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Remanufacturing Cleaning Operations and Some of the Pitfalls

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INTRODUCTION

With the global initiative to recycle and reuse for conservation of resources and minimize the amount of waste in replacing components that can be refurbished and rebuilt to like new condition, the remanufacturing part cleaning business is rapidly growing in order to provide clean parts for inspection, prior to overhaul and during repair and rebuilding.

This article will review some of the issues and pitfalls with these cleaning processes, as well as some recommendations for correcting them. Amidst many types of remanufacturing operations underway today, this paper focuses primarily on the automotive industry.

PART CONFIGURATION IN REMANUFACTURING PROCESS

There are many different part configurations subjected to the remanufacturing process. They are manufactured mostly from steel, cast iron and aluminum, with lesser amounts of the yellow metals, such as copper and brass commonly used for alignment pins or gasketing for metal to metal joining surfaces. In the case of automatic transmissions, engine blocks, cylinder heads and brake components, there are many blind holes with fine pitch thread areas that can be difficult to clean and dry.

For components that are subjected to combustion, like cylinder heads, cylinder walls, exhaust manifolds and pistons, soils consist of built-up, burnt on carbon and soot. Road dirt and a variety of unknown contaminants, including rocks, sand, dirt and often a heavy build-up of dried grease and oil can be found on automotive brake parts, transmission housings, drivetrain components and on other parts outside the engine compartment.

The most common cleaning process for this operation is a heated, aqueous immersion tank, with or without fluid movement provided by pumps and inductors below the bath surface. Parts are either individually racked or more often, dirty parts are loaded into a bulk basket with lids. The baskets are then immersed into a heated tank with pumps that move the fluid below the surface level (spray-under-immersion), for added impingement energy to flush away the soils once dislodged from parts.

Ultrasonics are often incorporated in the immersion tank. While a great option, some applications where bulk parts are loaded into large baskets, ultrasonics will do a great job cleaning the outer grouping of parts, but has difficulty getting into the center mass of parts. The density of parts tends to absorb the ultrasonic energy, minimizing its effect on parts deep within the basket. When it's used correctly however, it's a very good addition and can both improve the cleaning and shorten the wash cycle times.

ROTATION AND/OR AGITATION CLEANING PROCESS

Two other common cleaning process additions with aqueous immersion tanks are rotation and/or agitation. The rotation feature is like a bingo style wheel rotation where the basket or part is slowly rotated by a dedicated electric motor in the wash tank. This process not only releases entrapped air in the parts, it also will help the chemistry flush in and out of some of these difficult areas to help clean.

Like rotation, agitation or vertical oscillation is also very helpful by the part or basket being moved up and down while still under the bath surface. This flushing action aids with entrapped air and dislodging solids that have been solubilized and loosened by the cleaning chemistry. Part movement is especially effective when employed in combination with ultrasonics.

Spray-in-air systems, like turn-table cabinet spray washers, are also popular for cleaning large, heavy parts or components that don’t lend themselves to total immersion or extended residence time in hot detergent. Parts are typically placed inside the machines on a basket that rotates with the spray nozzles arranged on the sides, tops, and bottom of the chamber. After loading, you start the process timer and the system will wash then rinse and, in some cases, blow dry all in one chamber. Spray-in-air systems are often used as a pre-cleaning step to remove heavy oil and grease, followed by an immersion step to remove burned-on carbon.

Finally, media blasting is also a very effective cleaning heavy burned on carbon and soils, and for cleaning and prepping surfaces prior to repainting. Media blasting is a mixture of ceramic pellets, baking soda, corn cobs, dry ice or similar types of suitable materials mixed with either water or air and applied with a high-pressure spray gun. This process does require some experience and skill. If you get too far away from the work, it's not as effective and if you get too close, you risk damaging the surface itself.

REMANUFACTURING PROCESS PITFALLS

Some of the pitfalls that you could possibly see with the remanufacturing process would be of course incomplete cleaning. For example, the parts not coming out satisfactorily clean requiring secondary manual cleaning operations or you would have to pass it back through the cleaning process, wasting both time and money.

Without some corrosion protection built into the detergent or added to the rinse, flash rust and corrosion can be an issue. If parts come out of the washer with wash solution or rinse water droplets left on them, without corrosion protection, latent heat remaining in the part will cause the rinse water to dry and leave rust spots or streaks on parts. This would

be particularly detrimental if you're painting or powder coating the parts once rebuilt. Pitting on the parts could also be an issue, especially with the media blasting.

Too aggressive of a cleaning chemistry can be a problem as well. An extended wash cycle can impart too much heat which can in some cases cause darkening or pitting on surfaces. The risk of spec damage to the surfaces, especially for transmissions valve bodies, brake calipers or cylinder walls, damaging sealing surfaces is also plausible.

Complete cleaning of the fine pitch threads or the fluid galley ways can be an issue. If the parts are not positioned correctly or if the cleaning chemistry is not effective enough for the soils, oil, grease and dirt it can collect inside the threads and galleys especially on transmission valve bodies and brake parts with very small passage ways. Some with a 90-degree turn make it very difficult for the chemistry, and rinse water, to get in, clean and then get out efficiently.

Along the same line as the plugged fluid passages is partly solubilized grease, oil and semi-solids getting re-deposited into and plugging these passageways, inhibiting the cleaning chemistry from doing its job.

To avoid these cleaning pitfalls, it is important to match the chemistry to the requirement. It is very important that you choose a chemistry that will not only effectively remove soils but do so economically without compromising part surfaces.

It’s also important to optimize the actual cleaning process. Beyond the selection of a good cleaning chemistry, correct wash and rinse cycle times, proper wash temperatures and spray pressures must be established. Dialing in adequate parameters with spray-in-air processes includes directing sprays in the best location. Even simple orientation of the parts within the washer in many cases can make a difference between a good cleaning process or one you may struggle with. All these factors combine to result in a successful cleaning process.

Rinse water must be kept clean! With many cleaning processes, there is some carryover from the wash section through cupping or puddling on the parts that gets dragged over into the rinse water. Having a method to maintain the purity of the rinse water will play a big part in a successful cleaning process.

For cleaning ferrous components, consider using a cleaning chemistry that has added corrosion protection to protect parts from corrosion, atmospheric oxidation, and/or darkening, and in some cases even pitting, especially yellow metals.

Filtration is very important in the wash tank because once the soils are removed from the part it needs to be removed from the wash tank, so it doesn't re-deposit back onto parts, or leave behind a surface film. Filtration will depend upon the soils being removed. In some cases, bag or cartridge type filtration may be adequate while other processes may require oil separation systems like coalescers. The more effective the filtration, the longer bath life of the detergent, and the cleaner the parts.

Temperature is important to minimize any pitfalls. Wash bath temperatures need to be high enough to soften and solubilize the oils and greases, soften the outer layer of the carbon, opening the pores allowing wash chemistry to get underneath and start solvating and removing the soils. However, be aware that too high a temperature can darken some aluminum and yellow metals.

Rinse-ability of the wash chemistry should also be considered. The cleaning chemistry selected should be able to quickly split or reject oils to the surface for easy removal from the wash bath. The detergent should also be free rinsing to sheet liquid off parts to offer spot-free drying and a completely clean part.

Worker safety and the environment should always be considered. The chemistry not only has to do the job, is also must be safe for operators, equipment, and the environment.

CONCLUSION

In closing, matching the chemistry to the requirement, selecting the best mechanical agitation, adequate filtration and good process controls will help to maintain a good cleaning process and provide long wash bath life.