Environmental Impact of Hermetically Sealed Solvent Degreasing

Organic solvents have long been considered to be the best option for removing contamination from metal parts. This is due to a range of factors. Among these include repeatable high levels of surface cleanliness, ability to remove a wide range of soils, and reduced cycle times. These advantages are compared to other methods such as aqueous or semi-aqueous based processes.

There has been a shift in recent years to these alternative methods. New environmental standards have been implemented around the world in an effort to curb emissions and make parts cleaning ecologically conscious. Manufacturers have been driven to the alternative methods as a way of complying with such restrictions.

As a result, use of solvents in the cleaning process has been reduced. New regulations passed by the European Union and other countries have made traditional solvent tank cleaning systems obsolete. German regulations, the strictest in the world, further restrict the use of solvents in the cleaning process.

However, advances in solvent cleaning technology now allow manufacturers to take advantage of solvents while remaining within regulations. The hermetically sealed solvent-cleaning units exemplify these advances. These units are able to offer all the advantages of solvent based cleaning while remaining environmentally friendly to their surroundings.

Advantages of Solvent Degreasing

The low surface tension of the liquid used in solvent degreasing allows for small and complex parts to be thoroughly cleaned with ease. Many manufacturers produce parts that have numerous small openings and complicated geometry. Aqueous solutions can encounter difficulty with these challenges, and incomplete or unsatisfactory cleaning is a result of that difficulty.

Solvents are also capable of accommodating a larger range of contaminates as opposed to aqueous detergents, which are often “soil specific”, and therefore limited in their ability. When using these aqueous detergents, it is often necessary to utilize a variety of chemicals in order to effectively manage the cleaning process, adding complication and cost when compared to the more versatile solvents.

Due to their rates of latent heat evaporation when compared to water, solvents are able to provide a quicker and more complete drying process than water-based methods. By reducing the drying process, manufacturers are able to produce more parts, and achieve better results in the cleaning process.

The hermetically sealed solvent system ensures that clean solvent and pure vapors are available for each wash cycle, maintaining consistent results. Further, the units can apply vacuum methods to the treatment chambers which reduce the boiling point of the chamber. The residual parts will maintain heat, which ensures instant vaporization and allows for up to 10 cleaning cycles per hour. Most importantly for the eco-conscious, the hermetically sealed units guarantee all contamination is isolated in the distillation unit and eliminates the need to find a way to dispose of large quantities of contaminated solvent. Solvent suppliers also offer special transfer systems to make for safer delivery and closed circuit transfer of new solvent and waste residues.

The Process

The typical hermetically sealed solvent cleaning process consists of seven steps. It is designed to provide the results and benefits of traditional solvent cleaning while producing a near-zero atmospheric emission rate, thereby adhering to the most stringent of environmental regulations without sacrificing quality cleaning.

The process begins with a pre-cleaning, in which hot solvent is sprayed onto the part in the treatment chamber. After initial cleaning, the solvent is transferred to the distillation unit where the soil laden solvent is boiled to force soil and solvent separation. The resulting clean, purified and vaporized solvent is then condensed and transferred to a holding tank for use later in the process. The oil not vaporized is held for future disposal.

The product then moves to the Immersion cleansing, where the chamber is flooded with hot solvent. The solvent penetrates all complex geometric areas of the part such as fine thread and blind holes, thoroughly flushing out any trace of contamination including particulate matter. If necessary, there is the option to include a high-pressure solvent injection flooding and/or ultrasonic agitation at this stage. Following this cleansing, the clean solvent that has been stored in Tank 2 is sprayed into the chamber to provide a final liquid rinse for the material.

Hot solvent vapor is then released in to the chamber from the distillation unit, and condenses onto the surface of the parts providing a pure rinse and heating them in preparation for vacuum drying. The vacuum drying process is rapid and effective. This is achieved through the reduction of treatment chamber pressure, which ensures evaporation of the solvent from the clean parts.

PPM Reduction is next, and it is a critical step for meeting environmental regulations. During this process, the vacuum is broken. The vapor/air mixture that is left behind travels through a Coalperc activated carbon recovery unit, which holds the mixture until the concentration in the treatment chamber has been reduced to below 1 g/m^3 (or 150 PPM).

Following this reduction, carbon is regenerated until all absorbed solvent is released and returned to the holding tanks. Once the contamination has been isolated, the manufacturer can dispose of the waste through the waste transportation systems that are available from many solvent distributors.

Conclusions

By using hermetically sealed solvent degreasing units, manufacturers can produce clean, dry parts in the most efficient manner possible while also remaining compliant with even the strictest environmental regulations. With these advances in solvent cleaning, it is no longer necessary to compromise the quality of the cleaning process or substitute numerous chemicals in place of more efficient solvent cleaners.