THE WORLD'S LEADING
VAPOR PRESSURE
COMPANY

GRABNER
INSTRUMENTS

www.grabner-instruments.com

MINIVAP VPS / VPSH
CRUDE OIL PACKAGE
MINIVOL LVR
MINIVAP LPG

AMETEK®

MINIVAP VPS and VPSH

The Standard for Vapor Pressure Testing of Gasonline and Crude Oil

Vapor pressure is an important physical property of volatile liquids especially of spark-ignition engine fuels. It provides an indication of how a fuel will perform under different operating conditions. For example, vapor pressure is a factor in determining, whether a fuel will cause vapor locks at high ambient temperature or at high altitude, or will provide easy starting at low ambient temperatures. Petroleum product specifications are regulated by various governmental agencies. Maximum vapor pressure limits for gasoline are legally mandated in many areas as a measure of air pollution control.

! WHAT CUSTOMERS SAY ABOUT THE MINIVAP

»Grab a Grabner VPS, it´s worth the value. We have two!«

Masroni Sabini, Laboratory Technologist, Shell Eastern Petroleum (Pte) Ltd., Singapore

From "REID" to "GRABNER"

In 1927, the German chemist Reid developed a method for vapor pressure determination of gasoline. In 1930 the ASTM published this procedure for vapor pressure of gasoline, crude oil, and other volatile petroleum products as ASTM D323. In response to a need for a method suitable for oxygenated and non-oxygenated gasoline a new test method termed ASTM D4953 (dry method) was developed by the ASTM based on the D323 standard. Advanced measuring technology facilitated the development of next generation vapor pressure instrumentation resulting in ASTM D5191 in 1992, which is equivalent to EN 13016-1.

The real milestone in vapor pressure determination of gasoline and crude oil was set within the ASTM in December 1998, when two new methods, developed and written by Dr. Grabner, passed the committee. Based on the precision data of a large inter-laboratory test of more than 3000 samples the new standard test method for measuring the partial pressure of the dissolved air in gasoline by double injection or triple expansion – ASTM D6378 – was published. This new method makes life much easier in the laboratory and on-site. The gasoline sample is just brought to the tester and either injected immediately with the syringe or, even easier, the inlet tubing is put into the sample and RUN is pressed. Five minutes later the result is displayed or printed. **No cooling and no air saturation is necessary anymore!**

In addition to the new method for gasoline, ASTM D 6377 – The New Standard for Vapor Pressure of Crude Oil, was published.

Today more than 20 years of experience in developing and manufacturing Vapor Pressure Testing equipment made Grabner Instruments "the vapor pressure company" – and the MINIVAP the most thoroughly tested equipment with the broadest market penetration worldwide.

Key Features

- VPS: ASTM D5191, D6378, ASTM D6377, IP394, IP481, EN 13016-1
- Excellent correlation to ASTM D4953 ("dry Reid" – US EPA) and ASTM D323 (Crude Oil and "wet Reid")
- VPSH additionally complies with EN 13016-2, IP 409
- Precision better than ASTM D6378:
  - Repeatability: ± 0.50 kPa (0.07 psi) or better
  - Reproducibility: ± 1.63 kPa (0.22 psi) or better
- US EPA Referee Highest Accuracy
- No vacuum pump required
- Built in Peltier temperature control
- Fully automated, fast measurement
- Easy cleaning with solvent using an automated cleaning procedure
- Very low waste
- Laboratory and field applications (portable)
- RS232 interface
- MINIWIN software (for PC)

Your benefits

No Vacuum pump

The unique measuring principle with the integrated piston for automatic sample introduction and expansion offers high accuracy and easy operation and eliminates the use of a vacuum pump.

Easy operation

Since MINIVAP is a fully automatic vapor pressure tester, a possible operator bias is eliminated. The measuring cell is rinsed and filled sample automatically. No further equipment is necessary to start with testing.

No chilling and air saturation necessary – ASTM D6378 (Grabner method)

The new ASTM standard D6378 constitutes a real milestone in the history of vapor pressure determination. Due to the outstanding measuring principle of the MINIVAP sample preparation prior to the measurement is not necessary. You save expensive labor time and achieve significantly better precision, as a possible operator bias is eliminated.

Vapor pressure of Gasoline – ASTM D6378 (Grabner method)

ASTM D6378 is the new Triple Expansion Method for the determination of the dissolved air in the sample. It was developed by Grabner Instruments and replaces ASTM D5191, D4953 and D323. Official correlation formulas are mentioned in D6378 and are pre-programmed in MINIVAP VPS/VPSH. Chilling and air saturation is not required!

DVPE of Gasoline Mini Method – ASTM D5191 + EN 13016-1+2

ASTM D5191, the standard of the Mini method: Only 1ml sample volume is measured against vacuum for the determination of the DVPE of gasoline. Both versions of the vapour pressure tester – the MINIVAP VPS and the MINIVAP VPSH – are capable to test gasolines according to this standard, too.

Vapor pressure of Crude Oil – ASTM D6377 (Grabner Crude Oil method)

The new Single Expansion Method for Vapor Pressure of Crude Oil was developed by Grabner Instruments. The precision of this method is significantly better than the conventional ASTM D323 method. Crude Oil is collected in a pressurized floating piston cylinder (distributed by Grabner Instruments) to keep the volatiles inside the Crude Oil. No light end losses occur during the complete test.

RVPE of Crude Oil – ASTM D323 (old REID method)

Both versions of the vapor pressure tester – the MINIVAP VPS and the MINIVAP VPSH – can correlate to the RVPE (Reid Vapor pressure equivalent) with a pre-programmed correlation formula.

US EPA approved

As early as 1993 the US Environmental Protection Agency EPA chose the innovative Grabner instrument MINIVAP VPS as the official reference instrument for the USA.

MINIWIN Software – Easy remote control application for integration of VPS and VPSH into your LIMS

Wide range of applications

MINIVAP testers are utilized in most major oil and pipeline companies as well as in independent test laboratories worldwide. Applications include the compliance control of vapor pressure of gasoline-oxygenate blends and crude oil in the laboratory and the production plant in addition to testing directly in the field. MINIVAP VPSH further allows volatility studies at elevated temperatures and the vapor pressure determination of crude oil at very low vapor liquid ratios.

Multiple Autosampler

MINIVAP VPS and VPSH can be additionally equipped with an automated multiple sampler providing 6 inlets for 6 different samples instead of one single inlet. This sampler is mounted on the right side of the instrument where 6 different samples can be applied at the same time and can be programmed with different measuring programs and parameters for different needs.

MINIVAP VPSH + Crude Oil Package

MINIVAP VPSH + Crude Oil Package

For determining the vapor pressure of Crude Oil MINIVAP VPSH is the instrument of choice. It can be equipped with a Crude Oil Package which is needed to measure live or dead crude oil properly. The so called Crude Oil package consists of the Floating Piston Cylinder and the Rocking plate. The Floating Piston Cylinder takes the Crude Oil from a sample stream like a pipeline. The Cylinder is pressurized and keeps the light ends in the Crude Oil in order to avoid losses of volatiles. The complete vapor pressure tester is placed upon the Rocking Plate, which is needed to shake the instrument, so that measuring time is reduced and in order to get light ends out of the crude to stabilize the pressure.

Key Features

- Easy sampling of Crude Oil with a Floating Piston Cylinder – no light end losses occur!
- Fast Vapor pressure determination of Crude Oil by using a stirring mechanism (Rocking Plate) to reduce measuring times
- Correlation to ASTM D323 "Reid Method" possible
- No mess during testing through closed filling cycle with the Floating Piston Cylinder
- Comfortable cleaning of the instrument with solvents by an automated rinsing mechanism

MINIVOL LVR

The Ultimate Volatility Tester for Gasoline

According to ASTM D4814 the "Standard Specification for Automotive Spark-Ignition Engine Fuel" the V/L ratio for gasoline blended with oxygenates, such as ethanol, must be determined through direct measurement techniques, not through mere estimates. MINIVOL LVR offers one of the most accurate and reliable methods: It performs direct measurements for the V/L ratio per ASTM D 5188, the only mercury-free direct measurement technique accepted for gasoline blends containing ethanol and other oxygenates.

The compact MINIVOL LVR can precisely determine the V/L ratio of non-viscous liquids including hydrocarbons like gasoline, solvents and other highly volatile compounds over a wide temperature range (20 to 80 °C or 68 to 176 °F) according to ASTM D5188. It performs even better than the standard: Multiple point measurements at V/L = 100 down to V/L = 4 can be measured automatically. The instrument works fully automatically using only 4 mL of sample, providing results in minutes. All that is required is an external vacuum source.

Key Features

- ASTM D5188, D2533
- Precision according to ASTM D5188:
  Repeatability: ± 0.6 °C (1.1 °C)
  Reproducibility: ± 0.9 °C (1.6 °F)
- Only 4 mL of sample for complete measurement
- Accurate determination ofthe V/L ratio
- Measurement is performed fully automatically
- No thermostat required
- Portable
- Wide temperature range of 20 to 80 °C (68 to 176 °F)
- Fast measurement: 3 minutes (single point)
- Automatic multiple point measurement
- Built-in RS 232 interface for printer or computer
- Built-in diagnostic and safety features

MINIVAP LPG

Easy, Quick and Reliable Measurement of Liquefied Petroleum Gas

MINIVAP LPG is a stand-alone unit for the automatic vapor pressure determination of liquefied petroleum products. Measurement ist done in less than 5 minutes using overall only 15 mL of sample for measurement and rinsing. The instrument offers safe and easy operation and reduces environmental pollution. Automatic sample introduction, built-in Peltier temperature regulation and a pre-programmed rinsing cycle eliminate any manual operation or cleaning. The ease of use of the instrument allows for installation and operation without any special training. The vapor pressure is determined with high precision in a presetable temperature range of 5 to 70 °C (41 to 158 °F). Pressures may be measured up to 2000 kPa (290 psi).

ASTM D6897 Single Expansion Method

ASTM D6897 revolutionizes the vapor pressure measurement of Liquefied Petroleum Gas (LPG). It replaces the manual bomb method ASTM D1267, presenting results with an excellent correlation, but with a highly improved repeatability and reproducibility. MINIVAP LPG allows fast and fully automated measurement avoiding any operator bias and saving a significant amount of time and money for the users.

! WHAT CUSTOMERS SAY ABOUT THE MINIVAP

»The MINIVAP is a compact, easy to understand instrument and requires a small quantity of sample for analysis. Results by the MINIVAP instrument are well within repeatability & reproducibility.«

Ravi Kolambkar, Lab Manager, Indian Oil Corporation Ltd., India

Key Features

- ASTM D6897, D1267
- Repeatability (ASTM D6897): ± 7.4 kPa (1.1 psi) or better
- Only 15 mL of sample for complete measurement
- Accurate determination of LPG vapor pressure
- Fully automatic Measurement
- No accessories required
- Built-in diagnostic and safety features
- Fast measurement: only 5 minutes
- Automatic multiple point measurement
- Built-in RS 232 Interface for printer or computer
- Wide temperature range of 5 to 70 °C (41 to 158 °F)
- Small and rugged portable tester
- Optional 12V DC battery operation for field use

! WHAT CUSTOMERS SAY ABOUT THE MINIVAP

»During its 10-year life-time approximately 500 measurements were accomplished with no faulty operation ever detected. We are satisfied with the long-term performance of the vapour pressure analyzer MINIVAP and consider Grabner Instruments to be one of the most reliable suppliers of analytical equipment.«

R.O. Samsonov, General Manager, Vniigaz Ltd., subsidiary of Gazprom, Russia

TECHNICAL DETAILS MINIVAP VPS/VPSH

	MINIVAP VPS	MINIVAP VPSH
Temperature Range	20 to 60 °C	0 to 100 °C
Pressure Range	0 to 1000 kPa (0 to 145 psi)	0 to 1000 kPa (0 to 145 psi)
Vapor/Liquid Ratio	4.1	Standard V/L = 4/1 Adjustable Gasoline V/L = 0.8/1 to 4/1 Adjustable Crude Oil V/L = 0.01/1 to 4/1
Dimensions	W x H x D: 196 x 315 x 205 (7.7 x 12.4 x 8 inches)	W x H x D: 196 x 315 x 205 (7.7 x 12.4 x 8 inches)
Weight	7.3 kg (16 lbs)	7.6 kg (16.8 lbs)
Power Requirements	100/110/230 V AC, 50/60 Hz, 65 W	100/110/230 V AC, 50/60 Hz, 150 W
Sample Volume	10 mL for measurement including rinsing (Measurement sample: 1 mL)	
Field Application (optional)	DC/AC Powerconverter Prowatt 300 12V/8A DC	
Interfaces	Serial interface RS232 for printer and PC and/or LIMS, connector for external Mini-Keyboard	
Precision better than ASTM D6378	Repeatability: ± 0.5 kPa (0.07 psi) or better Reproducibility: ± 1.63 kPa (0.22 psi) or better	

TECHNICAL DETAILS MINIVOL LVR

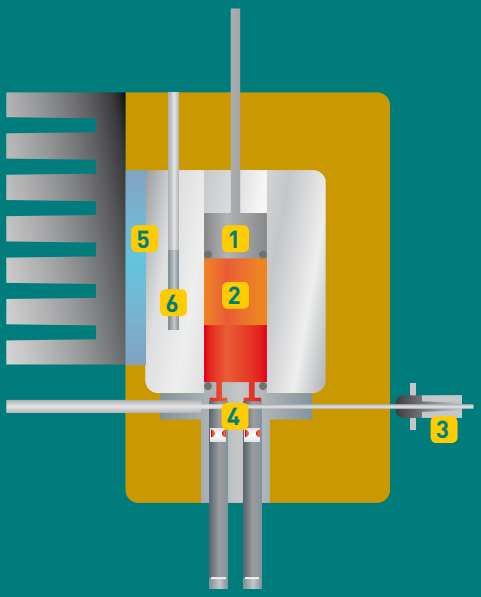
Sample Volume	40 mL	Accuracy of temperature reading	± 0.1 °C (± 0.2 °F)
V/L-ratio (single point)	20	Pressure range	0 to 1000 kPa (0 to 145 psi)
V/L-ratio (multiple point)	100, 80, 60, 40, 30, 25, 20, 15, 10, 5, 4	Units of pressure	hPa, kPa, psi, at
Precision	Repeatability = ± 0.6 °C (1.1 °F) Reproducibility = ± 0.9 °C (1.6 °F)	Power requirements	100/110/230 V AC, 50/60 Hz, 65 W
Temperature range	20 to 80 °C (68 to 176 °F)	Dimensions / Weight	W x H x D: 196 x 315 x 205 (7.7 x 12.4 x 8 inches) / 9.1 kg (20 lbs)

TECHNICAL DETAILS MINIVAP LPG

Temperature range	5 to 70 °C (41 to 158 °F)	Accuracy of temperature reading	± 0.1 °C (0.2 °F)
Pressure range	0 to 2.000 kPa (0 to 290 psi)	Units of pressure	hPa, kPa, psi, at
Power requirements	100/110/230 V AC, 50/60 Hz, 65 W	Field application	12 V/4A DC (vehicle battery)
Dimensions / Weight	W x H x D: 196 x 315 x 175 mm (7.7" x 12.4" x 6.9") / 8 kg (18 lbs)	Repeatability	ASTM D6897 = 7.4 kPa (1.1 psi) or better

MEASURING PRINCIPLE OF MINIVAP VPS / H

The sample is introduced through the Luer sample inlet (3) and the sample inlet valve (4) into the measuring chamber. The automatic sample introduction and the volume adjustment is accomplished by a piston with an integrated pressure transducer (1). The measuring chamber (2), with a total volume of 5 mL, is rinsed with 3 x 2.5 mL and filled with the appropriate amount of sample. After closing the valve (4), single or triple expansion to 5 mL (with vacuum created by piston withdrawal) is obtained by additional piston strokes. The temperature of the measuring cell is controlled by a high-power thermoelectric module (5) and measured with a precision Pt100 RTD sensor (6).



EXPANSION VERSUS VACUUM INJECTION

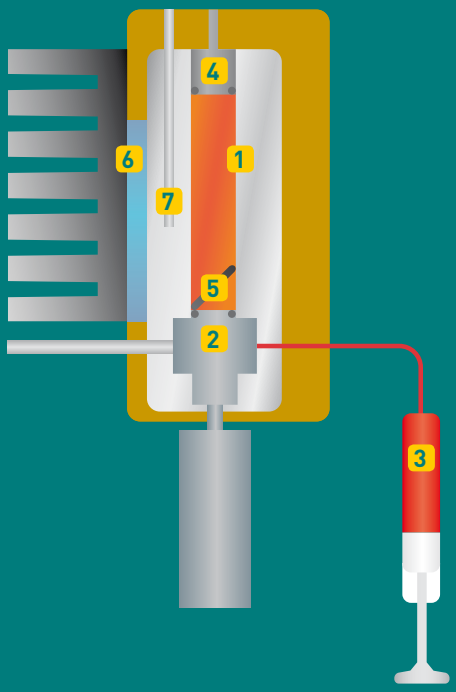
The conservative method of measuring vapor pressure against vacuum is to inject the sample into an evacuated chamber. The injection has to be done in a way that the sample enters the chamber directly (without any tubing). The easiest way to do this is to use septa. However, this method risks septum leakage. Moreover there is also the disadvantage that the sample must be of low viscosity in order to get it through a septum port. A specially designed ball valve is a much better solution. Drawing the sample with a piston into the chamber and making an expansion after closing the inlet valve is the equivalent to a perfect evacuation and injection. No vacuum pump is required with this method!

TRIPLE EXPANSION FOR ABSOLUTE VAPOR PRESSURE

Based on the assumption that the vapor pressure of liquids remains more or less constant and that all components - like dissolved air - follow the ideal gas equation, an expansion is performed in three steps at constant temperature. Three total pressure values are determined. From these three total pressure values the partial pressure of the air, the solubility factor of the liquid, and the absolute vapor pressure of the liquid are calculated. The Triple Expansion Method makes MINIVAP an unrivalled tester for the determination of the vapor pressure of different kinds of liquids. Due to governmental regulations the measurement of vapor pressure of gasoline is the most prominent application. However, MINIVAP can be used for all kinds of liquids produced by industries where the determination of vapor pressure is required for manufacturers´ safety data sheets or for quality control.

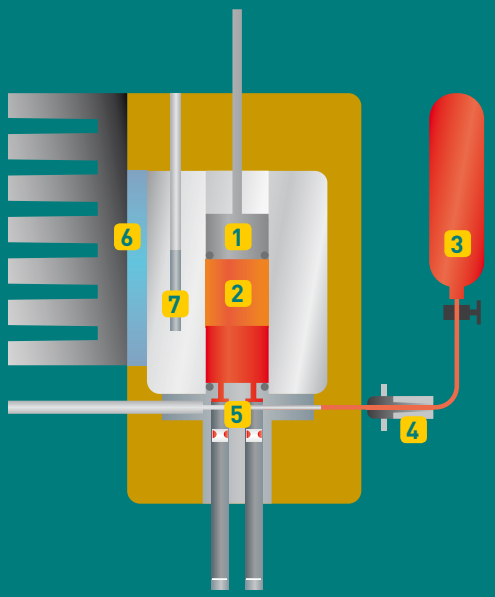
MEASURING PRINCIPLE MINIVOL LVR

The test chamber (1) has a volume of 15 mL. A motor driven ball valve (2) for injection and evacuation is located below the temperature controlled chamber. The chilled and air saturated sample is drawn into a precision syringe with Luer-lock (3), then the syringe is placed into the automatic injection drive. The pressure in the chamber is monitored with a high precision piezo-resistive pressure transducer (4). A magnetic stirrer (5) is installed inside the chamber to achieve fast equilibrium. Cooling and heating is performed with a thermoelectric module (6). The temperature of the test chamber is measured with a highly stable platinum RTD (7).



MEASURING PRINCIPLE OF MINIVAP LPG

The sample is contained in a pressurized sample bomb (3) and is attached using a quick-connect fitting (4). Automatic sample introduction and volume adjustment is performed by a piston with an integrated pressure transducer (1). The measuring chamber (2) with a total volume of 5 mL is automatically rinsed and filled with 3.3 or 3 mL. After closing the valve (5), the volume expansion to 5 mL is obtained by a further piston stroke. The temperature of the measuring cell is controlled by a thermoelectric Peltier element (6) and measured with a platinum RTD sensor (7). After the equilibrium time, the test result is displayed and can be printed. If more than one temperature is programmed the next temperature points are adjusted and measured consecutively.



GRABNER INSTRUMENTS
an AMETEK company

Grabner Instruments
Messtechnik GmbH
A-1220 Vienna/Austria
Dr. Otto-Neurath-Gasse 1
Phone +43/1/282 16 27-0
Fax +43/1/280 73 34
info.grabner-instruments@ametek.at
www.grabner-instruments.com