RUDOLPH RESEARCH ANALYTICAL

White Papers

API Gravity – Petroleum – Digital Density Meter Application Note

API Gravity – Density Meter Application Report Understanding API Gravity:

API Gravity – Crude oil is an indispensable starting material for all types of products and various other fuels, oils, and lubricants. Characterization of these products is most complex and often impractical. Therefore, the measurements of more simple properties such as flash point, vapor pressure, and viscosity have become standard chemical analysis procedures in nearly all petroleum laboratories. Of all these measurements, density has become one of the most important and frequently used physical properties used within the petroleum industry.

Measure API Gravity

The API Gravity (American Petroleum Institute) is a value which is supposed to make it easier to compare one hydrocarbon to another. The determination of API Gravity is done in an exact manner as prescribed and detailed in ASTM D-1250.

In the United States, API Gravities are usually determined at 60 ºF whereas in Europe and other parts of the world it is more common to use 15 ºC and/or 20 ºC. The DDM 2911 Automatic Density Meter may be controlled to bring the petroleum product to any of these temperatures and make the required measurement. However, for the more viscous hydrocarbons, the density is often measured at some elevated temperature and this value is then used to mathematically correct back to the proper API Gravity value for the lower temperature. This mathematic calculation is done using Volume Correction Factors (VCF). Each different type of petroleum product group has a different VCF.

The historical method for the measurement of API Gravity has been the hydrometer. However, the low precision of the hydrometer as the prices of crude oils increase make this method obsolete. Additionally, the large sample volume required, the large quantities of solvents needed for the cleaning of the hydrometer column, and the need for a dozen or more different hydrometers to cover the entire API range has made using this method completely impractical in today's petroleum laboratories.

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The DDM 2911 Density Meter provides the fastest, most accurate, and easiest means for the measurement of API Gravities. The API Gravity software that is built-into the DDM 2911 makes the use of external tables unnecessary. The measurement results are displayed on the large 10.4 inch digital color screen and the results may be saved locally or saved to your server. Results can also be printed out on any printer that is on your network. Further, the printouts may be customized and used as your certificates of analysis. Numerous and simultaneous results can be calculated. For example, the API Gravity at 60 ºF, 15 ºC and 20 ºC along with the results at these same temperatures for density and specific gravity may all be determined in one simple and fast measurement.

Multiple measurements made on the same sample can also be made automatically and the statistical results calculated with the final results. The sample size is small; typically 1 to 2 ml is all that is required. The subsequent cleaning of the sample is easy and also requires a small amount of solvent. The DDM 2911 Density Meter is robust and requires very little maintenance. All wetted parts are corrosive resistant and not affected by the chemicals and solvents used in this industry. Measurements are fast, normally requiring 2 to 3 minutes per sample.

The simple operation makes it easy to train lab personnel in its use. The DDM 2911 operates in a familiar Windows® environment making the navigation through the various menus intuitive and easy to do without the need for studying the manual. And if the manual is needed, it's found in the DDM 2911 32GB memory! The availability of having 3 USB ports and a Cat 5 cable connection will become indispensable for communication and adding of peripherals as needed for an efficient and up to date laboratory.

The most common source of error in measurements using digital density meters has been made easy to eliminate with the intelligent design of the DDM 2911. Rudolph Research Analytical exclusive VideoView™ ensures that your sample is bubble free for the most accurate and reproducible results. Bubbles can now even be seen in dark and cloudy samples.

Certified liquid density standards come with each DDM 2911 making it easy to validate the accuracy of your density meter. Calibration checks can be developed and customized to meet the specific requirements of your laboratory.

Rudolph Research Analytical's optional auto-sampler, the ASX 1400, may be utilized with any of our Density Meter and permits the measurement, cleaning, and drying of up to 240 samples per run. Our pressurized filling method ensures that light end hydrocarbons are not pulled off as would happen with auto-samplers using a suction mode.

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ASTM, ISO, and DIN – Industry Standards:

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ASTM D4052 – Standard Test Method for Density and Relative Density of Liquids by Digital Density Meter
ASTM D5002 – Standard Test Method for Density and Relative Density of Crude Oils by Digital Density Analyzer
ASTM D1250 – Standard Guide for Petroleum Measurement Tables
ASTM D5931 – Density and Relative Density of Engine Coolant Concentrates and Aqueous Engine Coolants by Digital Density Meter
DIN 51 757 – Testing of Mineral Oils and Related Materials; Determination of Density
ISO 12185 – Petroleum Products – Determination of Density – Digital Density Meter Method
See more about Rudolph Research's line of Density Meters