Cleaning of Cold Extruded Parts with Perchloroethylene

Effective against both particulate and processing contamination

German Report – Karl Roll GmbH and Richard Geiss GmbH at Alutec & Co. KG

Cold extruded parts used in sensitive automotive systems have to fulfil the strictest cleanliness requirements.

In order to economically and reliably meet residual contamination requirements which specify a maximum particle size of 500 micron as well as adhesion and coating compatibility, Alutec GmbH invested in several cleaning systems of like design which are operated utilising perchloroethylene.

Alutec Metallwaren GmbH & Co. KG, with headquarters in the southern German town of Sternenfels, has been manufacturing aluminium cold extruded parts since 1988 and more recently from hybrid materials such as aluminium-copper compounds. Ninety five percent of the company's customers are Tier 1 suppliers to the automotive industry such as Bosch, Continental, ZF Lenksysteme, Hella and Behr, to whom they ship parts around the world. Their product spectrum includes three main groups: housings such as those incorporated in parking distance control systems, heat sinks for applications in the field of power electronics and pistons which are used in, amongst other applications, wheel brake systems in passenger vehicles and trucks. The company produces between 40 and 45 million components each year.

Parts cleaning – a critical element in production

Stefan Kretz, Alutec's Managing Director explains "High performance cleaning is extremely important for the quality of our parts. On the one hand, organic contamination must be so effectively removed that the surfaces can be subsequently coated or bonded with adhesives. On the other hand, we have very strict requirements with regard to residual particulate contamination, for example a maximum particle size of 500 μm.

Where electronics housings are concerned, no metal particles are permissible which might cause short-circuiting. Furthermore, our customers place great importance

on spot-free surfaces". The zinc stearate used as a lubricant in the cold extruding process is also a challenge where cleaning is concerned. Since the company's former perchloroethylene cleaning system no longer fulfilled the specified cleaning requirements and also presented issues with both reliability and excessive stabiliser consumption, the decision was made at Alutec to replace it. A significant increase in manufacturing throughput with new projects also made it necessary to increase cleaning capacity. The company decided to invest in several systems of like design from Karl Roll GmbH.

Compatibility analyses and cleaning trials – part of the selection process

Extensive analyses of the compatibility of the processing media used in the cold extruding process with perchloroethylene contributed to system specification. These tests were conducted in-house by leading solvent supplier Richard Geiss GmbH. Various substances in the lubricant and the auxiliary processing media were identified during analysis which have a negative effect on cleaning and also contribute to high levels of stabiliser consumption. At the same time, tests revealed that contamination of the solvent with these substances can be considerably reduced by using a system operating under vacuum. This approach was implemented for the new equipment.

Stefan Kretz continues "In addition to this, we conducted comprehensive cleaning tests and residual contamination analyses at Roll's technical centre for the purpose of process development. They confirmed the fact that we were reliably achieving the targeted cleaning results. Furthermore, after considering the market and the options available systems it was clear that the Roll brand represented very good value for money."

Optimising cleaning performance

The Roll RWTVS cleaning systems selected operate with stabilised perchloroethylene. Each is equipped with two solvent tanks for both pre-cleaning and final cleaning with process steps including immersion, vapour degreasing and vacuum drying. Quick and effective removal of particulate contamination is achieved by ultrasonic agitation operating at a ratio of 20 Watts per litre. Rather than the "push-pull" bar technology adopted by many competitors, Roll ultrasonic technology incorporates individual ultrasonic transducers which can effectively "target" the components contained within the basket. Advantages include better and more even distribution of ultrasonic agitation, lower mechanical stress per transducer and significantly reduced loss of performance in the event of single unit failure. Furthermore compressed air with a maximum pressure of 18 bar provides for powerful turbulence which ensures total elimination of contamination from complex component geometries.

In order to consistently achieve the cleanliness requirements demanded by Alutec solvent integrity is of utmost importance. Solvent from both tanks is fed to full-flow filtration via a bypass filter. This mechanical filtration of solids takes place in both the chamber feed and return by means of double filters. Filter replacement is thus made possible without interrupting the process. RWTVS technology also incorporates both primary and secondary (or by-pass) solvent distillation for the removal of dissolved contaminants including oil and zinc stearate. A mixture of zinc stearate, oil and solvent is continuously drawn into the by-pass distillation unit from the primary vessel and subsequently concentrated further until to a residual perchloroethylene content of only one to three percent remains in the waste stream, the residues are removed automatically. This also assures that stabiliser consumption is significantly reduced.

Eighty percent of the parts to be cleaned are fed to the system automatically via a roller conveyor as individually positioned items in baskets with

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dimensions of 670 x 480 x 300 mm. Component carrier mounts which are designed in a part-specific specification assure that cleaning is supported as effectively as possible by means of ultrasound and pressure flushing. System process chambers have an electro-polished surface which prevents the formation of retained contamination. "We check the surface tension of the parts after cleaning with appropriate test inks. We run some of the residual contamination analyses for particulate cleanliness at our own facilities, and others are conducted at external laboratories. The cleaning results meet our expectations", observes Stefan Kretz with satisfaction.

Process air purification with minimal contamination of activated carbon

Integrated process air purification allows for completely exhaust-free operation: The exhaust air, which is contaminated with solvent, is directed through a cooling system with temperatures ranging from minus 30 to minus 40° C. This makes it possible to "precipitate" up to 97% of the solvent contained by the exhaust air before it's fed to the activated carbon units. This effectively reduces contamination of the activated carbon so that regeneration is not required as frequently. Furthermore the solvent is subjected to less thermal stressing, which also has a positive effect on stabiliser consumption and the service life of the cleaning agent.

Reliable supply and waste stream processing - recycling of solvent

Solvent is supplied to and removed from the customer by means of the TLB system operated by Richard Geiss GmbH. This consists of dedicated lidded bunded safety containers and a specially developed connecting system. Typically one of the containers is used for delivery, storage and filling of the cleaning system with fresh perchloroethylene. A second unit is utilised to collect the waste on site which is subsequently returned to the solvent supplier for onward transportation the Richard Geiss facility. The concept of the TLB system allows for efficient emission-free handling of the solvent and waste products.