoid immediate saturation.

Determining exactly what types of contaminants are present on the part is vitally important to the outcome of the process. If the cleaning chemistry does not take into account all contaminants present, it may not provide the necessary surfactant package required to break the surface tension between the part surface and the soil resulting in performance issues. For example, chlorinated paraffin is a waxy lubricant that is used to protect metal during deep stamping and metal forming so the metal does not tear. The surfactant package necessary to release that waxy paraffin lubricant from the part needs to be both extreme in its composition, yet also must be able to handle very high temperatures without breaking down and losing their effectiveness. Knowledge of the contaminant also helps in the maintenance of the cleaning system. When washing off organic oils a manufacturer should know that since this product can separate from water it is possible to remove the soil from the cleaning solution while in operation. Conversely, washing off synthetic coolants which do not separate from water requires larger tanks in order to expand the length of time between when the entire system needs to be taken down to dump and recharge each tank. If this is correctly designed for in the beginning, it will save headaches, money, and maintenance down the road.

After these issues have been resolved, it is time to determine the benchmark levels of cleanliness. Absolute clean is usually not necessary. Automotive parts do not need to be cleaned to the same level as surgical tools. Figure out at what point does contamination begin to affect performance, and work from there. Setting a specification a little higher than the point where contamination becomes a performance issue is not wrong, but setting it too high is inefficient. Keep in mind the diminishing returns of cleanliness past a certain point. The cost of increasing cleanliness is not linear but rather it is exponential. If the part performs admirably with 1mg contaminant per part with no particles greater than 120 microns, there is no plausible reason to require a cleaning specification that requires less than .2mg contaminant with no particles greater than 50 microns. While the part would be very clean at that standard, the increased cost with no real benefit to performance makes it wasteful.

With benchmarks established, a cleaning process can be designed that accounts for part dimensions, contamination, production rates and specifications. Three things are critical to determining the proper process: mechanical action, chemical reaction and material handling. Find a washer manufacturer that has a wealth experience and it is likely they will have worked on a part very similar to yours in the past, which will make the design process much smoother. The mechanical action used on the part is determined by machine design that is determined by production rate as well as cleanliness specifications. Some parts respond better to direct impingement methods, others to submersion in chemical baths and most respond well to a combination of the two. Chemical reaction between the part material, the cleaning compound and the soil must be tested in order to make chemical blends are not created that will create safety hazards or maintenance nightmares (i.e. excessive foaming). The material handling aspect must be designed to ensure no damage occurs to the part during transport.

Finally, it is time for validation. A cleaning process will be tested, which ensures that the machine achieves its goals and causes no damage to the part. Then, the part should be tested using the same methods that were used to determine the contamination levels of the part during the design process. The testing will make sure that the part meets the benchmarks that have been set. After testing, run the part through the entire production process with the washer included, making sure that the washing does not adversely impact the subsequent step in the production line.

By following these steps and working closely with a qualified manufacturer, you can be assured that your parts will be cleaned and fall within a reasonable specification. Reasonable, practical cleanliness standards will save a company money and time in the production process, avoiding the wastefulness of unnecessarily harsh restrictions and maintaining quality.