

C stands for **Cetane**

Cetane is a colorless, liquid hydrocarbon that ignites easily under compression. It is used as the standard measure of the performance of compression ignition fuels, such as diesel fuel and biodiesel. All the sundry hydrocarbon constituents of diesel fuel are measured and indexed to cetane's base 100 rating. To learn more about this property, let's apply the **AmSpec** approach.

A = Application



Figure 1 – Cetane Engine for Determining Cetane Number

Cetane number is the rating assigned to diesel fuel to rate its combustion quality, like the octane number rating that is applied to gasoline to rate its ignition stability. While gasoline's octane number signifies its ability to resist auto-ignition, also called knocking, diesel's cetane number is a measure of the fuel's delay of ignition time. The ignition time is the amount of time between the injection of fuel into the combustion chamber and the actual start of combustion of the fuel charge. Because diesel fuels rely on combustion ignition without a spark, the fuel must be able to auto-ignite. Generally, the quicker the fuel auto-ignites, the better. A higher cetane number means a shorter ignition delay time and more complete combustion of the fuel charge in the combustion chamber. This, of course, translates into a smoother running, better performing engine with more power and fewer harmful emissions.

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Normal modern highway diesels run best with a cetane number between 45 and 55. The following is a list of typical cetane numbers of varying grades and types of compression ignition diesel fuels:

- Regular diesel--48
- Premium diesel--55
- Biodiesel (B100)--55
- Biodiesel blend (B20)--50
- Synthetic diesel--55

Cetane Number

The process for determining the true cetane rating requires the use of precisely controlled test engines and procedures or fuel analysis with exacting instruments and conditions. The results generated from these engines are known as the cetane number.

Cetane Index

Using dedicated engines and processes or instruments for real fuel tests is painstaking, expensive and time consuming. Therefore, many diesel fuel formulators use a "calculated" method to determine cetane numbers. The Cetane Index is a means for directly *estimating* the ASTM cetane number of distillate fuels from API gravity and specific distillation points.

M = **Methods**

These are the most common methods that AmSpec uses to determine the cetane content:

D613 – Cetane Number of Diesel Fuel Oil

D976 – Calculated Cetane Index of Distillate Fuels

D4737 – Calculated Cetane Index by Four Variable Equation

D6890 – Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber

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S = Scope

Method	Products	Scope
D613	Diesel fuel. Unconventional fuels may also be used such as synthetics, vegetable oils, and the like. However, the relationship to the performance of such materials in full scale engines is not completely understood.	The cetane number scale covers the range from zero (0) to 100, but typical testing is in the range of 30 to 65 cetane number.
D976	Diesel fuel. The Calculated Cetane Index formula is particularly applicable to straight-run fuels, catalytically cracked stocks, and blends of the two.	N/A
D4737	Procedure A is used for diesel fuels with sulfur contents above 500 ppm or No. 1-D diesel fuels. Procedure B is used for diesel fuels with sulfur contents at or below 500 ppm or No. 2-D diesel fuels.	N/A
D6890	Diesel fuel, oil-sands based fuels, and blends of fuel containing biodiesel material.	This test method covers the ignition delay range from 3.1 to 6.5 ms (64 to 33 Derived Cetane Number).

**** Please note below, Turnaround Time is defined as the actual length of time, on average, it takes to perform a particular method once the sample has arrived and logged in the lab, and prepared for testing.**

P = Procedure Notes

Method	Limitations	Instrumentation	Turnaround Time
D613	It is not suitable for rating diesel fuel oils with fluid properties that interfere with unimpeded gravity flow of fuel to the fuel pump or delivery through the injector nozzle.	Number	2 hours
D976	It is not applicable to fuels containing additives for raising cetane number, pure hydrocarbons, synthetic fuels, crude oils, residuals, and products having a volatility of below 500°F end point.	Index	10 minutes
D4737	It is not applicable to fuels containing additives for raising the cetane number, pure hydrocarbons, non-petroleum fuels derived from coal, and fuels containing biodiesel.	Index	10 minutes
D6890	This test may not be applicable to non-conventional fuels as the performance of in full-scale engines is not completely understood.	Number	2 hours

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E = Equivalents

ASTM	IP	ISO	DIN	JIS	AFNOR
D613	41	5165		K2280	M07-035
D976					
D4737		4264			
D6890					

C = Cause & Effect

Just as there is no benefit to using gasoline with an octane rating higher than recommended for a specific engine by its manufacturer, using diesel fuel with a higher cetane rating than is required for a particular diesel engine design yields no bonuses. Conversely, running a diesel engine on fuel with a lower than recommended cetane number can result in rough operation, noise and vibration, low power output, excessive deposits and wear, and hard starting. Cetane number requirements depend mainly on engine design, size, speed of operation, load variations, and atmospheric conditions.

For any questions about these methods, please contact Jennifer Nesci at JNesci@amspecllc.com

Also, please download the new & improved AmSpec Smart Phone app for a number of useful conversion tools and information.

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