

# The Importance of Biodiesel Meeting the ASTM D6751 Standard

An OEM Perspective on Fuel Quality

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# Overview

## Outline

- ASTM D6751
- Impact of Fuel Properties on Engine Components
- Federal and State Fuel Quality Requirements
- John Deere's Position on Biodiesel Quality
- Questions



# ASTM D6751

## Biodiesel (B100) Standards

Property	Test Methods		Units	ASTM D 6751
	ASTM	EN & ISO		
Cloud Point	D 2500		°C	Report
Carbon Residue (on 100% Sample)	D 4530		% mass	0.050 max
Water and Sediment	D 2709		% volume	0.050 max
Free Glycerin	D 6584		% mass	0.020 max
Total Glycerin	D 6584		% mass	0.240 max
Distillation Temperature, 90% Recovered	D 1160		°C	360 max
Alcohol Control: One of (a) & (b) Must be Met				
(a) Methanol Content		14110	% volume	0.2 max
(b) Flash Point	D 93		°C	130 min
Flash Point	D 93	3679	°C	93 min
Kinematic Viscosity at 40°C	D 445	3104	mm <sup>2</sup> /s	1.9 - 6.0
Sulfated Ash	D 874	3987	% mass	0.020 max
Copper Strip Corrosion	D 130	2160 (3 h at 50°C)	Rating	No. 3 max
Cetane Number	D 613	5165		47 min
Acid Number	D 664	14104	mgKOH/g	0.50 max
Phosphorous Content	D 4951	14107	% mass	0.001 max
Sulfur Content	D 5453	20846 or 20884	% mass	0.0015 max (S15) 0.05 max (S500)
Group I Metals (Na + K)		14538	mg/kg	5 max
Group II Metals (Ca + Mg)		14538	mg/kg	5 max
Oxidation Stability, 110°C		14112	hours	3 min

**Note:** Please refer to the original documents of ASTM D 6751 for further detail.



# ASTM D6751 – Critical Properties

Water and Sediment – Fuel cleanliness impact the whole fuel system. Amongst problems that can be caused by dirt are fuel filter plugging, injector wear and spray hole plugging impacting atomization. Water contributes to acid formation which leads to corrosion. It can also cause microbial growth in the fuel which leads to filter plugging and acid formation. Biodiesel has an affinity for water and it is difficult to separate the two. If emulsions form, it negatively impacts the fuel injection system.

Free and Total Glycerin – Excessive levels of these can cause injector deposits and clog fueling systems. Excessive levels of total glycerin may adversely affect cold flow and contribute to fuel filter plugging.

Alcohol Content and Flash Point - Flash point is a safety issue. If excessive alcohol is left in the biodiesel, it can severely lower the flash point leading to a very dangerous situation.



## ASTM D6751 – Critical Properties cont.

Sulfated Ash – Ash forming materials are often present in biodiesel: (1) abrasive solids, (2) soluble metallic soaps and (3) unremoved catalysts. Abrasive solids and unremoved catalyst material can lead to wear in the injector, fuel pump, piston, liner, ring and can also cause engine deposits. The soluble metallic soaps can cause filter plugging and engine deposits.

Calcium (Ca) and Magnesium (Mg) – Come from hard water (water wash). They can be present as either abrasive solids or soluble metallic soaps. They can negatively impact aftertreatment devices, especially at elevated levels. Ca and Mg are sources of poisons for the precious metals used on aftertreatment devices and can form oxides and sulfates, plugging diesel particulate filters and react with silica weakening the substrate.

Sodium (Na) and Potassium (K) – Are unremoved catalysts. They can be present as either abrasive or soluble metallic soaps. They can negatively impact aftertreatment devices, especially at elevated levels. Na and K are sources of poisons for the precious metals used on aftertreatment devices and can form oxides and sulfates, plugging diesel particulate filters and react with silica weakening the substrate.



## ASTM D6751 – Critical Properties cont.

Acid Number – High acid number can lead to increased fuel system deposits and corrosion. It is used as a measure of free fatty or processing acids.

Phosphorous (P) – Can poison catalysts in aftertreatment devices.

Oxidation Stability – Oxidation products can be in the form of acids or polymers. At a high enough concentration, they can cause fuel system deposits, plug fuel filters and cause corrosion. Use of stability additives (antioxidants) can improve oxidation stability. They are most effective when added close to the time of manufacture.



# Federal and State Requirements

EPA – In order to satisfy the 211(b) requirement of the Clean Air Act, which requires the registration of fuel and fuel additives with the EPA, biodiesel must meet the current version of ASTM D6751. Any biodiesel that is sold as motor fuel and does not meet that standard is in violation of the EPA and subject to a fine of \$25,000 for every day of violation plus the amount of economic benefit or savings resulting from the violation.

IRS – ASTM D-6751 compliance is required of biodiesel gallons on which Biodiesel Tax Credit is claimed. 26 U.S.C. 40A(d)(1). The blender claiming the credit is required to obtain from the biodiesel producer a certificate stating, under penalty of perjury, that the biodiesel or agri-biodiesel is properly registered with the EPA and meets the requirements of the most current version of ASTM D-6751. IRS Notice 2005-62, sec. 2(h)(ii). If in violation, fines up to \$100,000 or (\$500,000 in the case of a corporation) or imprisonment of not more than three years, or both, together with the costs of prosecution could be levied. 26 U.S.C. 7206.



## Federal and State Requirements cont.

State Government – Enforcement of biodiesel standards are by the state government's bureau of weights and measures. Enforcement differs from state to state. Not all states have adopted ASTM D6751. Among those states who have, their enforcement may not be proactive only reactive. Missouri is a state that is proactive in their enforcement.



# John Deere's Position on Biodiesel Quality

## B20 or Lower Blends –

Require that customers purchase biodiesel produced by BQ-9000 accredited producers and sold by BQ-9000 certified marketers. If no BQ-9000 accredited producers or certified marketers are in their area, it is required that the bio portion of the biodiesel blend being sold meets ASTM D6751 (at a minimum) and a Certificate of Analysis for that batch being sold be supplied. Product must be used within 3 months of the date the bio portion was produced.

## Blends Above B20 –

Require that the bio portion meet EN14214 and a Certificate of Analysis for that batch being sold be supplied. Product must be used within 45 days of the date the bio portion was produced.



# John Deere's Position on Biodiesel Quality cont.

## Detergent Additives –

For blends below B20, it is recommended that customers use a John Deere approved fuel conditioner with a detergent/dispersant additive.

For blends B20 and above, it is required that customers use a John Deere approved fuel conditioner with a detergent/dispersant



# Fuel Quality Complaints

On the National Biodiesel Board Website, [www.nbb.org](http://www.nbb.org), information is provided on how to file a fuel quality complaint:

Access [www.nbb.org](http://www.nbb.org) website. Click on "Fuel Quality Information."

Click on "Fuel Quality Enforcement Guidelines."

Click on "NBB Fuel Quality Enforcement Guide > ASTM D6751 Enforcement."



# Questions



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