



Safe Operations

Quality assurance of
materials and equipment
for the Armed Forces

**PEOPLE
YOU
CAN
TRUST**

 **Metrohm**



No compromises when it comes to our security

**The armed forces protect
and defend our security.
That is their daily mission.**

This mission can only be ensured if materials and complex technical systems are available at all times and perform reliably under the harshest conditions. This requires a high level of maintenance and suitable analytical methods.

That is where we come in.



Metrohm is a world-leading manufacturer of chemical analysis equipment for the civilian and military sectors for testing the quality of operating supplies, equipment, and materials for the armed forces – safely and reliably according to proven and standardized methods. The range of applications for our instruments extends from determining the quality of fuels and lubricants to monitoring cooling and drinking water to the

quality testing of food and pharmaceuticals. The quality inspection of explosives and fire extinguishing powders as well as corrosion measurements and solutions for virus diagnostics are additional applications that can give you an idea of the scope of our solutions. Numerous armed forces already rely on our analyzers and collaborate with us on R&D projects. Discover how we can support you as well.

Analysis of fuels and lubricants – reliably and accurately

Our solutions for testing fuels and lubricants

TESTING LUBRICATING OILS AND HYDRAULIC OILS

Vehicle, ship, and aircraft units

- Determination of Total Acid Number (TAN) by thermometric titration (in accordance with ASTM D8045) or potentiometric titration (in accordance with ASTM D664)
- Determination of Total Base Number (TBN) by potentiometric titration (in accordance with ASTM D2896)
- Determination of water content in fuels by coulometric Karl Fischer titration (in accordance with ASTM D6304)

Fuels such as kerosene, diesel, and gasoline must be of the highest quality. These substances cannot be stored indefinitely, as they are subject to a natural oxidation process, i.e. aging. This produces by-products that promote corrosion even at very low concentrations.

The same applies to high performance lubricants and hydraulic oils that are exposed to ambient air. These corrosive by-products also develop during the combustion of fuels in turbines. The

effect is the same: the alloys of turbines and hydraulic systems are attacked and deteriorate as a result.

In particular, the parameters that must be closely watched for the quality control of fuels and lubricants are Total Acid Number and Total Base Number. Both parameters are determined by titration in accordance with ASTM standards. Our automated titration systems are the preferred solution for this purpose.



QUALITY DETERMINATION OF FUELS

Aviation fuel, diesel, gasoline

- Determination of Total Acid Number (TAN) by potentiometric titration (in accordance with ASTM D664)
- Research Octane Number (RON), Motor Octane Number (MON), flash, pouring, and cloud point, cetane number, API number and viscosity by near infrared spectroscopy
- Antioxidants (amines and phenols) by means of voltammetry (in accordance with ASTM D6971)
- Quantification of mercaptan sulfur (in accordance with ISO 3012, ASTM D3227)

Water analysis – stationary, semi-stationary, and mobile

The following applications give an overview of our solution portfolio for water analysis

COOLING WATER MONITORING on ships

- pH measurement (by direct measurement)
- Monitoring the service life of various corrosion inhibitors (by ion chromatography)

DRINKING WATER MONITORING

- Measurement of standard ions (EPA 300.1), oxohalides (EPA 300.1, 317.0, 326.0, DIN EN ISO 15061) and chromate (EPA 218.7) by ion chromatography
- Perchlorate by ion chromatography (EPA 314)

Water is essential. Safe and reliable drinking water analysis must be readily available everywhere to ensure the supply of fresh drinking water to the troops. Biological contaminants must be monitored, but also in particular the concentration of dissolved metals and other inorganic contaminants. Equally important is water as an operating fluid in the form of cooling or boiler feed water for drive systems. The pH value and chemical impurities are particularly critical here. In low concentrations these impurities promote

corrosion and/or result in deposits, for example, in the water-steam cycle of nuclear as well as conventional ship propulsion systems. We offer armed forces a comprehensive range of analytical methods and instruments for water testing both for the analysis of cooling and boiler feed water as well as for stationary, semi-mobile, and mobile drinking water analysis. Wherever you are, you can rely on trusted Metrohm instruments to safeguard your water source.

COOLING WATER IN THE PRIMARY AND SECONDARY CIRCUITS

Nuclear-powered ships

- Boric acid by titration
- Anions by ion chromatography
- Cations (alkali metals, alkaline earth metals, amines) by ion chromatography

SAFEGUARDING THE QUALITY OF BREATHING AIR ON SUBMARINES

- Online analysis of amine-containing washing solutions by titration

BOILER FEED WATER of conventional ship propulsion systems

- Anions by ion chromatography
- Cations by ion chromatography



MEASURING CORROSION

Changes in electrochemical conditions on metallic surfaces reveal hidden corrosion processes. These processes must be measured and suppressed before they become critical. Our solutions:

- Measurement of corrosion processes on steel
- Corrosion measurement of critical machine components on ships
- Optimization of sacrificial anodes

PROTECTING AGAINST CORROSION

Metallic surfaces (e.g., steel) can be protected against corrosion by electrochemical coating (electroplating). Our solutions:

- Monitoring of electroplated chromium, cadmium, copper, nickel, silver, brine, and zinc baths by titration and voltammetry
- Monitoring of anodizing, etching, phosphate, cleaning, and stripper baths

Corrosion tests and material testing using electrochemical methods

Corrosion is a wear process that attacks alloys and decomposes over time. The visible effect is the formation of rust. We offer armed forces extensive know-how and technical solutions for

corrosion measurement and material testing, along with reliable monitoring of galvanic baths and analysis of cooling and boiler feed water.

PREVENTING CORROSION

During the running operation of turbines of conventional and nuclear ship propulsion systems, corrosion can be slowed down or completely prevented by the alkaline provision of cooling and feed water or the addition of inhibitors (e.g., phosphates). Our expertise:

- Measurement of corrosion inhibitors in cooling water and antifreeze for cooling water by ion chromatography
- Determination of anions, cations and amines in cooling water by ion chromatography
- Measurement of chloride and sulfate in heavy oil by combustion IC
- pH measurement of cooling water on ships and submarines

Reliable quality control of explosives

Numerous quality parameters of explosives can be monitored with Metrohm analysis methods and equipment, especially water content. The method of choice is Karl Fischer titration because it directly measures water content, is specific to water, and the smallest quantities can be precisely determined.

DETONATORS AND EXPLOSIVE ORDNANCES

- Identity and quality testing by Raman spectroscopy
- Identification of critical substances in explosive ordnance clearance by Raman spectroscopy
- Determination of azides in detonators by Raman spectroscopy

DETERMINATION OF WATER CONTENT IN NITRO COMPOUNDS

- Water content by coulometric Karl Fischer titration



DETERMINATION OF WATER CONTENT IN EXPLOSIVES

- Water content determination by Karl Fischer titration
- Water content by near infrared spectroscopy

DETERMINATION OF TETRAZENE IN IGNITION MIXTURES

- Quality control by near infrared spectroscopy

DETERMINATION OF PICRIC ACID AND STYPHNIC ACID

- Quality control by ion chromatography

Solutions for other fields of application: food, pharmaceuticals, military medicine

Other applications of our analytical solutions include quality testing of foodstuffs and pharmaceuticals. The application spectrum is broad and ranges from the analysis of Active Pharmaceutical Ingredients (APIs), excipients, and impurities in pharmaceuticals to the determination

of sugars, vitamins, and trace elements in foods. For many of the methods used for these analyses, we have developed applications that are compliant with the standards of regulatory authorities such as the FDA or other standards developing organizations such as DIN, ASTM, etc.

Here is an overview of Metrohm system solutions that are already used by armed forces





QUALITY CONTROL OF PHARMACEUTICALS

- Determination of water content by volumetric Karl Fischer titration
- Measurement of infusion solutions: pH, conductivity, anions, cations
- Conformity checks
- Rapid and non-destructive determination of active pharmaceutical ingredients and medication carriers by Raman spectroscopy
- Identification of counterfeits

QUALITY CONTROL OF FIRE EXTINGUISHING POWDER

- Determination of sodium hydrogen carbonate content by titration

PROTECTION AGAINST INFECTIONS

- Rapid tests for antigens, antibodies, and viruses by printed thick film electrodes (SPE voltammetry) and Surface Enhanced Raman Scattering (SERS)

QUALITY CONTROL OF FOODSTUFFS

- Determination of sugars by ion chromatography
- Measurement of vitamin C by voltammetry
- Determination of Total Acid Number by titration
- Targeted detection of pesticides by Raman spectroscopy

We are here for you worldwide



Local service and support – worldwide

- Subsidiaries
- Exclusive distributor



Since our company was founded more than 75 years ago, our headquarters, including development and production, has been located in Herisau, Switzerland. We are owned by the private Metrohm Foundation and are not listed on the stock exchange, and focus on the development of the latest analytical technologies.

We have more than 40 of our own subsidiaries worldwide, through which we supply our customers and support them directly on site with service and user knowledge. In some countries we work solely with exclusive distributors; all in all, we are at your service in over 120 countries.



