

HYDAC

INTERNATIONAL

**Technical Cleanliness
Solutions Provider**



FILTRATION

**CONDITION
MONITORING**

**PROCESS
CHAIN
ANALYSIS**

**TECHNICAL
CLEANLINESS**

From a clean component...
to a technically clean system.



Automotive Production



Parts Washing System



Machine Tools



Mobile Hydraulics



Aviation



Medical Equipment Industry



Your Partner for Expertise in Technical Cleanliness

Not an option, but an obligation.

Our aim is to maximize machine availability and to optimize systems of all media types — hydraulic oil, lubricants, water, cooling lubricants, cleaning and test fluids — while reducing operational costs and improving product quality.

HYDAC will support you throughout the production process with products, systems and services designed to achieve the technical cleanliness targets by:

- Reduction in start-up breakdowns
- Reduction in consumption of operating fluids
- Increase in availability of machines and systems
- Analysis and engineering support throughout the process chain
- Service, repair, maintenance and supply of spare parts

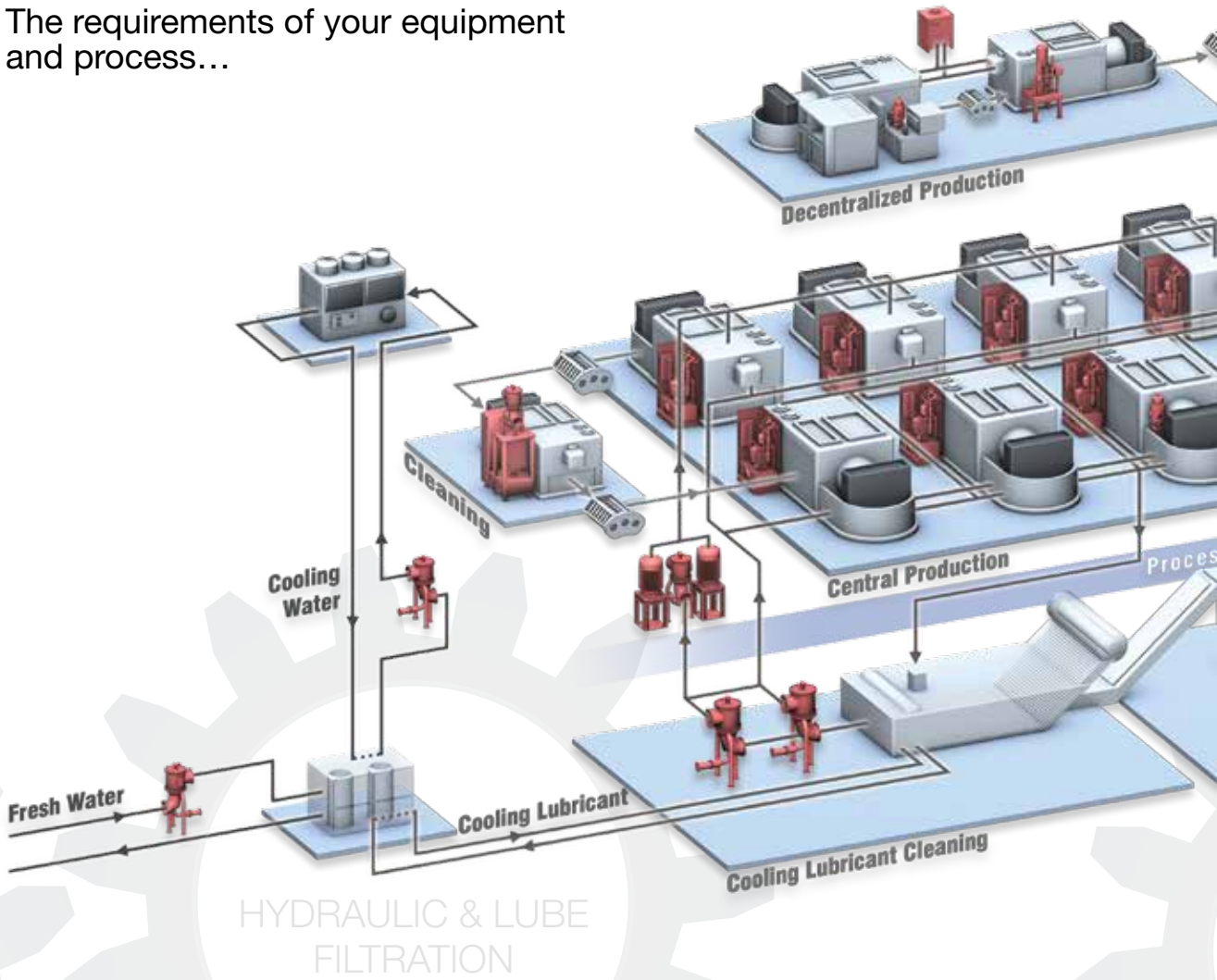
**One supplier.
One contact.**



Unfold for more details. ▶



The requirements of your equipment and process...



Critical Processes

Process Water Supply

Process Water Supply

The supply of fresh, quality water to a plant from any source can only be ensured with filtration. Both the heating and cooling water circuit can add up to thousands of feet of pipeline. Water quality suffers during any conversions necessary on machine tools, or when changing the course of the lines. HYDAC filtration protects machine operations and the pumps and valves in your system.

Cooling and Lubrication

Cooling and Lubrication

Modern, high speed production requires high reliability and easy maintenance. HYDAC return and cartridge filters supply consistent quality cooling lubricant to these systems which protect against contamination and water ingress and minimize failures on rotary feedthroughs, pumps and tools.

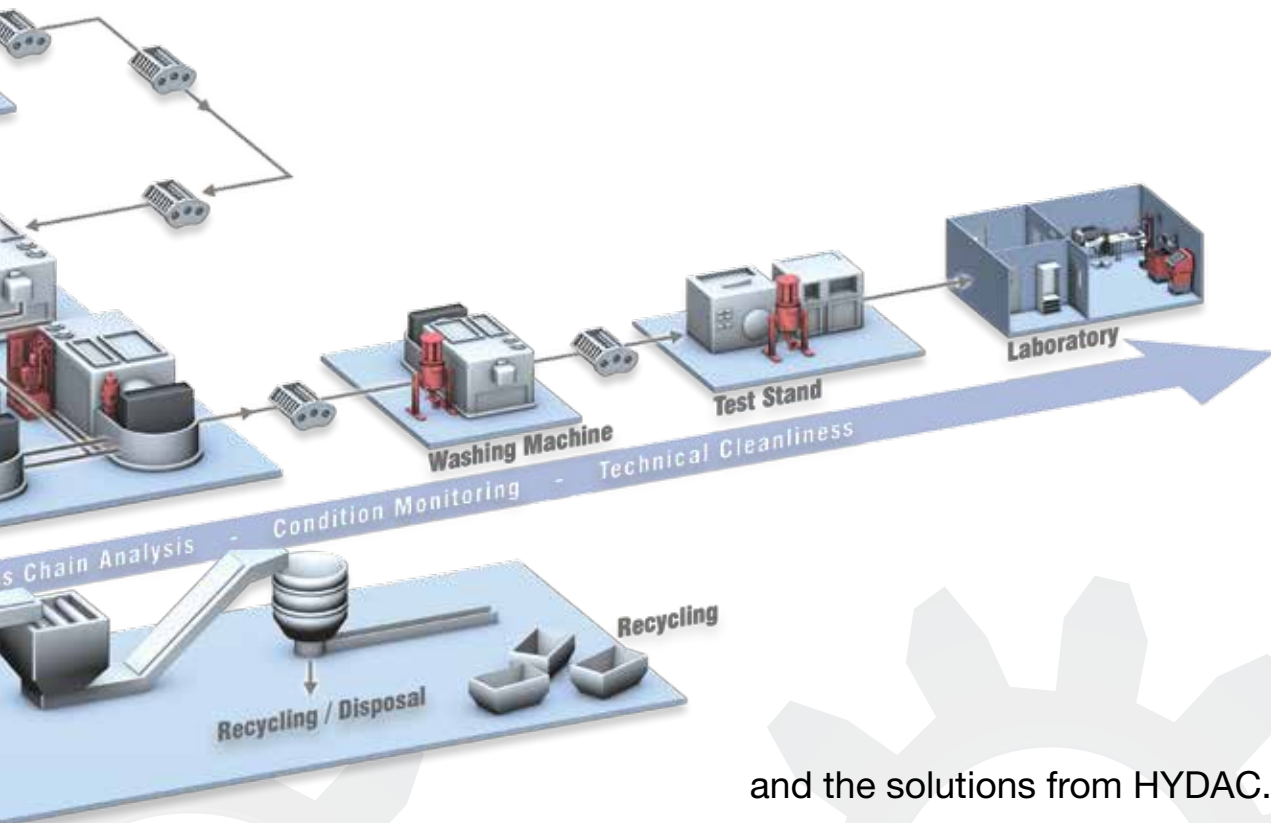
Manufacturing & Machining

Manufacturing and Machining

HYDAC Condition Monitoring allows you to record pressure, overheating, particle contamination, water content, filter differential pressure and fluid levels. This enables you to efficiently plan maintenance and maximize the availability of your system.

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and the solutions from HYDAC.

CONDITION
MONITORING

TECHNICAL
CLEANLINESS

Measure and Verify

Parts Washing System

End-of-Line Testing/Roll-Off

Technical Cleanliness

Parts Washing System

Modern drive technology, increased component size, higher performance density and component weight reductions place continuously increasing requirements on the technical cleanliness of components and systems.

End-of-Line Testing / Roll-Off

Roll off cleanliness is affected by contamination that is “built in” to a system. It could be due to contamination of new fluid introduced to a system, a result of the manufacturing process or contamination of supplied components. HYDAC filtration and condition monitoring enhances productivity and roll-off cleanliness.

Technical Cleanliness

Technical cleanliness is becoming increasingly important in manufacturing and mobile hydraulics. This is being driven by the need for ever increasing productivity and the trend for extended product warranties. HYDAC provides Contamination Test Units and Modules which allow you to carry out your own inspections in a flexible manner.

What does Technical Cleanliness mean?

“Technical Cleanliness” refers to the process of minimizing contamination so that particles will not constrain or interfere with the subsequent function of a technical component. Having a high degree of, or increasing your level of technical cleanliness allows for:

- Cost reductions at roll-off:
 - Less troubleshooting and testing
 - Less scrap
 - Lower warranty costs
 - Improvement throughout
- Maximum equipment availability and productivity for the end user
- Improved processes in-plant
- Improved supply chain quality



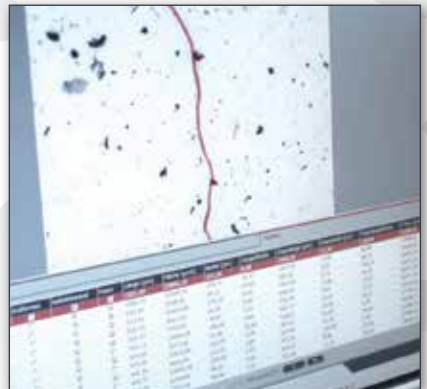
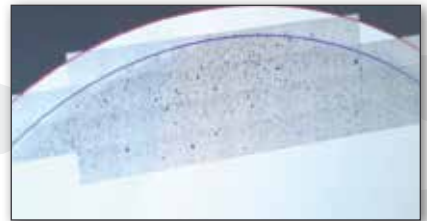
Cleanliness Specifications

ISO 16232 is a standard published by the International Organization for Standardization (ISO), which covers the methods to be used for extracting, analyzing and expressing results for cleanliness levels. Some of these methods include: agitation, pressure rinsing, ultrasonic techniques, utilization of a test bench, gravimetric and microscopic analysis.

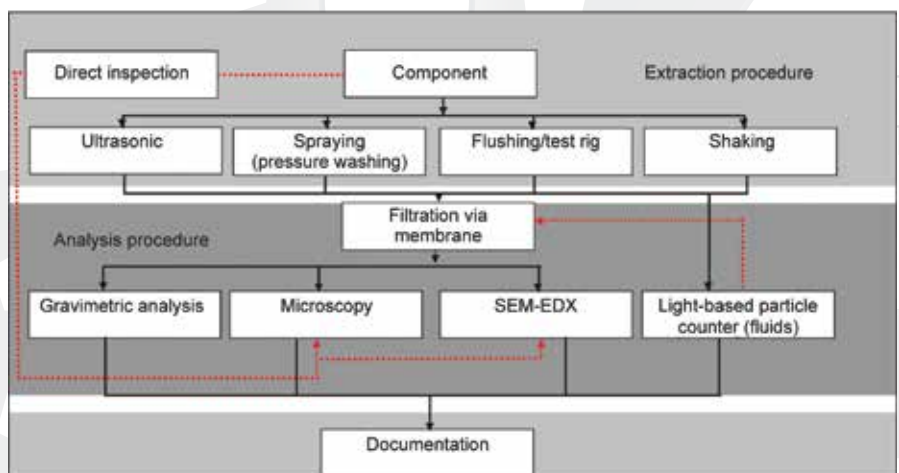
VDA-19 is the European counterpart to ISO 16232 as it relates to automotive manufacturing.

Companies in the automotive, agricultural and construction machine industry apply and use these procedures to determine the technical cleanliness. Cleanliness specifications are drawn up and forwarded to suppliers so that component requirements can be met and monitored. These analyses are carried out predominantly in-house or in independent laboratories established specifically to analyze component cleanliness.

Customers can apply to the **HYDAC Fluid Care Center**, to have component cleanliness carried out (in addition to media and filter analysis).



Determining the particle contamination in the HYDAC lab



Process Water / Cooling & Lubrication / Parts Washing

Modern production technology requires consistent high quality fluids to ensure maximum availability of equipment as well as ease of maintenance and low operating costs.

HYDAC offers products for continuously separating solid particles from low-viscosity fluids such as cooling lubricants, washing emulsions, machining oils. These solutions protect process function, increase the life expectancy and service life of components and systems and improve the quality of the medium being filtered.

Solutions from HYDAC Filtration

AutoFilt® TwistFlow Strainer - ATF

With filtration ratings of between 200 µm and 3,000 µm, the AutoFilt® TwistFlow Strainer (ATF) is particularly suited to the intermittent separation of solid particles from preferably water-based or low-viscosity fluids.

- Suitable for wide variability in the quality of untreated water
- Flow rates up to 1500 gpm with minimal pressure drop
- Continuous filtration, self-cleaning, low maintenance



AutoFilt® RF3 / RF7 Back-flushing Filter

Automatic self-cleaning filters designed for continuous and maintenance free filtration in all sectors of industry for water filtration.

- Available in coarse (> 200 µm) and fine filtration (200 to 25 µm)
- Flow rates from 20 gpm to 31,000 gpm, 150 psi
- Fully automated, low maintenance and operating costs

AutoFilt® RF4 Back-flushing Filter

A self-cleaning system for removing particles from low-viscosity fluids. Automatic cleaning starts as soon as the elements become contaminated. The flow of filtrate is not interrupted during the back-flushing.

- Tried-and-tested function principle, compact design
- Flow rates up to 70 gpm, 150 psi
- Fully automated, low maintenance and operating costs



Element Technology

Wedgewire Elements – Stainless steel elements for residue-free cleaning, fewer back flushing cycles, even flow characteristics

Conical Supermesh Elements – Used for applications with the highest cleanliness requirements — highly efficient cleaning due to optimal velocity distribution in the 3-layer element materials

Ion eXchange Elements – Designed to condition phosphate ester based fluids, effective removal of soaps and acids

Dimicron Elements – Distinguished for high contamination retention capacity due to the glass fiber layers. The folded construction of the elements enables a high flow rate.



Process Inline Filter - PLF1

Suitable for the continuous separation of solids from low-viscosity fluids.

- High dirt holding capacity and compact design and high filtration performance (3 to 90 μm)
- No transfer of dirt during element change out
- Flow rates up to 10,000 gpm, 150 psi



Inline Filtration



Pressure/Inline filters produce the lowest system contamination levels assuring clean fluid for sensitive high-pressure components.

- Varying sizes for a variety of applications, flow range from 30 gpm to 600 gpm, up to 600 psi
- Duplex inline filters available for non-interrupted service
- Variety of designs, materials, and elements for optimal application compatibility

Duplex Filtration

- Flow rates up to 100 gpm, 900 psi
- Duplex filtration allows for uninterrupted operation during element change out.



Off Line Separator Water - OLSW

Used for separating free mineral oil from aqueous cleaning fluids in accordance with the coalescence principle.

- Removes oil from contaminated washing fluids (< 10% oil by volume), 5 gpm
- Coalescing non-absorbing elements for near unlimited service life
- Turn key solution, optional automatic oil drain



Wombat - WBF

The Wombat filter housing is used in particular for pre- and main filtration of fluids. It is used in high contamination retention capacity as well as a low pressure drop.

- Very high fluid purity vs. filter bags (1 to 40 μm)
- Lower pressure drop (up to 30% less)
- High temperature stability and designed for rapid change out

Process Bag Filter - PBF

Suitable for continuous filtering of solid contamination from low-viscosity fluids, such as cooling lubricants, washing emulsions and processing oils.

- User-friendly, reliable, versatile, high-quality construction
- Low procurement costs and rapid change out
- Outstanding bypass-free sealing



Manufacturing, Machining, Molding and Forming

From 70% to 80% of all breakdowns in hydraulic and lubrication systems are due to contamination.

HYDAC offers a comprehensive range of easy-to-use measurement and analysis equipment to monitor fluid condition and filtration solutions—to maintain system requirements, reducing life cycle costs, and total cost of ownership.

HYDAC Solutions - Filtration & Condition Monitoring



Medium and High Pressure Filters

- Flows up to 180 gpm, pressures up to 6,000 psi
- Brand labelling to protect spare parts business
- Elements also available in DIN standards

In-tank / Inline Return Filters

- Non-welded housings prevent fatigue failure
- Various porting options to allow for easy installation
- Flows up to 3900 gpm, 360 psi



Breathers and Suction Strainers

- Various accessory products to ensure system cleanliness
- Desiccant and filter breathers to optimize tank environments and limit particulate and water ingress
- Strainers for all media types, port sizes, and mesh rating

Varnish Mitigation Unit - VMU

- User-friendly, reliable, versatile, high-quality construction
- Low procurement costs and rapid change out
- Flow up to 2.4 gpm, 116 psi
- Turbine oil applications



Element Technology

Optimicon® Elements – Optimized in respect of filtration performance and energy efficiency. They offer the best combination when it comes to separation efficiency, service life and differential pressure.

Stat-Free® Elements – The innovative element technology which protects hydraulic and lubrication systems safely against electrostatic charging.

Betamicon® 4 Elements – Leaps ahead in system performance resulting in reduced life cycle cost.



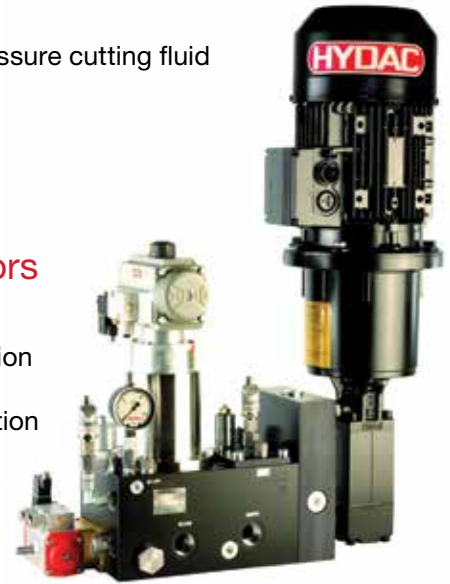
Process Booster Unit - PBB

- Compact modular design simplifies traditional large complex high pressure cutting fluid supply systems
- Simple install, small footprint, and minimal maintenance
- 1000 psi operating pressure, 20 gpm flow rate



Water and Contamination Sensors - CS 1000 Block Kit

- Online measurement of solid contamination and water (optional AS 1000/3000)
- Compact and rugged plug and play solution
- Early detection results in avoidance of operation interruptions



Metallic Contamination Sensor - MCS

- Measurement of metallic particles > 70 µm
- Early detection of component and gear damage
- Avoidance of expensive system breakdowns



Pressure Switches

- Compact electronic pressure switches with digital display
- Up to 2 switching outputs, one reversible analog output
- Simple handling through key programming

Fluid Level Sensors

- Electronic level switch with integrated display
- Up to 4 switching outputs to include warnings on overflow, water ingress, or suction of air into the pump for example

Pressure and Temperature Transmitters

- High precision pressure transducer accuracy +/-0.15%
- Outstanding EMC Characteristics
- Rugged and compact design

Flow Rate Transmitters

- Available in flow ratings from 0.25 gpm to 160 gpm
- Pressure ratings up to 5800 psi
- Additional connection options available



End-of-Line Testing / Roll-Off Cleanliness

“Roll-Off Cleanliness” is the fluid system contamination level of equipment at the time of release from an assembly or rebuild line, and is a leading cause in early (0-km) failures.

This deals with contamination that is “built in” to equipment:

- Due to contamination that already exists in the new fluid
- Due to contamination that is already in supplied components
- Due to contamination introduced during the assembly process
- Results in costly warranty claims in the field and production line downtime
- Negatively impacts quality control and tracing of product



New oil as delivered in **tanker**

ISO 20/18/15



New oil as delivered in **mini-container**

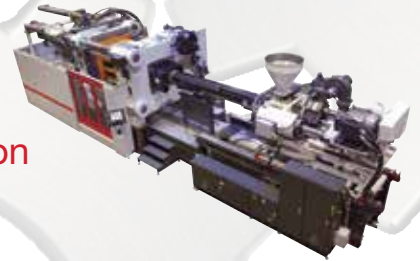
ISO 17/15/13



New oil as delivered in **barrels**

ISO 23/21/18

Filtration Solution

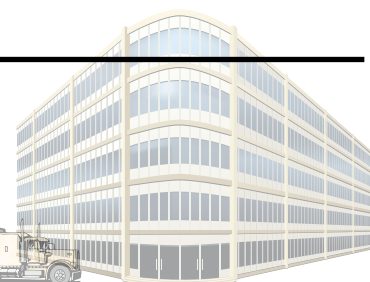
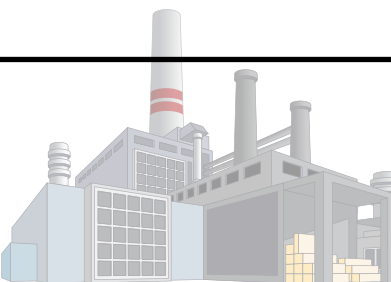
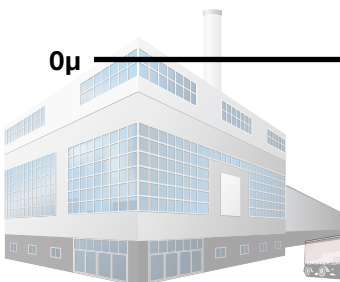
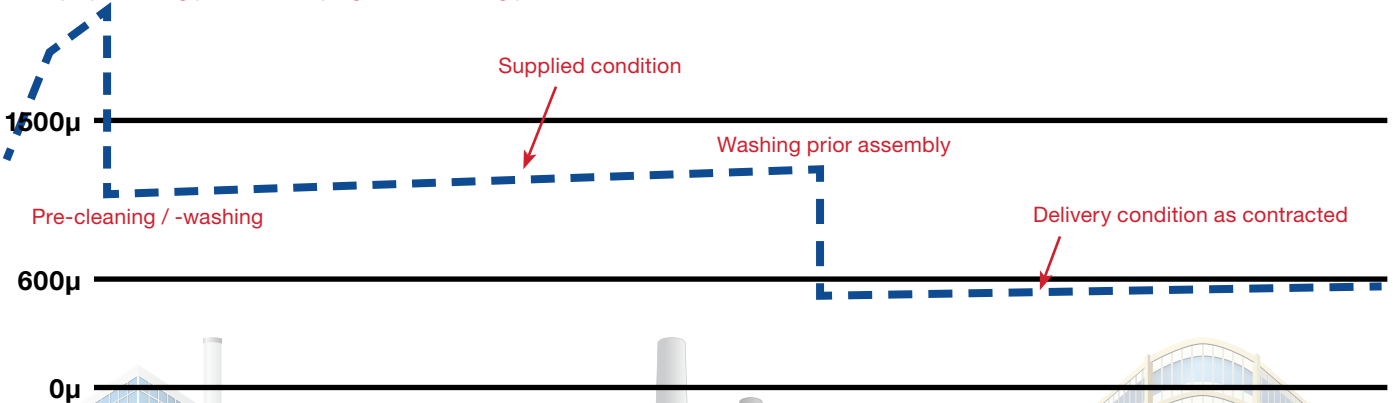


ISO 16/14/11
Demanded by modern hydraulic systems



Component Contamination in the Process Chain

Chips producing process, shaping manufacturing process



Raw Materials → Logistics → Manufacturing → Logistics → End User

HYDAC Solutions - Filtration & Condition Monitoring



Compact Offline Filters - OLF Compact

- Integrated pump & motor units for a compact cost effective solution
- Filtration of fluids for intermittently operated systems
- Designed for systems with reservoirs up to 1000 gallons

Contamination Sensor Module - CSM 1000

- CS1220 Contamination Sensor with integrated pump/motor
- Monitoring system for continuous measurement of solid contamination in fluids with high air content
 - Ideal for test bench validation of hydraulics components prior to shipment



Hand-held Portable Filter - OF7

- Ideal for flushing and changing oil of small hydraulic systems
- Off-line filtration of systems with inadequate filtering capacity
- Removes particulate contamination

Offline Filter Carts - OFCS/OFCD

- Cost effective solution for end of assembly and functional testing
- High efficiency, high capacity elements for particulate and free water removal
- Simple time based method for roll off cleanliness

Offline Filter Systems - OFS & OFS-AM

- Provides visibility and traceability of data previously unavailable or unmanaged, making true predictive maintenance a reality
- Programmable cleanliness levels and automatic switch-off
- Asset history management and record keeping for trending



Portable Measuring & Data Logging - HMG 3010

- User-friendly, robust design with full color graphic display
- Up to 10 sensor connections and 32 measurement channels
- Measuring rates up to 0.1ms with CAN compatibility



Technical Cleanliness

Clean Components and Clean Systems

Technical cleanliness is becoming increasingly important in many sectors of industry: automotive, machine tools, injection molding, mobile hydraulics, and production systems. High demand for the reduction and prevention of start-up breakdowns and for extended warranty periods is driving the need for improved component cleanliness.

HYDAC Solutions - Condition Monitoring & Analysis



Contamination Test Unit - CTU 1000

- Extraction washer capable of ultrasonic, spraying, flushing and agitation
- Fully enclosed and sealed for optimal consistency
- Filter 1 μm ($\beta_x > 5000$), two tanks, automatic tank change over

Contamination Test Modules - CTM

- Modular system to fit cleaning of specific component types
- Identification and elimination of weak points in processes
- Allows for internal and external process optimization



Fluid Control Units - FCU 1000, 2000

- Portable service unit for measurement of particulate contamination, water saturation, and fluid temperatures in hydraulic systems
- Cleanliness classes in accordance with ISO and SAE and/or NAS

Process Chain Analysis

- On-site service, documenting the current condition
- Evaluation of the technical cleanliness according to VDA 19/ISO 16232
- Optimization of the production process, implementation and monitoring

< 100 - 200 μm

< 100 - 250 μm

< 250 - 400 μm

< 250 - 500 μm

< 400 - 600 μm

Typical particle sizes in the automotive sector



HYDAC Lab Services

Performing analysis to current standards
**ISO16232, VDA 19, internal company standards
 or customer specifications**

Technical Cleanliness Analysis

- Gravimetric analysis per ISO 4405 (mg/component)
- Particulate identification utilizing a light microscope: number, size distribution and type of particle per ISO 16232
- Four testing locations: Leetsdale, PA; Bethlehem, PA; Glendale Heights, IL; Denver, NC for local expertise and flexible coverage
- Automated microscopic particle counting and size classification
- SEM-EDX on request
- Small to large part sampling (6 cylinder engine block)
- Full extraction, analysis, and documentation
- Technical Cleanliness Experts to assist with consultation, process chain analysis, implementation and monitoring



Fluid Care Center

- Fluid Analysis – Fluid cleanliness, viscosity, conductivity, water content, gravimetric and microscopic particle analysis
- Automatic Particle Counter – Oil analysis per ISO 4406
- Multi-Pass Test Stand – Filter efficiencies (β), dirt holding capacity (DHC), beta stabilities, collapse/burst and pressure drop
- Dynamic Multi-Pass – Utilize customer dynamic loading profile to better understand real world filter efficiency and dirt holding capability
- Karl Fisher Titration System – Water content determination
- Bubble Point Test - Filter element integrity testing
- And many other tests to validate element performance and design
- Locations: Bethlehem, PA and Leetsdale, PA



Particle Size (µm)	Total No. of Particles	No. of Reflecting Particles
5 - 15	39.731	6.873
15 - 25	8.287	1.877
25 - 50	4.352	2.195
50 - 100	856	619
100 - 150	98	79
150 - 200	42	37
200 - 400	29	25
400 - 600	3	3
600 - 1000	0	0
>1000	1	1

Pore Size of Membrane	5 µm
Total / Component	0.6 mg

Chart results of successful reduction of particle count.

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