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Determination of the Octane Number of Fuels Using a Near IR Technology Adopted into a Handheld Octane Analyzer

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Introduction

The K88620 determines the Pump Octane Number, Research Octane Number (RON), and Motor Octane Number (MON) of unleaded gasoline, ethanol blended gasoline, leaded gasoline and Cetane Number for diesel fuels. Over 60 countries across the world utilize portable octane analyzers, with about 45 states in the United States using them. This design can test the octane value of gasoline quickly, easily, and precisely without causing any damage to the sample as well as give an idea of the tendency of the fuel to detonate.

How the Instrument Works

The K88620 is the most recent top-of-the-line portable gasoline analyzer, capable of evaluating fuels for octane, cetane, ethanol percentage, and biodiesel percentage. Here is how to prepare and run a test:

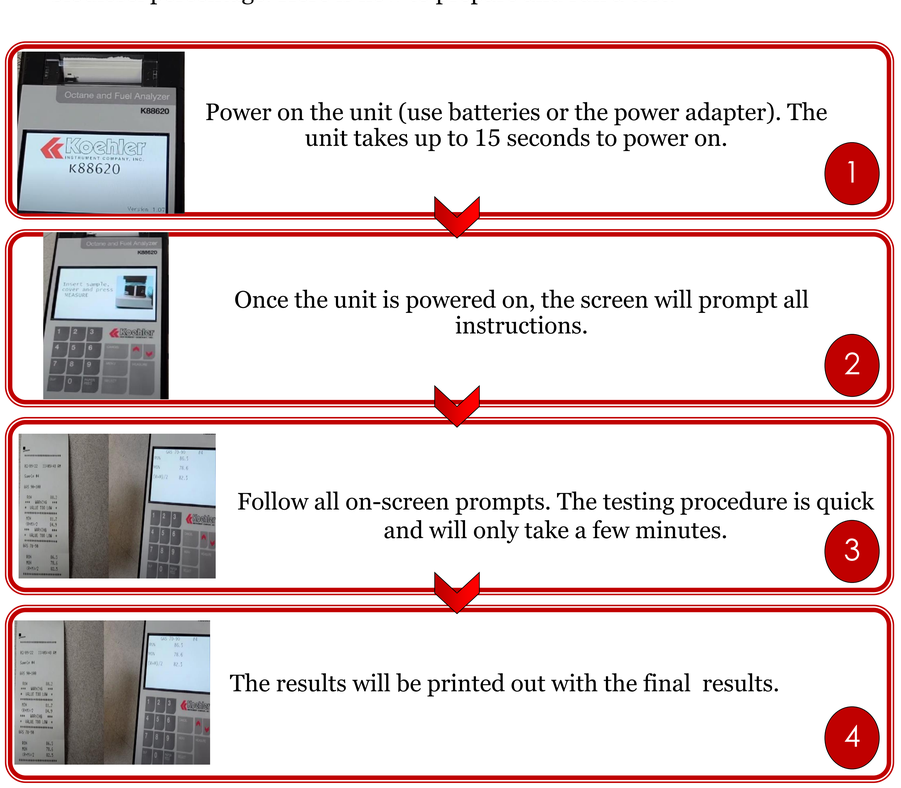

Figure 1. Test procedure using the K88620/K88629 – Enhanced Portable Fuel Analyzer

What is an Octane Analyzer?

The Octane Analyzer is an add-on upgrade for automating the octane test of the Cooperative Fuel Research (CFR) F1/F2 per procedure D of both ASTM Methods D2699 and D2700. Accuracy & Repeatability is equivalent to the following 2 test methods: ASTM D2699 & ASTM D2700. The system varies the air/fuel ratio of the engine test by running the fuel through a variable speed pump. The higher the octane number, the greater the fuel's resistance to knocking or pinging during combustion. The octane number is the percentage by volume of iso-octane in the iso-octane-heptane mixture that matches the fuel being tested in a standard test engine. The Fuel Octane Analyzer is a measure of the knock resistance of gasoline, to make pinging or ticking sounds in a car's engine when you step on the gas pedal.

Data Analysis

The K88620 is pre-calibrated for octane number RON, MON, (R +M)/2. Motor O.N. and Research O.N. are major specification measurements used by engine manufacturers, petroleum refiners and marketers, and in commerce to match fuels and engines. Octane Analyzer reduces operator interaction with the instrument during the test procedure and provides improved consistency amongst multiple users and better repeatability on consecutive passes. With fuel-air sweeps being managed consistently by the OA, repeatability improves versus what a human operator could achieve managing the same maximum KI determinations.

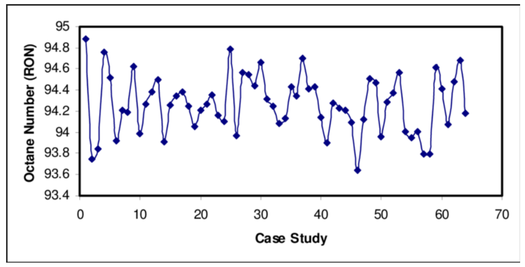

Figure 2. Case study of Octane Numbers over the past decades

The antiknock index of automobile spark-ignition engine fuels is defined by Motor O.N. in collaboration with Research O.N. The antiknock index of a fuel approximates the road octane ratings for many cars; it is displayed on retail dispensing pumps in the United States and is mentioned in vehicle manuals. Motor O.N. is a metric used to assess the antiknock performance of spark-ignition engine fuels containing oxygenates.

The antiknock index of a fuel approximates the Road octane ratings for many vehicles, is posted on retail dispensing pumps in the U.S., and is referred to in vehicle manuals. Antiknock index can be represented as 0.5 Research O.N. + 0.5 Motor O.N. + 0. This is more commonly presented as:

$$\text{Antiknock Index} = (R + M)/2$$

Octane numbers are based on a scale on which isooctane is 100 (minimal knock) and heptane is 0 (bad knock). The higher the octane number, the more compression required for fuel ignition. Fuels with high octane numbers are used in high performance gasoline engines. Higher percentages of octane numbers denote the stable fuel derivatives. The octane number with high percentage denotes gasoline engine and low percentages of octane number carry diesel engine. Octane numbers with high percentage-based fuel are initially more expensive than the low percentage base fuel.

1	Reference standard	ASTM D2699, ASTM D2700
2	Test sample	Gasoline
3	Working temperature	-5℃~+30℃
4	Octane measuring range (ON)	40-120
5	Allowing error of measurement	±0.5
6	Floating range of measuring result	±0.2
7	Measuring time (s)	<20
8	Normal standby time (h)	200
9	Output mode	LCD display, printer output
10	Weight	15kg

Figure 3. RON parameters

Conclusion

The K88620 enhanced portable octane analyzer has been proven to be reliable and accurate. This user-friendly device has allowed for 25-25 seconds analysis of readings for RON, MON and (R+M/2) which represents the antiknock index. This device is also easy to configure custom tests with simple switching between single pass or multiple pass and allows for broader Octane Number ranges. Portable octane analyzers have dominated portable gasoline analysis in fuel labs, research institutions, repair shops, and pipelines, among other places and will continue to do so in the future.

References

2007. Standard Test Method for Research Octane Number of Spark-Ignition Engine Fuel.