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O+P FLUIDTECHNIK

INDUSTRIEHYDRAULIK – MOBILHYDRAULIK – PNEUMATIK

TITEL

BAUTEILREINHEIT IN DER HYDRAULIK
Sauberkeit des Hydrauliksystems vor der Inbetriebnahme

DIFFERENTIAL-SPERRVENTILE
Innovative Features bringen Verbesserungen

PROPORTIONAL-VENTILE
Volle Kontrolle unter Hochdruck

MIT 16 SEITEN MOBILE MASCHINEN

Top-Thema:
SENSORIK AUF DER BAUSTELLE

VEREINIGTE FACHVERLAGE
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COMPONENT CLEANLINESS

TECHNICAL CLEANLINESS IN HYDRAULICS

Boris Mette, *Head of STAUFF Marketing Communication*

Foreign particles in hydraulic oil can significantly impair the operation and service life of a hydraulic system. This explains why the machine and plant manufacturers of original equipment as well as users rely on high-performance filtration in practice. In addition to cleanliness during actual operation, “initial” cleanliness is coming into sharper focus: this concerns the cleanliness of the hydraulic system prior to commissioning mobile and stationary systems, or installing new components and assemblies.

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01 **Measures have been put in place along the entire process chain to avoid or minimise particle ingress.**

02 **Test show that products from Stauff's "clean production" have maximum particle sizes of 273 µm (metallic) and 213 µm (non-metallic).**

03 **By 2023, Stauff had already made considerable investment in cleaning and test systems, and assumes responsibility for the entire hydraulic system**

As machines and systems become more complex, the cleanliness of the operating fluid for the optimum functional operation of the hydraulic system also becomes increasingly important. The hydraulic oil is continuously filtered using application-specific concepts consisting of primary, offline and bypass filters, ventilation filters, and dessicant air breathers etc. This prevents the ingress of contaminants and moisture through the "breathing" hydraulic tank. Furthermore, the quality of the fresh oil and filtration are also taken into consideration during filling.

However, contaminants in the hydraulic system even prior to initial commissioning of a complete system are frequently neglected. This refers to the particle load on each and every individual component. Plant manufacturers (when specifying bought-in parts) and also users (during rebuilds or retrofits) can help to minimise the risk of contamination in advance.

IN FOCUS: TECHNICAL CLEANLINESS

Originating in the automotive industry, "technical cleanliness" is now discussed throughout the mechanical engineering sector, and implemented with varying degrees of consistency. This approach was triggered by premature component failures, for instance in injection systems. These failures could be attributed to contaminants produced during production but not removed.

Increasing awareness of "component cleanliness" led, among other things, to the development of an ISO standard (ISO 162329) and a VDA regulation (VDA 19). These regulations are binding for the automotive industry. However, the cleanliness levels defined in them are increasingly being applied to hydraulic system components in other sectors. They define the maximum particle size that can be detected on newly produced components.

HYDRAULICS: PARTICLES UP TO 1,000 µm

A maximum particle size of up to 1000 µm is generally considered sufficient for hydraulics systems. However, it should be noted that contaminants in hydraulic systems can cause a high percentage of premature system failures. Metallic particles, in particular, can contaminate the hydraulic oil and lead to wear on pumps, valves, motors, cylinders, seals and hoses etc. Sealing surfaces and the control edges of valves are particularly at risk. Filters clog up more rapidly and need to be replaced more frequently. These and other consequences affect the operation and service life of the hydraulics.

As there is a high proportion of metallic contaminants in new components – after all they are produced during machining – Stauff recommends that machine and plant manufacturers should opt for a higher cleanliness class. Most manufacturers offer this option. However, this is often associated with considerable additional costs, potentially increasing the price of a simple assembly five-fold. The decision needs to be made: is there a corresponding benefit to the additional cost?

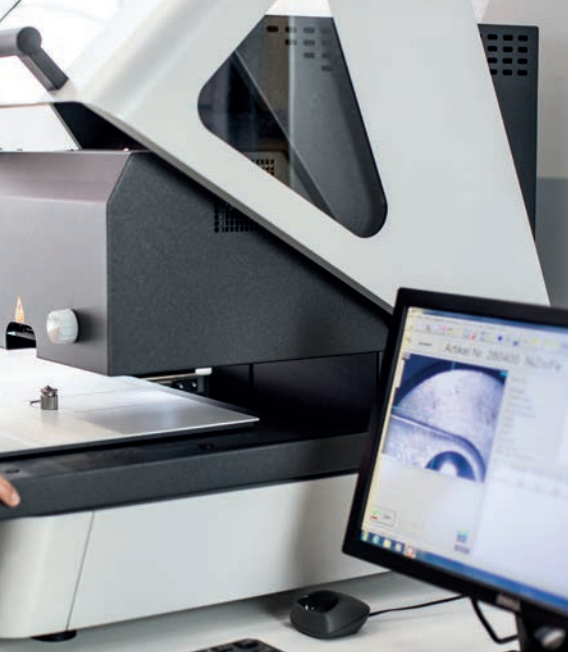
STAUFF: 500 µm PARTICLE SIZE AS STANDARD

This decision is made for OEMs and users of the Stauff product range at no extra cost. The full-liner for all components of hydraulic line systems has organised the production of clean-sensitive components, assemblies and systems in terms of technical cleanliness to a maximum particle size of 500 µm.

Measures have been put in place along the entire process chain to avoid or minimise external particle ingress, particle production within the process per se, and particle entrainment.

After machining, the individual components of the fasteners are cleaned of swarf and oil residue in the production washing system. A second cleaning (pickling) takes place at the electroplating partner's prior to coating in order to guarantee even surface cleanliness prior to this machining stage. After coating, all the items are delivered to Stauff in sealed transport containers. The routes between the electroplating partner and Stauff's production and logistics sites in the Sauerland region are short and require no reloading operations during which crates could topple over and packaging could accidentally open.

Packages are opened for incoming goods inspections. Component cleanliness is therefore an integral element of quality assurance before the articles are individually packaged. Any necessary assembly steps also take place under clean room conditions. This



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involves no additional costs for customers, as Stauff has adopted this as a standard measure, not as an option to actual production.

TESTED CLEANLINESS

Stauff has examined the effectiveness of these measures in multiple series of tests using different measuring methods. This is done, among other things, using a test extraction system by removing the particles from the test objects with liquid and ultrasound in the following process steps: injection, flushing, acting/dissolving, ultrasound, shaking.

A representative example from multiple measurement series: A largest metallic particle of 846 µm and a largest non-metallic particle of 963 µm was measured on a 90° equal elbow in standard production (1000 µm). This is slightly less than a millimetre and it is easy to imagine that particles of this size could cause damage to a valve or different seals etc. By contrast, in Stauff's clean production, the largest metallic particle measured was 273 µm, and the largest non-metallic particle 213 µm.

Equally persuasive are the numerical and gravimetric analysis processes undertaken, that is verifying the number and weight of the particles. 22,806 particles with a total weight of 1.5 mg/1000 cm3 were counted on the conventionally produced equal elbow. By contrast, 6253 particles with a total weight of 0.6 mg/1000 cm3 were counted on the same product produced under "technically clean" conditions. This shows that even technically clean components still have contaminants on their surface, albeit in significantly lower quantities and, as demonstrated above, with considerably smaller particle sizes at Stauff.

RESPONSIBILITY FOR THE ENTIRE SYSTEM

The availability and service life of all functional units of the hydraulic drive increased with the cleanliness of the hydraulic oil. While the main focus in the past has been on the ingress of external contaminants and maintenance of the oil in production, this is increasingly shifting to "initial" cleanliness too. Individual packaging of hydraulic components from clean production is just as important for the lasting maintenance of the hydraulic fluid as operational measures, including fluid filtration, ventilation filtration, refilling of filtered fresh oil and regular analysis of the oil in situ or by an external laboratory.

By 2023, Stauff had already made considerable investment in cleaning and test systems to ensure enhanced component cleanliness. The full-liner is therefore ahead of the market for all components of hydraulic line systems, and assumes responsibility for the entire hydraulic system. Apart from Stauff's generally high quality standards, one aspect that should not be neglected here is the company's own in-house depth of production – short distances between production, logistics and the warehouse, as well as its carefully selected cooperation partner, the "electroplating service provider" just round the corner.

Images: *Stauff*

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> **PRODUCTION OF SENSITIVE COMPONENTS IS ORGANISED BASED ON TECHNICAL CLEANLINESS**

PUTTING IT PLAINLY

- STAUFF IS INVESTING IN THE TECHNICAL CLEANLINESS OF SENSITIVE COMPONENTS
- CLEANLINESS AT STAUFF IS CONSIDERABLY HIGHER THAN THE STANDARD
- COMPANY'S IN-HOUSE DEPTH OF PRODUCTION IS BENEFICIAL HERE
- MULTIPLE NUMERICAL AND GRAVIMETRIC ANALYSIS PROCESSES