Metal Component Degreasing

Process Summary

In the fabrication of metal components the parts often contain residual machining lubricants which need to be cleaned before being surface treated or coated. Consequently, metal component degreasers are widespread throughout the manufacturing sector. Two common methods of degreasing which present pollution prevention opportunities are liquid solvent cleaning (cold cleaning) and vapor degreasing. Cold cleaning consists of a dip tank containing a solvent-based cleaning solution at room temperature. The component is dipped in the tank with a varying residence time and then removed often with drag-out. Like cold cleaning degreasers, vapor degreasers consist of a tank containing solvent-based cleaning solution but at elevated temperatures resulting in higher volatilization rates of the solvent creating the need for the condenser. The condenser converts much of the vapor back to the solution.

Waste Summary

As mentioned above, cold cleaning and vapor degreasing units utilize solvents as the degreasing substrate. Vapor degreasing typically utilizes chlorinated solvents such as methylene chloride, 1,1,1-trichloroethane, or perchloroethylene, all hazardous air pollutants (HAPs). Volatilization occurs when the tanks lids are left open (or the absence of lids) and during the drag-out and drying process resulting in HAP emissions. Another waste stream is spent cleaning solvents; however, the spent solvent is often reclaimed by the user or their vendor. Solvents spills and drips from the drying component comprise another waste stream.

Pollution Prevention Opportunities

Pollution prevention opportunities exist in two areas for degreasing of metal components:

1. *Alternative Cleaning Solutions*

   Alternatives exist to the solvent-based cleaning units of cold cleaning and vapor degreasing. A common alternative is the use of aqueous based cleaners with an automated process that reuses the cleaning substrate. Power washing systems are also an option but the cleaning substrate is often not reclaimed. Another option for degreasing metal parts is the use of ultrasonic degreasing technology. Ultrasonic degreasing technology incorporates cavitational force to remove contaminants from the parts. The ultrasonic degreasing technology may be used in conjunction with aqueous cleaners for effective, non solvent-based cleaning/degreasing units.

Although not specifically pollution prevention by definition, other metal component degreasing alternatives include non-HAP/low VOC solvents and complete enclosure of the degreasing unit with add-on controls for the capture and destruction of VOCs such as an activated carbon cylinder. These options reduce air emissions but can be costly and burdensome.

2. Eliminate the Need for Cleaning

Although not always an option, production processes may have opportunities to eliminate the need for degreasing. Rerouting a metal part's process flow may remove a degreasing requirement; for example, routing a metal part directly from one soiling process to another may eliminate the need for an intermediate degreasing step. Another option is to eliminate the process that contaminates the component by replacing with a technology that does not require lubricants such as dry cutting, laser cutting, and low-solid fluxes. These are generally capital intensive process changes but in certain manufacturing operations are economically and environmentally beneficial.

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Pollution Prevention Checklist

- Replace solvent-based degreasers units with aqueous-based degreasers, ultrasonic cleaners, or terpene-based cleaners.
- Does the process possess the potential to eliminate part degreasing? Does redundant part degreasing exist in the process? Can the use of lubricants be reduced?
- Can the residue be burned off in a later process such as annealing?
- Keep the degreasing unit covered; develop Standard Operating Procedures (SOPs) to ensure the unit is covered the majority of time.
- Avoid heating the cleaning fluid to eliminate air releases.
- Would agitation in the tank improve the cleaning effectiveness?
- Reduce drag-out from the degreasing unit by allowing parts to drip back into the degreaser tank and installing drip pans to collect residue.
- Minimize rack and fixture size to reduce drag-out from the degreasing unit.
- Reclaim and reuse the cleaning substrates.

References:

"Guide to Cleaner Technologies: Cleaning and Degreasing Process Changes", United States Environmental Protection Agency; EPA/625/R-93/017, February 1994.

"Guide to Pollution Prevention: Municipal Pretreatment Programs", United States Environmental Protection Agency; EPA/625/R-93/006, October 1993.