Solutions from upstream to downstream

Petroleum Industry
Anton Paar, the market leader in the development and manufacturing of reliable and accurate measuring instrumentation, is your trusted partner for optimizing production processes at key points. We specialize in increasing the productivity of routines in many areas of refining, processing, distributing, and trading of petrochemical products. To meet our customers’ various needs, we offer a full-range portfolio. From the analysis of crude oil to the testing of fuels and biofuels, lubricants, liquefied petroleum gas, asphalt, and much more, you can be certain you will find the right solution for your laboratory or process environment.

- **Safeguard** your processes and people with high-quality instruments and integrated safety features
- **Enhance** your productivity with automated solutions and minimal operator interaction
- **Maximize** your production output and eliminate product loss due to quick measurements and fast reaction times
- **Certify** your products according to relevant standards and specifications
- **Reduce** waste and environmental impact by using smaller samples and fewer solvents
- **Save** time thanks to fast measurements and minimum sample preparation
Your tomorrow is our mission

YOUR CHALLENGES
We support you in your challenges: complying with national and international regulations, reaching maximum efficiency in the development of new products, meeting the highest safety standards, and fulfilling current requirements for sustainable procedures and technologies.

OUR PORTFOLIO
Our instruments are at hand for the analysis of crude oil, fuels, lubricants, and asphalts at the refinery, before transport and distribution, and for consumers as well as testing laboratories. Instruments by Anton Paar are known for their reliability, accuracy, and robust construction.

Analysis for exploration and oil recovery
Fuel analysis at refineries
Lubricant analysis at refineries
Asphalt and bitumen analysis at refineries
Transportation and storage of finished products
Analysis of raw materials, petroleum products, and oil-condition monitoring

UPSTREAM DOWNSTREAM DOWNSTREAM DOWNSTREAM MIDSTREAM TESTING LABORATORIES

We are confident in the high quality of our instruments. That’s why we provide full warranty for three years.

All new instruments* include repair for 3 years.
You avoid unforeseen costs and can always rely on your instrument.
Alongside the warranty we offer a wide range of additional services and maintenance options.

*Due to the technology they use, some instruments require maintenance according to a maintenance schedule. Complying with the maintenance schedule is a prerequisite for the 3-year warranty.

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Broadest standards compliance on the market

CRUDE OIL
Density D5002
Viscosity D7042
Cold flow properties D5853

FUEL OIL
ASTM: D396, D2880
EN: EN 14214
ISO: ISO 4261, ISO 8213
Density D4052, ISO 12185
Viscosity D7042
Cold flow properties ISO 3016
Pennsky-Martens flash point D93, EN ISO 2719
Distillation D86, ISO 3405

AVGAS
ASTM: D910, D9227, D7047, D7263
Density D4052, ISO 12185
Pennsky-Martens flash point D93, EN ISO 2719
Distillation D86, ISO 3405
Gum content D381, ISO 6246

DIESEL & BIODIESEL
ASTM: D975, D8751, D7467
EN: EN 590, EN 14214, EN 15540, EN 16709, EN 16734
Viscosity D7042, EN 16806, ISO 23581
Oxidation stability D7545, EN 16091
Cold flow properties D6371, D2500, ISO 3015, EN 23015, ASTM D97
Pennsky-Martens flash point D93, EN ISO 2719
Distillation D86, ISO 3405

AVIATION TURBINE FUELS
ASTM: D1655, D7566
DEF STAN 21-498
INCA 4025
Density D4052, ISO 12185
Viscosity D7042
Pennsky-Martens flash point D93, EN ISO 2719
Abel/Tag flash point D56, EN ISO 13736
Distillation D86, ISO 3405

KEROSINE
ASTM: D3699
Viscosity D7042
Abel/Tag flash point D56, EN ISO 13736
Distillation D86, ISO 3405

ASPHALT
ASTM: D440, D2321, D3381
D5076, D5114, D8373, D3220
EN: EN 12591, EN 13108, EN 14023
ISO 15122, EN 12591, EN 12591
Density D4052, ISO 12185
Penetration D5, EN 1426
Softening point D36, EN 1427
Fraass Breaking Point EN 12 583
Cleveland flash & fire point D92, ISO 2992

ETHANOL
ASTM: D4606
Density D4052, ISO 12185
Distillation D86, ISO 3405
Gum content D381, ISO 6246

GASOLINE
ASTM: D4814, D5797, D5798, D8011
EN: EN 228, EN 15293
Density D4052, ISO 12185
Oxidation stability D525, D7525, ISO 7536
Distillation D86, ISO 3405
Gum content D381, ISO 6246

FURTHER TEST METHODS
Density D7777, D7961, IP 365, IP559
Viscosity D2161, D2270, D2501, D2502, IP 626
Oxidation stability D8206
Penetration D5, D217, D1321, D1403
Distillation D850, D1078
Refractive index D1218
Elemental analysis D7876
Evaluate crude oil properties by using Anton Paar’s measuring instruments. Receive hard facts to make decisions about the drilling process, yield improvement, crude oil treatment, and transportation.

Using measuring instruments to evaluate and simulate conditions at the well will help you to optimize the drilling process and take the right steps to improve reservoir yield. To support your crude oil exploration, Anton Paar offers a wide range of solutions for crude oil analysis, including measurement of density, viscosity, and rheological behavior. Knowledge of these parameters gives you the information you need to optimize your crude oil treatment and ensure hassle-free transportation to the refinery. As the refining process is highly sensitive to changes in the crude oil composition, constant monitoring with reliable instrumentation enables you to react immediately to any deviations in output quality and process safety.

### USE CASES

- **Choosing the right extraction strategy based on actual reservoir conditions**
- **Determining the bubble point to increase the extraction potential of the well**
- **Improving drill fluid management**
- **Checking the purity of crude oil after treatment**
- **Evaluating the flow behavior to obtain good pumpability**

### BENEFITS

- Characterize the composition of artificially changed crude oil in pressure-volume-temperature studies by measuring density to increase the exploitable reservoir capacity by up to 80%.
- Expand the extraction potential of a well by up to 40% by measuring the technology-based determination of the bubble point.
- This will reduce the costs for crude oil recovery and ensure well bore stability by optimizing the drilling fluid performance without on-site presence or sample drawing.
- Determine automatically the °API for crude oil classification and checking the crude oil purity within 30 seconds in just 1 measurement.
- Ensure the most economic pipeline transport conditions by simulating and fine-tuning the crude oil's flow behavior.

### USE CASES BENEFITS

<table>
<thead>
<tr>
<th>DENSITY</th>
<th>VISCOSITY</th>
<th>RHEOLOGICAL PROPERTIES</th>
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**UPSTREAM**

**Analysis for exploration and oil recovery**
From fuel research to fuel quality testing, using analytical instruments at key points in your work will help you increase productivity and maximize returns.

At the refinery, measuring technology can help you ensure that incoming crude oil keeps flowing as it should and that the additives you use have the right composition when delivered. Our instruments provide process and laboratory measurements to identify incoming raw material, monitor production processes, or conduct quality testing of final products ranging from jet fuel to heavy bunker oils. Anton Paar’s devices determine parameters such as density, viscosity, distillation behavior, flash point, or oxidation in full compliance with ASTM, EN, or ISO. Automated measurements relieve your lab personnel, increase efficiency, and minimize handling errors. Anton Paar’s instruments assess the best time to make distillation cuts and ensure that the final products meet specifications. They also speed up the time required for sample preparation in elemental analysis. For researching new products as well as reducing carbon emissions and overall environmental impact, our portfolio offers the equipment you need.

### USE CASES
- Determining the cloud and pour point of incoming crude oil
- Certifying petroleum products and novel biofuels according to relevant standards
- Automating data management to increase productivity
- Precisely measuring the mass of final products to ensure profitable trading and a reliable basis for account settlement
- Optimizing sample preparation (digestion) for elemental analysis (ICP)
- Characterizing new fuels, blends, and solvents during research and development
- Measuring fully and automatically the density and viscosity of highly viscous samples
- Obtaining the correct boiling point characterization during crude oil and fuel distillation
- Atmospheric distillation measurement according to ASTM D86
- Checking the composition of incoming additives used for cracking and other manufacturing steps to ensure safe operation

### BENEFITS
- Ensure the right concentration of additives to keep the crude oil moving (along the pipeline).
- Achieve the highest accuracy and convenient quality control for efficient, fast, and error-free process and product safety.
- Reduce the work load of lab personnel, eliminate the risk of human error, and ensure data integrity.
- Save time and money when trading goods by using mass-to-volume conversion.
- You will save time and increase safety during routine sample preparation.
- Benefit from economically efficient measurements and get several physical parameters with easy-to-use instruments to save time.
- Minimize the operator’s contact with hot substances, increase your lab’s safety and productivity, and eliminate potential human errors.
- Safely and accurately simulate the distillation in the lab to maximize process output and meet environmental regulations.
- Benefit from step-by-step user guidance to ensure that distillation results comply to ASTM D86 and avoid repeated testing due to possible operator error.
- Quickly and correctly identify and prevent hazardous reactions due to mixups and eliminate risk for personnel and process plants.
At all steps in a refinery – from vacuum distillation to solvent extraction, hydro treatment to blending – Anton Paar’s measuring solutions help you optimize your processes.

Automated measurements with Anton Paar’s benchtop devices relieve your personnel of repetitive work, increase efficiency, and minimize handling errors, e.g. when conducting product certification in the lab to ensure compliance with the required specifications. Our instruments for sample preparation provide digested samples in a fraction of the time required by conventional methods, allowing you to get on with elemental analysis with ICP, e.g. for lubricant contamination analysis. During distillation, for instance, our instrumentation can help you to assess the best time to make distillation cuts. Our portfolio offers the viscometers, rheometers, penetrometers, density meters, and flash point testers you need: for research into new and improved products as well as for the reduction of carbon emissions and overall environmental impact.
Using analytical instruments at key points in asphalt and bitumen quality testing will help you increase productivity and maximize returns.

In order to guarantee that asphalt and bitumen withstand all potential environmental conditions, analysis of their material properties during development and quality control is required. Anton Paar’s measuring devices help you fine-tune the elasticity of your asphalt/bitumen products by analyzing the additives used. Results from our measuring instruments form the basis for evaluating the long-term stability of bitumen emulsions as well as the deformation and flow behavior of asphalt compositions. We also provide solutions for determining parameters, such as softening point, penetration, and breaking point in order to assess consistency. Our devices support you in certifying asphalt binders according to standards and in calculating the mass of bitumen from a known volume for account settlement purposes.

### USE CASES

<table>
<thead>
<tr>
<th>USE CASES</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Certifying asphalt binders according to relevant standards</td>
<td>Benefit from increased speed and safety, and take advantage of more user-friendly certification of modified and unmodified asphalt binders and bitumen over a wide temperature range, especially compared to traditional methods.</td>
</tr>
<tr>
<td>Investigating asphalt and bitumen consistency, and rheological properties with automated solutions</td>
<td>Perform measurements without potential human errors; our comprehensive software reduces the complexity of analysis. The rheometer’s active Peltier elements ensure that the set temperature is reached within a few minutes, which significantly reduces the measurement and cleaning time.</td>
</tr>
<tr>
<td>Developing bitumen emulsions to meet design specifications, performance, and stability criteria</td>
<td>Avoid the risk of unintentional product transformations during storage, transport, and processing.</td>
</tr>
<tr>
<td>Determining the purity and composition of bitumen, and classifying mixtures by the gas pycnometry technique</td>
<td>When performing quality control and purity/composition determination of bitumen, reduce the time needed for measurements and virtually eliminate operator error by measuring with a gas pycnometer.</td>
</tr>
<tr>
<td>Characterizing and specifying products</td>
<td>Achieve the highest accuracy and convenient quality control for unrivaled process and product safety.</td>
</tr>
<tr>
<td>Performing temperature calibration at regular intervals to ensure constant measurements</td>
<td>Profit from fully automated temperature calibration and verification procedures, even overnight, with Anton Paar’s rheometer software RheoCompass™.</td>
</tr>
<tr>
<td>Classifying bitumen based on accurate penetration testing</td>
<td>Apply automatic surface detection for fast penetration test results – requiring only a fraction of the time of manual methods – to determine the correct degree of bitumen hardness, and choose the right bitumen type for the asphalt mixture.</td>
</tr>
<tr>
<td>Determining the viscosity of asphalt binders to assure pumpability, mixability, and processability</td>
<td>Take advantage of Anton Paar’s rotational rheometer, equipped with an air counter-cooled temperature device, allowing for fast heating and cooling of the sample.</td>
</tr>
<tr>
<td>Accurately measuring and matching the density of bituminous semi-solids, asphalt binders, and mixtures with paving requirements</td>
<td>Conduct fast and accurate measurements to determine the purity and composition of bitumen, and to classify mixtures.</td>
</tr>
</tbody>
</table>
Use measuring technology to ensure that the quality of the petroleum products you purchase is still the same after storage and transportation to your site.

As a consumer or seller of petroleum products, you need to check the quality or specifications of the fuels you buy or trade. Anton Paar offers a range of devices for this purpose, including checks on the viscosity, density, gum content, and purity of fuel products. We will help you rise to the challenges of stricter legal regulations regarding emissions and environmental impact and the resulting increase in testing and monitoring of fuels whenever they change hands. We have the measuring technology you need to keep pace with developments in the automotive sector, such as improved biofuels, additive technologies, and electric vehicles. Responding to the trend of using liquefied gases in household cooking and heating, we have the testing equipment you need at production and distribution facilities.

### MIDSTREAM

**Transportation and storage of finished products**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Performing on-board checks before refueling aircraft, watercraft, and land vehicles</td>
<td>Avoid damage to engines with correct product identification and checking of fuels for signs of aging and reduced quality.</td>
</tr>
<tr>
<td>Meeting safety legislations for transportation, handling, and selling of final products</td>
<td>Evaluate flammability and volatility to meet regulations and assign hazard classifications according to internationally accepted referee methods.</td>
</tr>
<tr>
<td>Checking for adulteration, biodegradation, and contamination during fuel storage and transportation</td>
<td>Avoid damage to tanks, filters or engines by continuously monitoring parameters indicating contamination during loading and storage operations.</td>
</tr>
<tr>
<td>Unloading fuels and lubricants without losses or mixups</td>
<td>Monitor pumping and unloading processes continuously to avoid contamination and unintentional mixups, and minimize mass balance errors – a requirement for tight financial control of custody transfer points.</td>
</tr>
<tr>
<td>Determining fuel volume and the derived CO₂ tax for aircraft refuelling</td>
<td>Avoid excessive CO₂ tax payments and ensure optimal fuel volume on board the aircraft.</td>
</tr>
<tr>
<td>Determining the storage stability of final products</td>
<td>Meet the performance criteria of fuels and lubricants and make sure that there are no issues with residues or oxidation stability before and after storage, to ensure correct specifications and prevent customer complaints and liability issues.</td>
</tr>
<tr>
<td>Identifying products in hazardous areas on-site</td>
<td>Use a single intrinsically safe device to reliably identify all types of incoming and outgoing goods.</td>
</tr>
<tr>
<td>Calculating the mass of bitumen for trade</td>
<td>Enjoy flawless mass-to-volume conversion of bitumen in only 2 minutes by using a digital bitumen density meter that requires only a few milliliters of sample and cleaning solvents.</td>
</tr>
<tr>
<td>Conducting viscosity analysis of asphalt and bitumen samples at different temperatures (primed by fast heating and cooling rates)</td>
<td>Benefit from Anton Paar’s easy-to-use, stand-alone rotational viscometer, equipped with an air counter-cooled temperature device that allows fast heating and cooling. Use a small sample adapter system to enjoy these advantages with your current rotational viscometer equipment.</td>
</tr>
<tr>
<td>Measuring rheological properties of asphalt binders regularly in quick succession</td>
<td>Quickly investigate rheological properties of samples in the petroleum industry: our rheometer’s active Peltier elements ensure that the set temperature is reached within a few minutes, which significantly reduces the measurement and cleaning time.</td>
</tr>
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</table>
Anton Paar’s analytical instruments enable you to obtain reliable and traceable results for product characterization, classification, and dispute settlement.

As a testing laboratory, you are called on to provide a wide array of analyses: from fuel and diesel oil analysis to fuel quality testing, lube oil testing, and oil-condition monitoring (OCM). Anton Paar’s devices help you to achieve high sample throughput and high-accuracy results. We provide automated filling and cleaning for individual measuring instruments. You can also choose a completely automated platform with integrated robotics for sample processing on an industrial scale. Anton Paar is your partner for the utmost reliability of measured data and provides trusted and traceable result protocols.

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<td>Characterizing and specifying products</td>
<td>Improve efficiency, reduce operator time and operational costs, and increase flexibility and uptime with fast, error-free, and accurate measurements to obtain crucial physical parameters for product characterization.</td>
</tr>
<tr>
<td>Conducting high-throughput rheology measurements for OCM</td>
<td>Benefit from unattended high-throughput measurements which run 24/7, and from results with fewer handling errors and less redundancy.</td>
</tr>
<tr>
<td>Automating measurements and data transfer to increase your productivity</td>
<td>Eliminate the risk of human error, reduce the amount of waste, and greatly improve the repeatability and reproducibility of your analysis.</td>
</tr>
<tr>
<td>Settling disputes in fuel trading</td>
<td>Save time and get the correct results quickly by using mass-to-volume conversion based on reliable and accurate results from the gold standard in digital density measurement.</td>
</tr>
<tr>
<td>Conducting crude oil analysis to evaluate composition, and classify it according to API</td>
<td>Apply cost-effective solutions for fast and flexible classification of °API of crude oils in less than 30 seconds, and determine the viscosity and rheological properties of a wide range of different samples.</td>
</tr>
<tr>
<td>Determining friction and wear as well as the right time for renewing a lubricant</td>
<td>Quick and easy quantification of a lubricant’s long-term performance under given conditions to save your equipment from damage and unnecessary downtimes.</td>
</tr>
<tr>
<td>Preparing samples for elemental analysis, asphalt / bitumen quality, and properties assurance</td>
<td>Prime operating parameters and optimized reaction control, so samples can be fully digested for subsequent error-free elemental analysis. Superior digestion quality can be delivered at up to 300 °C and 199 bar.</td>
</tr>
<tr>
<td>Ensuring asphalt doesn’t crack in winter</td>
<td>To evaluate the performance and quality of asphalt and bitumen under the conditions of its later application, determine the Fraass breaking point and the consistency. This way, the right bitumen can be used for the asphalt mixture to ensure streets make it through a cold winter without any cracks.</td>
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<tr>
<td>Developing bitumen emulsions to meet design specifications, performance, and stability criteria</td>
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