

## ADU 5

Automatic Distillation Unit

::: Volatility ..... Distillation



# Atmospheric Distillation

Distillation tests are used to characterize the volatility of petrochemical products. These volatility characteristics are a critical measurement of the overall performance and safety of hydrocarbon-based fuels.

Petroleum distillation according to ASTM D86 is one of the most common methods used to determine the boiling range characteristics of petroleum products. Since this method is so well established, it still provides the best basis for assessing the behavior of products and processes.

ADU 5 is a fully automated, stand-alone distillation unit which is operated by touch-screen interface. This makes it the ideal solution for performing high-precision atmospheric distillation tests for all standard fuel measurements. In addition, the unit comes ready for the determination of biodiesel and ethanol-blended gasoline, and prepared for automatic dry point detection.

Testing and results are in full compliance with ASTM D86 (Group 0, 1, 2, 3, 4), D850, D1078, ISO 3405, IP 123, IP 195.

## Test principle

According to the strict guidelines described in the applicable standards, a given volume of sample is placed in the distillation flask and distilled under conditions according to the standard. The sample is heated, vapor is formed, the vapor is then cooled in the condenser line and the condensate is collected in a graduated cylinder. During the test, the temperature-recovered volume of condensate and time are precisely recorded.



# Advantages

## Heating optimization

ADU 5 automatically recommends the best distillation conditions according to the selected program. It features an excellent heat control to guarantee an optimum standardized distillation rate even for complicated mixtures. Due to the very reactive Anton Paar heating system the distillation rate of ethanol-blended gasoline showing azeotropic behavior can be constantly maintained between the ASTM D86 limits of 4 mL and 5 mL per minute. The final heat adjustment for the last 5 mL to distillate is applied fully automatically. As and when required, the Anton Paar heat set optimizer automatically suggests optimized heater temperatures after the test run was completed.

## Excellent precision

Thanks to the excellent temperature stability of the receiving chamber, an automatic correction of the results to standard pressure and perfect distillation rate control, ADU 5 guarantees highly accurate results to ensure outstanding repeatability and reproducibility.

## Innovative software

ADU 5 comes with a completely new user interface that can be fully adapted to your preferences. It makes the handling of this important test as easy as possible.

## High level of safety

ADU 5 meets the highest safety standard in its class and the requirements of the latest version of ASTM D86. The distillation unit features an automatic fire-extinguishing system that can be connected to N<sub>2</sub> or CO<sub>2</sub> gas. An automatic shut-off and a low-level detection of the cooling liquid prevent overheating of the unit. The password management system guarantees selective access areas.

## Extended range of application

For operating in an impressively wide range of application, ADU 5 features:

- ▶ Cetane index determination which automatically calculates the cetane index after a density value is inserted
- ▶ Automatic dry point detection system provided as a standard delivery item
- ▶ Preparation of 10 % bottom residue for EN ISO 10370
- ▶ Calculation of the driveability index after the volume of ethanol is inserted
- ▶ An extended temperature range of the condenser line (0 °C to 80 °C) and the sample Pt100 (0 °C to 450 °C)



# Innovative Software

The software of ADU 5 has been fully adapted to your needs, making the handling of this important test as easy as possible.

The user interface is completely adjustable to your preferences. From the main menu you can choose between different displays to show the values you require. Each individual parameter shown in the main menu can be changed by pressing the icons for a second.

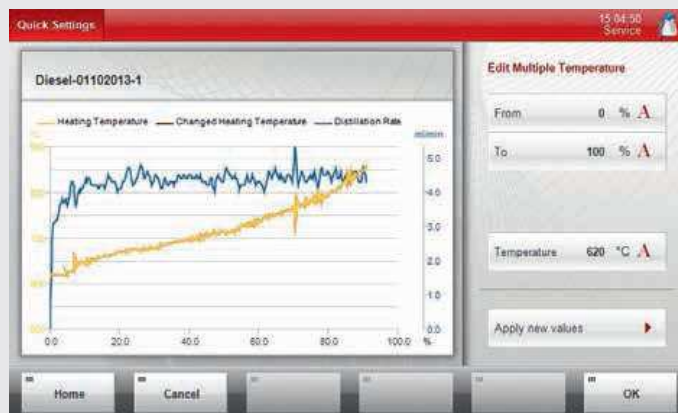
All data can be accessed during the test run. The nominal heater temperatures are displayed in zoom when navigating into the side bar and can be adapted during the initial heating phase.

The “quick settings” button allows quick and easy adaptation of the most important distillation parameters. Using the “based on” icon programs can be copied easily.

Favorite windows can be added to the side bar so you can navigate quickly and easily in the menu. A zoom-in function guarantees a good view of the displayed graphs.

The fix point table, which shows distillation results, is editable even after the test run was completed so you can evaluate other data than those specified by the standard methods.

## Manual heating curve

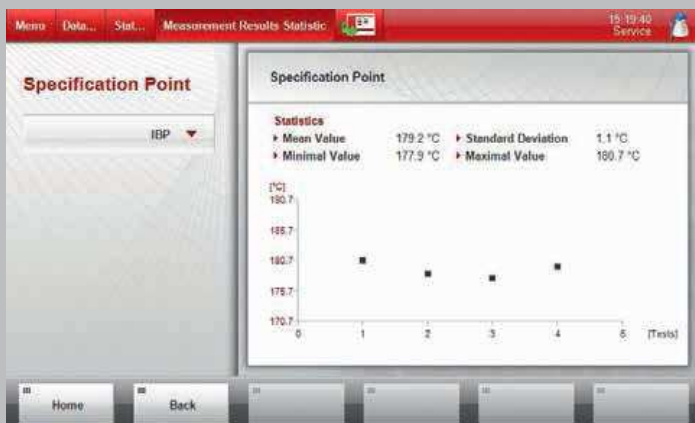


ADU 5 features a manual heating curve. After a test run was completed successfully the heating curve of this test run can be applied when testing the same sample type the next time. By copying the program and activating “use manual heating curve” in the quick settings, the heating curve is shown in the display window, where it can be adapted before starting the next test run. The automatic heat control of ADU 5 will be disabled for this test. This feature helps to optimize the distillation performance, especially for complicated mixtures like ethanol-blended gasoline, and guarantees maximum precision for selected samples.





## Statistics



The ADU 5 software features a well-arranged overview of all relevant statistical data. The statistics program automatically calculates the mean, max and min value and the standard deviation for selected samples. You can choose between different specification points:

- ▶ Initial boiling point
- ▶ Corrected temperature
- ▶ Evaporated temperature
- ▶ Final boiling point

# Accessories



## Standard accessories

To make it ready to start all distillation tests according to ASTM D86 Group 1 to 4, ADU 5 comes with a built-in cooling system and the following accessories:

- ▶ 125 mL distillation flask
- ▶ 100 mL receiving cylinder
- ▶ 5 mL residue measuring cylinder
- ▶ Vapor probe with centering device
- ▶ Heat plates with 38 mm and 50 mm diameter
- ▶ Flask connection
- ▶ Drip plate
- ▶ Condenser cleaner
- ▶ 300 mL test sample with boiling stones

## Special accessories & dry point detection

ADU 5 covers the whole application range of atmospheric distillation with the necessary accessories for ASTM D86 Group 0 and solvent distillation.

- ▶ 200 mL distillation flask
- ▶ Dry point sensor for 125 mL and 200 mL
- ▶ Heat plates with 25 mm and 32 mm diameter

ADU 5 comes already prepared for automatic dry point detection. An additional anti-dazzle screen can be placed in front of the glass window of the door to the heater chamber. This allows a clearer view of the distillation process.



# Specifications

## Standard methods

ASTM D86 (Group 0, 1, 2, 3, 4), D850, D1078, ISO 3405, IP 123, IP 195.

Technical specifications	
<b>Test programs</b>	<ul style="list-style-type: none"> <li>▶ ASTM D86 Group 0 to 4</li> <li>▶ ASTM D850 IBP &lt; 112 °C   ASTM D850 IBP = 112 °C to 145 °C   ASTM D850, IBP &gt; 145 °C</li> <li>▶ ASTM D1078 IBP &lt; 50 °C   ASTM D1078 IBP = 50 °C to 70 °C   ASTM D1078 IBP = 70 °C to 150 °C   ASTM D1078 IBP &gt; 150 °C</li> <li>▶ ISO 3405 Group 0 to 4</li> <li>▶ Hexadecane, toluol and 231 user programs</li> </ul>
<b>Operation</b>	
<b>Temperature range</b>	<ul style="list-style-type: none"> <li>▶ Vapor temperature: 0 °C to +450 °C</li> <li>▶ Condenser temperature: 0 °C to +80 °C</li> <li>▶ Chamber temperature: 0 °C to +50 °C</li> </ul>
<b>Measuring system</b>	<ul style="list-style-type: none"> <li>▶ Pt100 vapor temperature sensor (emergent stem correction is automatically applied)</li> <li>▶ Volume detection by static light barrier system</li> </ul>
<b>Cooling</b>	Built-in liquid cooling system using a mixture of water and glycol
<b>Pressure sensor</b>	Barometric pressure sensor included (results are automatically corrected to standard pressure)
<b>Cetane index</b>	Automatic calculation of the cetane index after a density value has been inserted
<b>Driveability index</b>	Automatic calculation of the driveability index after the ethanol volume has been inserted
<b>Safety</b>	<ul style="list-style-type: none"> <li>▶ Overheat protection, automatic shut-off</li> <li>▶ Overflow protection, automatic shut-off</li> <li>▶ Automated fire-extinguishing system</li> <li>▶ Password protection</li> <li>▶ Low-level detection of cooling liquid</li> </ul>
<b>Detectors</b>	<ul style="list-style-type: none"> <li>▶ Low-level detection of cooling liquid</li> <li>▶ Detection of receiving cylinder (present and empty)</li> <li>▶ Detection of drip plate</li> <li>▶ Detection of Pt100 temperature sensor</li> <li>▶ Detection of dry point sensor</li> <li>▶ Detection of correct chamber position</li> <li>▶ Detection of sensors not connected or defective</li> </ul>
<b>Measurement units</b>	User can select between °C and °F as well as kPa, mbar, psi, hPa, mmHg and mWC
<b>Individual operators</b>	Up to 50
<b>Languages</b>	German and English
<b>Documentation</b>	
<b>Data memory</b>	500 results
<b>Data export</b>	<ul style="list-style-type: none"> <li>▶ LIMS connectivity</li> <li>▶ Export of measurement results to memory stick (pdf, Excel)</li> <li>▶ Data printout to a ticket printer or all supported Anton Paar printers</li> </ul>
<b>Interfaces</b>	USB, RS232, LAN
<b>Data input options</b>	Keyboard, mouse, bar code reader
<b>Display</b>	Color touchscreen
<b>Requirements and dimensions</b>	
<b>Power supply</b>	230 V, 50 Hz, 3000 W
<b>Gas supply</b>	Nitrogen or CO <sub>2</sub> (6 bar to 12 bar)
<b>Dimensions</b>	410 mm x 650 mm x 850 mm (W x D x H)
<b>Weight net</b>	54 kg
<b>Options and accessories</b>	Ticket printer, bar code reader, CRM reference material, anti-dazzle screen, dry point sensor for 125 mL and 200 mL distillation flask, glassware for solvents and Group 0 distillation

[www.anton-paar.com](http://www.anton-paar.com)