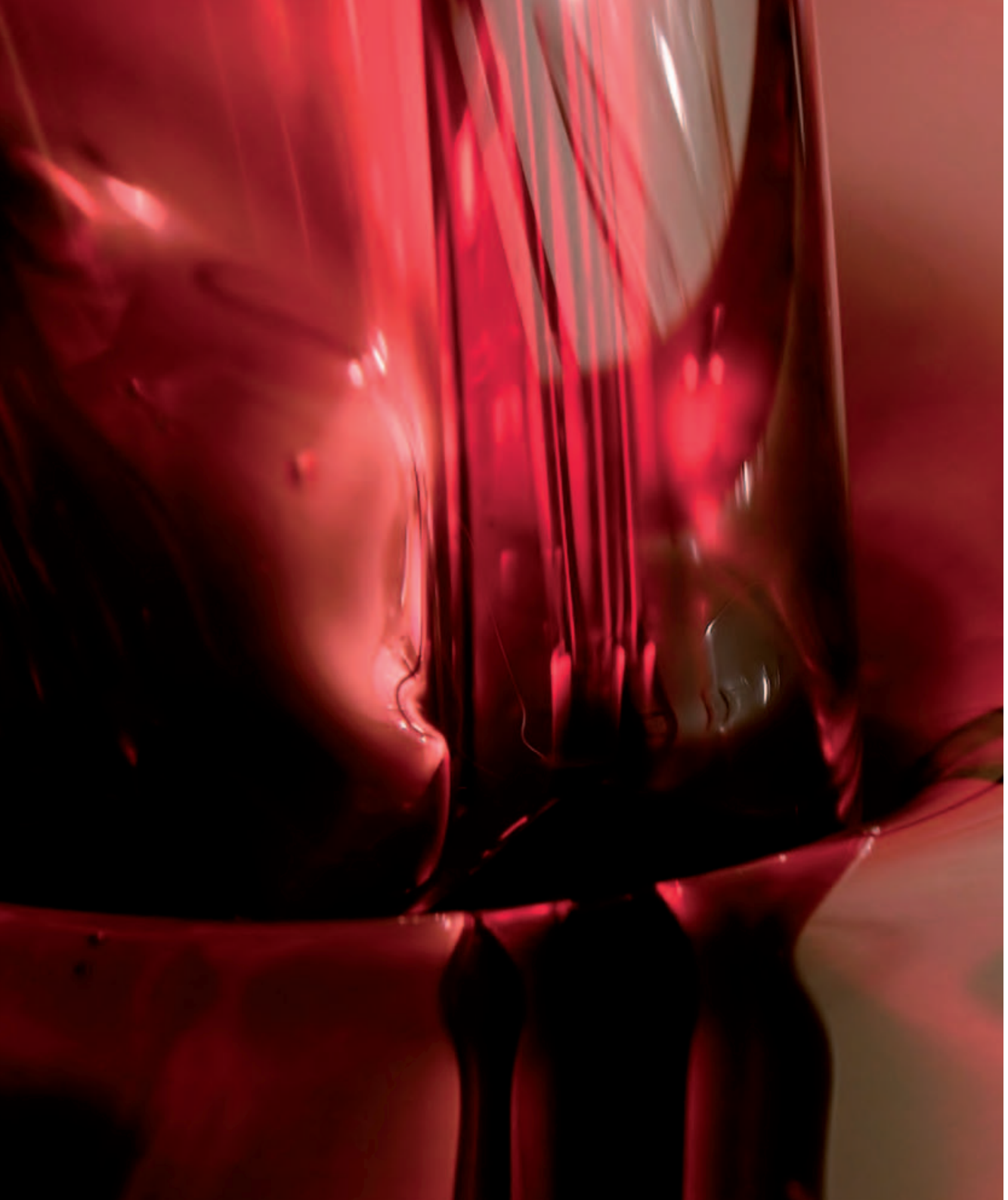


PAMAS
Partikelmess- und Analysesysteme

IN THE WORLD OF PARTICLES PAMAS COUNTS

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GLOBAL PLAYER

Founded in 1992 PAMAS is a private, self financed, independent company that has sustained solid responsible growth through its own efforts.

PAMAS Partikelmess- und Analysesysteme GmbH is based near Stuttgart Germany. We develop, produce and sell highquality devices for particle measuring and analysis.

A largely branched network of subsidiaries and representations working closely together with the head office in Germany, globally insure a consistently high level of solution-oriented systems.

Operating worldwide through our satellite offices and representatives we can be found offering solutions wherever hydraulic machines or lubricating systems are being used, where it is necessary to control complex applications of the chemical and pharmaceutical industry or where water requires treatment. PAMAS particle counters are the number-one choice for all these applications.

VISIONS

PAMAS stands for continuous innovation and evolution within our field of expertise. PAMAS offers continuous progress; we believe technical stability at the highest level will maintain its quality only by conversion and upgrading. With this in mind, we also optimise continuously our quality management. In 2003, the PAMAS company obtained its first certification as per ISO 9001.

DEVELOPMENT

Our findings not only feed into our products. We also make our expertise available to numerous standardization committees and other industry bodies to develop standards where we are actively contributing.

Whether it is about optoelectronics, mechanical engineering, programming, electrical engineering or mechatronics – the multidisciplinary exchange of our experts and close coordination during the whole development process excludes many sources of error from the very beginning.

It is our demand to be always one step ahead. We are proud of our successes and our knowledge in the field of volumetric measuring technology.

SERVICE

PAMAS has a worldwide network of subsidiaries and agencies which is continuously expanding.

Repairs can be performed and spare parts made available worldwide within 24 hours since all subsidiaries and agencies are disposing of the same knowledge as the parent company in Germany.

PAMAS maintains a close knit network of qualified service engineers who are up to date regarding relevant developments. Due to the continuous rotational training program we can reduce or eliminate product downtime to a minimum.

PRODUCTION

The prototypes of our devices are developed in-house at the PAMAS headquarters in Rutesheim. High technology suppliers, certified by PAMAS, support us in the serial production.

The actual finishing or the final assembly and the quality control, before delivery to our customer, takes place at the internal production of the parent company.



OIL



In hydraulic and lubricating oil systems, particle counters are used for oil contamination analysis. Permanent condition monitoring of hydraulic and lubrication oil systems is a pre-requisite for continuous operation: Preventive analysis methods make a future need of repair and maintenance predictable. The portable particle counters of the **PAMAS S40** product series can be used for batch and online sampling and for on-site measurements. With the aid of pressure reducer devices, the particle counters are adapted to sample fluid viscosity and to environmental pressure. The customer hence gets a tailor-made analysing system that has been individually manufactured for his specific application.

PAMAS particle counters can cope with high pressures up to 420 bar and thus are ideal instruments for the analysis of hydraulic fluids: During online measurement, the pressurized hydraulic fluid is analysed under real conditions in its original physical state during operation. A particle analysis under real conditions enables to detect the real level of contamination as it indeed occurs during operation. The result of online measurement thus reflects the real cleanliness level in the fluid power system.

In tribology systems, high viscous lubricating oil is used to reduce friction and to divert heat. The oil lays as lubrication film between mechanical parts and prevents abrasion (e.g. in gear boxes, bearings and motors).

Furthermore, Automatic Particle Counters are also used for the quality control of insulating oil in liquid filled power transformers. Particles in the oil affect the dielectric strength of the insulating oil. Depending on the type of particles (metallic, fibres, sludge, water), a flash-over might be generated, since contaminants in the oil diminish the distance between conductors. In case of particles in the insulating oil, the oil itself turns into an electric conductor and hence has no more an insulating function. A flash-over in insulating oil may lead to a break-down of the system and increases danger of explosion or fire hazard. The quality control of insulating oil thus is a key issue in preventive oil condition monitoring.



HEAVY EARTH MOVING MACHINERY



For the purpose of preventive and proactive maintenance, automatic particle counters are used to control the cleanliness of hydraulic fluids. Hydraulic fluids are used for power and energy transmission in fluid power systems. The pressurised fluid transfers energy from a pump to a power machine. The quality of hydraulic fluids mostly is adapted to the application type. In aviation, fluid power is done with hardly inflammable fluids. In the offshore sector however, environmentally friendly hydraulic fluids on water basis are preferred, as they are biodegradable and they cause little harm if they accidentally flow into sea water. The most common hydraulic fluids are mineral oil-based fluids. Hydraulic oil is used e.g. in mobile hydraulic systems including agricultural machinery, forklift and pallet trucks, hoists and in construction machinery.

Hydraulic oil is mostly analysed according to a cleanliness standard such as ISO 4406:1999 (Hydraulic fluid power - Method for coding the level of contamination) or SAE AS 4059 (Aerospace fluid power - Contamination classification for hydraulic fluids). The measuring result shows how many particles of a certain size are included in one millilitre of the sample fluid. As per ISO 4406, particle counts are reported for the three size channels > 4 µm(c), > 6 µm(c) and > 14 µm(c). The standard SAE AS 4059 requires a more differentiated particle analysis in six size channels > 4 µm(c), > 6 µm(c), > 14 µm(c), > 21 µm(c), > 38 µm(c) and > 70 µm(c). From the result, the user knows if the oil needs to be cleaned. An extraordinarily high number of particles in the oil is a sign for abrasive and wear particles or for a damaged filter. With the aid of particle counting, the user knows at an early stage if hydraulic components or the filter are damaged.

In the special case of heavy earth moving machinery, hydraulic fluids are mostly analysed directly on site. The on-site analysis is done via online measurement, i.e. the fluid is led through a bypass out of the system and it flows directly into the particle counter. After the measurement, the analysed sample fluid can either be fed back into a reservoir or drained into a waste container. In opposition to offline measurement in a laboratory, online measurement in the field does not only save time and money, but it also impedes the need for sample preparation. Phenomena of sample storage, like sedimentation and agglomeration, do not occur at all during online measurement, for the sample fluid is not transported into a laboratory. So there is no need to refill or store the sample fluid.

PAMAS offers the portable particle counting devices **PAMAS S40** and **PAMAS S4031** for this purpose. The instruments can be used both for online and batch sampling. The **PAMAS S40** analyses fluids like oil, fuel and phosphate-ester and reports the results in 8 size channels. With its 32 free selectable size channels, the **PAMAS S4031** can be used for a more differentiated particle analysis.

FUEL ANALYSIS

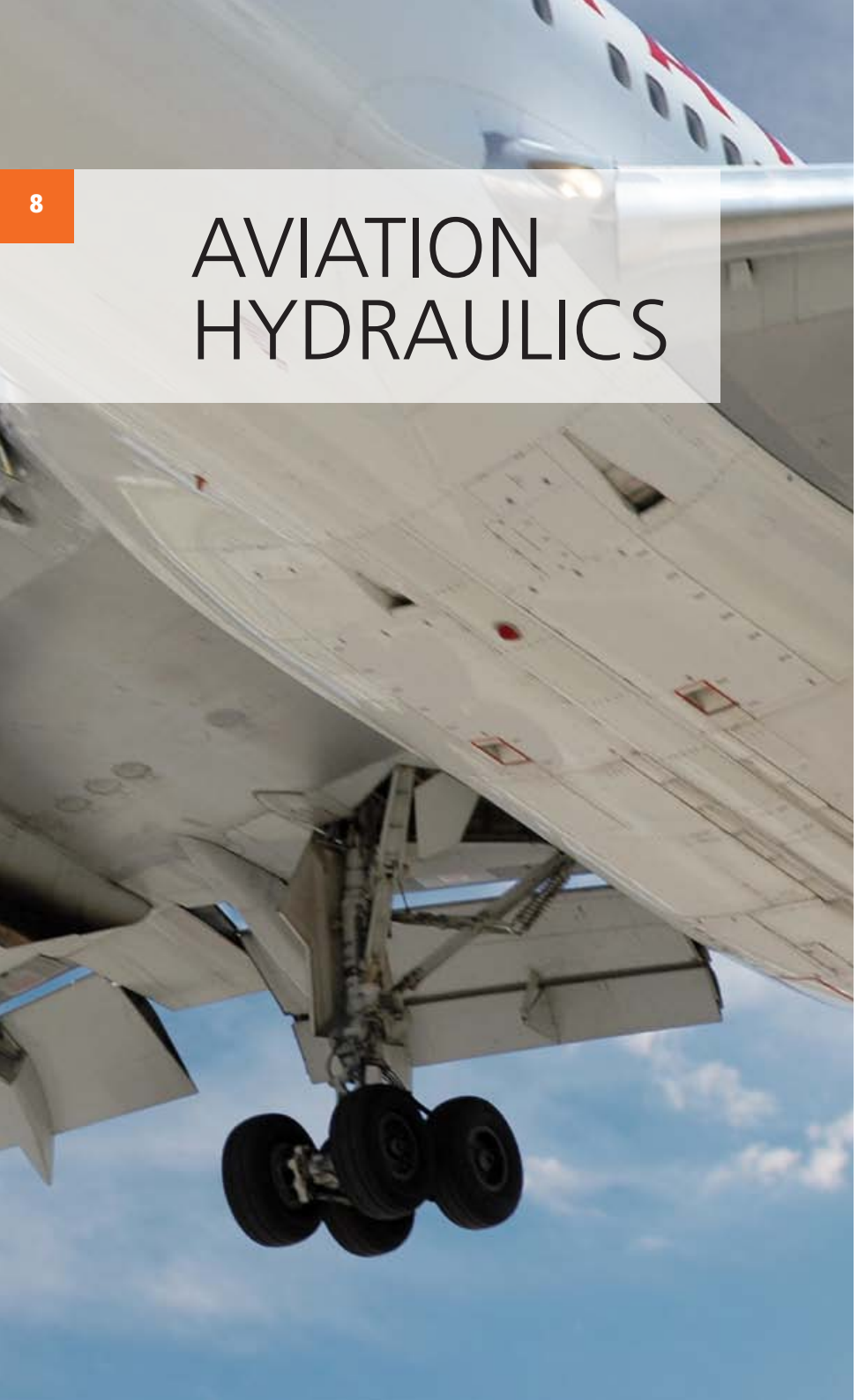


Fuel is less viscous than oil. In low viscous fluids, the particles slump down in the liquid and build a sediment at the bottom of the bottle (sedimentation). Individual particles might also stick together during storage and become agglomerated bigger particles (agglomeration). Before a sample can be analysed via laboratory measurement instruments, it needs to be prepared with applied mechanical energy to redisperse the particles in the liquid. Before undertaking laboratory particle analyses, the sample thus must be adequately prepared for measurement.

In case of online measurement, sample preparation is not at all afforded, as the liquid is directly taken in a state as it typically occurs during operation. To avoid phenomena of sedimentation and agglomeration during measurement, particle counters for fuel analysis are equipped with special structural alterations at the flow path, adapting them best to the specific requirements of fuel condition monitoring. For Jetfuel analysis, PAMAS has developed the portable particle counter **PAMAS S40 AVTUR** which can be used both for online and batch sampling. The system is compliant with the IP 577 analysing method of the Energy Institute London and to the DEF STAN 91-91 standard of the British Ministry of Defence.

Fuel containing free water can be analysed with the **PAMAS S50DP** online particle counter. This instrument is equipped with an integrated dilution system which continuously adds a programmable amount of a low viscous solvent to the raw sample fluid before online measurement. Without prior dilution, free standing water in fuel would lead to false measurements. In the **PAMAS S50DP**, the water droplets in the fuel sample are dispersed in the added solvent and thus do not affect the subsequent online measurement any longer.

AVIATION HYDRAULICS



The cleanliness control of hydraulic fluids is a typical application of optical particle counting with the aid of an Automatic Particle Counter. Hydraulic fluids are used for the transfer of energy in hydraulic systems. For smooth operation and uninterrupted maintenance of functionality, it is essential that the operating liquid is regularly controlled; a high degree of contamination could cause a malfunction within a component and may also lead to a complete system break-down.

Different types of hydraulic fluids are used for different types of application. The three main types of hydraulic fluids are: oil based liquids (e.g. mineral oil), biodegradable hydraulic fluids (e.g. water glycol or polyglycols) and fire-resisting or hardly inflammable liquids (e.g. Skydrol®).

Fire resisting or hardly inflammable hydraulic fluids are applied in environments where mineral oils cannot be used due to an elevated fire hazard (e.g. in mining or in aviation). Skydrol® is a common hydraulic fluid used in commercial aviation. This fire resisting fluid is based on phosphate ester and additives. Besides fire resistance, Skydrol® also has another key advantage: It can be used at low temperatures in cold environments and at very high altitude, and it is mainly applied for the hydraulic motion of aircraft components.

Skydrol® is a highly corrosive liquid and therefore incompatible with some types of substances. To avoid corrosion, particle counters for the analysis of Skydrol® are produced with chemically stable materials recommended by the manufacturer. For the analysis of Skydrol®, PAMAS offers laboratory, online and portable particle counters: among these, there are the models **PAMAS S40**, **PAMAS S40 GO** and **PAMAS SBSS**. Due to its intelligent flow path structure and its high quality component compatibility, a single **PAMAS SBSS** instrument can be used for both oil based fluids and for Skydrol®.

For safety and ecologic reasons, hydraulic systems in the offshore Oil&Gas industry are operated with biodegradable hydraulic liquids. These water-glycols cause less harm than oil based hydraulic fluids if they accidentally flow into sea water. Water based fluids are also preferred because of their stable viscosity degree regardless oscillating temperature. Furthermore, they are fire resisting and hardly inflammable. Water based hydraulic fluids are used in the following offshore applications: Subsea Christmas Trees and Wellhead Assemblies, Hydraulic Power Units, Hydraulic Accumulators, Subsea Umbilicals, Hydraulic Valves and Control Systems.

For the use in dedicated offshore applications, PAMAS has designed specific instruments which are adapted to the contamination analysis of water-based fluids: The portable particle counters **PAMAS S4031 WG** and **PAMAS S4031 GO WG** and the laboratory instruments **PAMAS SBSS WG** and **PAMAS FastPatch 2 GO** and the online unit **PAMAS OLS50P WG** are ideal instruments for the analysis of water based hydraulic fluids and are compatible with the following hydraulic liquids: MacDermid Oceanic HW 540/443/443R, Castrol Transaqua, Pelagic 100, Aqualink 325-F Houghton, Aqualink HT804F and Aqualink 300-F. Due to their reliability, PAMAS instruments for offshore applications are tried and tested with a reputation for dependability in the most demanding production environments.



WATER BASED HYDRAULICS

PHARMACY



For the particle analysis of pharmaceutical fluids, PAMAS provides two laboratory instruments with different options and equipment. Due to this variety, the user is able to select the ideal particle analysing system for the individual fluid and the specific application.

The analysing instrument **PAMAS SVSS** (Small Volume Syringe System) is designed for the analysis of low viscous fluids including infusion solutions, parenterals, pharmaceutical suspensions and intravenous or ophthalmic liquids. For higher viscosity samples or for fluids containing gas bubbles, PAMAS offers the measuring instrument **PAMAS SBSS** (Syringe Bottle Sampling System). This user-friendly laboratory instrument offers full flexibility as virtually all measuring parameters can be pre-set and adapted to the specific application by the user. The main benefit of the **PAMAS SBSS** laboratory instrument is the integrated pressure container. This sample vessel is used to create either a high pressure or vacuum atmosphere that is safely enclosed within the locked container. High pressure is applied to transport high viscous liquids through the sensor for measurement, whereas the vacuum mode removes gas bubbles out of the sample.

The laboratory instruments **PAMAS SBSS** and **PAMAS SVSS** and the corresponding **PAMAS USP** software are fully compliant with 21 CFR Part 11 and fulfil the requirements of the USP, EP, BP, JP, KP and IPC pharmacopoeia.

Both standard instruments are also available with optional equipment for the analysis of small sample volumes: With the help of the optional Small Volume Kit, the **PAMAS SVSS** is able to measure small volumes of low viscosity samples out of containers down to 1 ml. As with the **PAMAS SVSS**, the **PAMAS SBSS** can also be optionally equipped for small sample volumes. With the help of an optional small pressure container, higher viscosity liquids in small volume ampoules down to 1.5 ml can be analysed under pressure.



For applications in the chemical sector, PAMAS offers specially equipped particle counting systems. The flow path and the sensor measuring cells can be adapted to aggressive fluids. Materials that are used for such applications are non-corrosive and chemically stable.

FILTER



Filter efficiency testing is another application field of Automatic Particle Counters. The performance of a filter depends on its efficiency and its retention grade: A good filter retains solid particles more efficiently than a filter of low quality.

There are various standardised test methods to determine the characteristics and quality of a filter. These methods mostly refer to the specific conditions dependent on the industry sector (e.g. test methods for water filters or for hydraulic filters).

The Multi Pass Filter Test is standardised by ISO 16889. Its performance can be greatly improved by the use of Automatic Particle Counters. This test rig determines three filter characteristics: the beta value, the retention grade and the particulate holding capacity of the filter. Two automatic particle counters are used on this test rig, allowing simultaneous upstream and downstream measurements. Unlike the Single Pass Filter Test, the liquid circulates continuously through the test rig on the Multi Pass Filter Test. A constant dirt volume is permanently filled in this test circle. This amount of contaminant is partly retained by the test filter; what remains runs again through the system and is then exposed to the filter during the next circulation. The Multi Pass Filter Test is performed until a certain pressure difference is achieved.



For Single Pass & Multi Pass Filter test rigs, PAMAS has developed the filter efficiency and ß-ratio measuring system, the **PAMAS 4132**. The system fits in to the test rigs of filter manufacturers and analyses various liquids (e.g. oil, fuel, water, etc.).

WATER



There are various existing methods to determine whether water is clean and free from particulate contamination. In water treatment systems, both particle counters and turbidimeters or nephelometers are used for water quality control. Whereas turbidimetres and nephelometres indicate the degree of turbidity which is caused by the particle contamination, an Automatic Particle Counter detects every single particle that passes the sensor cell during measurement. The knowledge of the particle sizes is of paramount importance in water applications, as it helps to quickly identify certain types of bacteria or even a failure in the system (e.g. break-through of a membrane filter). The Automatic Particle Counter thus gives more versatile and significant results than a turbidimeter.

For dedicated water applications, PAMAS offers four online measuring instruments: The **PAMAS WaterViewer** is installed as a fixed stationary instrument for water condition monitoring. The system is the ideal instrument for the analysis of potable water, process water, purified waste water or raw water. For condition monitoring, it may be connected to several measuring points.

The PAMAS WaterViewer has been tried, tested and trusted for many years and considered by many users as an accurate and reliable measuring instrument for water applications. A multitude of existing publications and scientific papers prove that the **PAMAS WaterViewer** is used for scientific research at many universities in Europe, e.g. at the Technical University Delft in the Netherlands, at the University of Lorraine in France and at the University of Kuopio in Finland. As an example, the **PAMAS WaterViewer** helped to identify relevant factors for the ideal construction of water distribution pipeline systems and the most efficient filtration speed required in pool water treatment.

The second system especially designed for the use in coagulation and water treatment is the floc size analyser **PAMAS FSA-2002**. Water is often treated by adding flocculents. These flocculation agents are used to gather solid contaminants to particulate agglomerates. Before the process of filtration or sedimentation commences, the floc size and quantity is analysed using the **PAMAS FSA-2002** online particle counter. Precise information about the particle size helps to verify and to determine if amount and quantity of the flocculation agents are sufficient for an efficient filtration or if the process needs to be modified.

The third system PAMAS offers for online measurement of water is the **PAMAS OLS4031** online particle counter, which is equipped with 32 size channels.

If water samples shall be measured directly in the field, the **PAMAS S4031** portable particle counter is the ideal instrument for water analysis on-site.



FLUID PARTICLE COUNTING

The German company PAMAS develops, manufactures and sells Automatic Particle Counters for fluid cleanliness control. The advanced and highly sophisticated sensor technology enables the detection of particle sizes down to 0.5 microns.

It is impossible to detect particles in liquids and to analyse the actual level of contamination with the naked eye. A variety of analysing technologies can be used to measure particle contamination in liquids. However, methods such as gravimetric or microscopic membrane analyses are time-consuming or they depend on the operator's skills and thus they are not objective.

Automatic particle counters offer the quickest objective method of particle contamination analysis in liquids. These measuring instruments count solid particles and classify them according to their size. Every solid particle is measured in the individual size range of the analysing sensor.

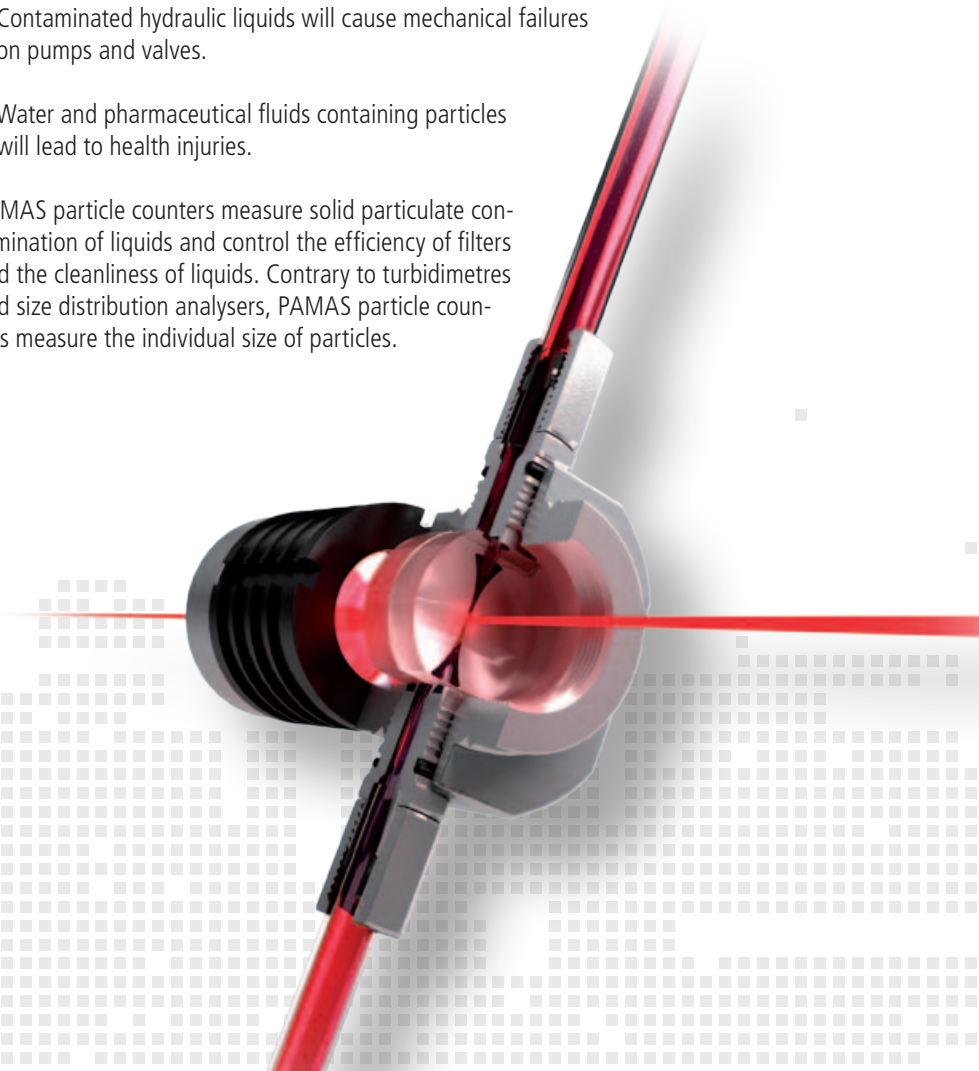
Particles circulating at high speed and pressure in the liquids of turbines, power plants, gearboxes and offshore applications are capable of damaging mechanical parts of the system. Particle contamination affects not only the quality of a specific liquid (e.g. pharmaceutical solutions, drinking water and process water), but also the connected components and machines (e.g. aviation turbines and hydraulic components).

Particle measuring technology is used to control cleanliness of liquids and to identify quality deficiencies and excessive wear in order to avoid eventual costly machine failures.

Application examples:

- Particle contamination in lube oil will damage the bearings of moving components.
- Contaminated hydraulic liquids will cause mechanical failures on pumps and valves.
- Water and pharmaceutical fluids containing particles will lead to health injuries.

PAMAS particle counters measure solid particulate contamination of liquids and control the efficiency of filters and the cleanliness of liquids. Contrary to turbidimetres and size distribution analysers, PAMAS particle counters measure the individual size of particles.



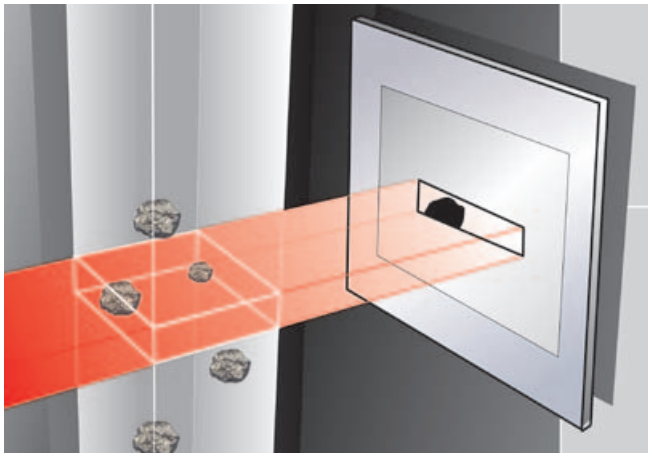
PHYSICAL MEASURING PRINCIPLES: METHODS OF LIGHT EXTINCTION AND OF LIGHT SCATTERING

Optical particle counters work with the help of light. In optical measurement proceedings, the light beams through the liquid. The electromagnetic waves may be deflected or absorbed when meeting the particles in the measuring cell. The light effect on the particles is analysed with the help of a previously calibrated optical electronic hardware.

Contamination analysis with the help of a PAMAS particle counter determines the quantity and the size of particles in a liquid. There are two basic principles of contamination analysis: the principle of Light Extinction (according to which particle sensors of the series PAMAS HCB-LD proceed) and the principle of Light Scattering (according to which the particle sensor PAMAS SLS-25/25 works).

Method of Light Extinction with the sensors of the PAMAS HCB-LD series

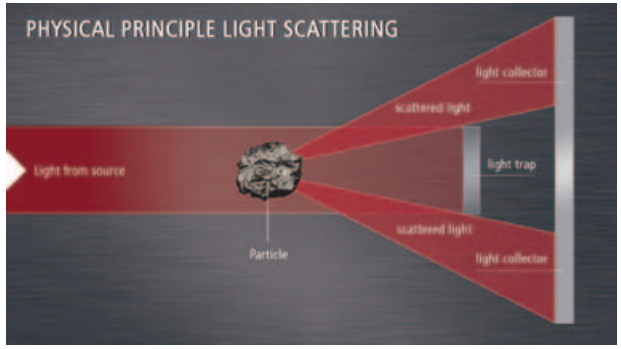
Particle counting with light blockage sensors



According to the principle of Light Extinction, the liquid flows through the measuring cell of the sensor. The size of the measuring cell is different for each application. On one side of the measuring cell, there is a light beam, on the other side there is a photodetector. If the liquid is pure and clean and does not contain any particles, then the light would beam unhamperedly through the cell.
However, if there are particles in the liquid, then the light beam hits the particles and as a result, the shadow of the particle is shown on the photo-detector. The surface of the shadow causes a voltage change in the photodetector and indicates the size of the particle flowing through the sensor cell. The particle counter transfers the number of shadows in the photo-detector into the quantity of particles in the liquid. Furthermore, the particle sizes are distributed in different size classes.

Light Scattering Method with the PAMAS SLS-25/25 sensor

Physical principle of the PAMAS SLS-25/25 scattered light sensor



Light rays shining on a surface are reflected and the refracted rays scatter in all directions. The procedure of the Light Scattering Technique is similar to that of Light Extinction: on their flow path, the particles also flow through the illuminated volume of the measuring cell. In the case of Light Scattering, the scattered light rays are analysed instead of the extincted ones. The light rays which are not deflected or scattered are absorbed by a separate light trap. If there aren't any particles in the measuring cell, the light is completely absorbed by the light trap.

CALIBRATION STANDARDS

Measuring accuracy of automatic particle counters is guaranteed through calibration. Depending on the application, PAMAS particle counters are calibrated according to the international calibration standards ISO 11171, ISO 4402 or ISO 21501. All three calibration standards are published by the International Organization for Standardization (ISO) in Geneva. Particle counters for water and pharmaceutical applications are calibrated with monodisperse latex spheres according to ISO 21501. For oil applications, the calibration standards ISO 11171 and ISO 4402 are applied. The two calibration standards ISO 11171 and ISO 4402 mainly differ in three aspects: the type of calibration material, the definition of particle size and the industry they are applied in.

Calibration according to ISO 11171

The ISO 11171 calibration standard defines guidelines for the calibration of Automatic Particle Counters (APC) for the contamination analysis of hydraulic fluids. The first edition of the standard was published in 1999 and revised in 2010. With its defined guidelines for a standard calibration of Automatic Particle Counters, the ISO 11171 assures the exact determination of the particle size distribution and a high measuring accuracy. ISO 11171 defines the particle size as the diameter of a circle equal in area (equivalent projected surface). The abbreviation „µm(c)" marks the standardized particle sizes; the (c) represents the calibration of Automatic Particle Counters according to ISO 11171. This abbreviation enables to distinguish between the old dimension unit as per ISO 4402 and the new dimension unit as per ISO 11171. The particle size 1 µm corresponds to approximately 4 µm(c). As per ISO 11171, Automatic Particle Counters are calibrated with the ISO MTD medium test dust.

Calibration according to ISO 21501

The calibration of particle counters with monodisperse latex spheres is defined through the ISO 21501 calibration standard. ISO 21501 is subdivided into four parts: ISO 21501-2 defines the calibration of liquid-borne particle counters with an integrated scattered light sensor, whereas the third part of the standard, ISO 21501-3, is dedicated to liquid-borne particle counters that work according to the light extinction principle. The first part and the fourth part of the ISO 21501 calibration standard target particle counting in gaseous media with the aid of aerosol spectrometers and airborne particle counters.

Calibration according to ISO 4402 (withdrawn)

The calibration standard ISO 4402 stipulates the use of ACFTD (Air Cleaner Fine Test Dust). Today, ACFTD is no longer available, as the production of this material ceased in 1992. The ISO 4402 calibration standard thus is not a current standard, although it is still used in many sectors. As per ISO 4402, the particle size is measured in the measuring unit „µm". ISO 4402 defines the particle size as equal to its longest dimension.



COMMON CLEANLINESS STANDARDS

An automatic particle counter reports the measuring results in cumulative or differential particle counts and in the measuring unit „particles per millilitre“. According to user requirements, the particle counts can also be assigned to cleanliness classes. There are nine approved industrial standards commonly used for fluid cleanliness classification and for the report of contamination levels. The standards were established to enable uniform fluid cleanliness classification. With the help of these standards, the user can easily and quickly assess the fluid's contamination level.

Example: The triple code according to ISO 4406:1999 refers to the size intervals > 4 µm(c), > 6 µm(c) and > 14 µm(c). The code 18/16/13 indicates that the liquid contains more than 1.300 and up to and including 2.500 particles per millilitre (code 18) of particle sizes larger than 4 µm(c). There are more than 320 and up to and including 640 particles per millilitre (code 16) sizing more than 6 µm(c). The interval from more than 40 and up to and including 80 particles per millilitre is attributed to code number 13, which means that there are more than 40 and up to including 80 particles per millilitre in the liquid which measure more than 14 µm(c).

Standard	Calibrating procedure and Calibration material	Particle size channels
DEF STAN 91-91	Procedure: ISO 11171 Test dust: ISO MTD	three size intervals for the particle sizes > 4 µm(c), > 6 µm(c) and > 14 µm(c)
GJB 420	Procedure: ISO 11171 Test dust: ISO MTD	six size intervals for the particle sizes > 4 µm(c), > 6 µm(c), > 14 µm(c), > 21 µm(c), > 38 µm(c) and > 70 µm(c)
GOST 17216	Procedure: ISO 4402 Test dust: ACFTD	size intervals between 0,5 and 200 µm
ISO 4406:1987 (withdrawn)	Procedure: ISO 4402 Test dust: ACFTD	two or three size intervals > 5 µm and > 15 µm or > 2 µm, > 5 µm and > 14 µm
ISO 4406:1999	Procedure: ISO 11171 Test dust: ISO MTD	three size intervals for the particle sizes > 4 µm(c), > 6 µm(c) and > 14 µm(c)
NAS 1638 (withdrawn)	Procedure: usually ISO 4402 Test dust: ACFTD	five size intervals for the particle sizes > 5 µm, > 15 µm, > 25 µm, > 50 µm and > 100 µm
SAE AS 4059	Procedure: ISO 11171 Test dust: ISO MTD	six size intervals for the particle sizes > 4 µm(c), > 6 µm(c), > 14 µm(c), > 21 µm(c), > 38 µm(c) and > 70 µm(c)
VDA-19	Procedure: ISO 11171 / ISO 21501 Test dust: ISO MTD / monodisperse latex spheres	ten size intervals for the particle sizes > 5 µm, > 15 µm, > 25 µm, > 50 µm, > 100 µm, > 150 µm, > 200 µm, > 400 µm, > 600 µm and > 1000 µm
ISO 16232-10	Procedure: ISO 11171 / ISO 21501 Test dust: ISO MTD / monodisperse latex spheres	ten size intervals for the particle sizes > 5 µm, > 15 µm, > 25 µm, > 50 µm, > 100 µm, > 150 µm, > 200 µm, > 400 µm, > 600 µm and > 1000 µm

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