

Technical Service Information



ANAVISTAR COMPANY

TSI-08-12-07

This TSI replaces TSI-05-12-21

Date: May 2008

Subject File: Engine

Subject: Biodiesel Fuel and Biodiesel Blends

Engine Family: All International® Diesel Engines

Engine Family: All International® MaxxForce™ Diesel Engines 2007-up Model Years

Description

This TSI contains policy and position statements for biodiesel fuel, biodiesel blends, recommendations for storage and use of biodiesel blends, warranty coverage, and the impact of biodiesel fuels on engine emissions.

Policy and Position Statements

Navistar, Inc. understands and supports customer interest in renewable fuel resources and recognizes the rapidly growing biodiesel industry and the availability of government incentives which promote biodiesel use.

Navistar agrees with the official position of the Engine Manufacturers Association (EMA) on the use of biodiesel fuel. See www.enginemanufacturers.org, for more information.

Navistar's position regarding biodiesel blends is as follows:

Biodiesel Blends (up to B5)

Currently, all blends up to B5 have characteristics that are indistinguishable from diesel fuel. Work is

underway to include specifications for blends up to B5 in the ASTM D975 standard. Navistar approves of blends up to B5, provided that the two components satisfy current specifications ASTM D6751 and ASTM D975. Quality biodiesel blends up to B5 should not cause engine or fuel system problems.

Biodiesel Blends (B6-B20)

Biodiesel blends B6-B20 have different characteristics than diesel fuel. B20 is used by fleets in the United States, because B20 balances performance, emission levels, cost, and availability. B20 is also the minimum blend level that qualifies as an alternative fuel, in compliance with the Energy Policy act of 1992. Blends lower than B20 are used regionally, depending on favorable tax incentives that vary from state to state.

There is no ASTM standard for B6-B20 blends, which makes it difficult for consumers to determine fuel quality. The ASTM is working on a standard for B6-B20 blends; in the interim, the EMA released a B20 Test Fuel Specification (June 2006) defining characteristics for fuel quality and consistency.

Policy and Position Statements (cont.)

Until the ASTM B6-20 standard is issued, the EMA B20 Test Fuel Specification is recommended for users requesting quality and consistency of B20 blends.

The National Biodiesel Board (NBB) has established a voluntary biodiesel BQ9000 Quality Management Program to train, certify, and accredit biodiesel producers and sellers. This program should significantly promote product quality and consistency in the emerging biodiesel industry. See www.nbb.org, for more information.

If customers want to use B6-B20 biodiesel blends, Navistar recommends the following:

- Biodiesel blends should meet the EMA B20 Test Fuel Specification.
- Biodiesel blends should be procured from a BQ9000 accredited producer or distributor.
- The customer should follow Navistar's recommendations for biodiesel blends described in this TSI.

Biodiesel Blends (over B20)

Navistar does not recommend biodiesel blends higher than B20; higher proportions of biodiesel in the blend can cause problems during engine operation.

Warranty Coverage

Navistar unconditionally warrants use of biodiesel blends up to and including B5 blends meeting ASTM D6751 and ASTM D975 specifications.

Use of B6-B20 blends in International® MaxxForce™ Diesel Engines 2007-up is at the discretion of the customer/operator and will not automatically void an engine warranty. However, if engine component failure can be directly attributable to use of a B6-B20 blend not provided by a BQ9000 certified fuel supplier, not meeting the EMA B20 Test Fuel Specification or not used per recommendations in this TSI, Navistar may, at its option, deny warranty on the affected engine or engine component.

Biodiesel Fuel

The American Society for Testing and Materials (ASTM) defines biodiesel as a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B100.

Esters are oxygenated organic compounds that can be used in diesel engines, because some of their key properties are comparable to those in diesel fuel.

Raw or refined vegetable oil or recycled greases **that have not been processed** into biodiesel are not biodiesel and should be avoided.

Regardless of the biomass feedstock used to produce biodiesel B100 (neat), the final product must meet the requirements of ASTM D6751 or European EN14214 specifications.

Soy Methyl Ester (SME) biodiesel, derived from soybean oil, is the most common biodiesel produced in the United States. Rape Methyl Ester (RME) biodiesel, derived from rapeseed oil, is the most common biodiesel produced in Europe. Collectively these fuels are sometimes referred to as Fatty Acid Methyl Esters (FAME).

Biodiesel fuels are produced by a process called transesterification, in which various oils (triglycerides) are converted into methyl esters through a chemical reaction with methanol in the presence of a catalyst, such as sodium or potassium hydroxide. The by-products of this chemical reaction are glycerols and water, both of which are undesirable and need to be removed from the fuel along with traces of methanol, unreacted triglycerides and catalyst. Biodiesel fuels naturally contain oxygen, which reduce fuel stability during storage. Although biodiesel feedstock does not inherently contain sulfur, this element may be present in biodiesel fuel if contaminated during transesterification and storage.

B100 biodiesel may be blended with diesel fuel. Biodiesel blends are designated BXX, where XX represents the percentage of B100 in the biodiesel blend (e.g. B5, B20).

Recently, ASTM D6751 has been revised to include fuel stability criteria and measurement. Future revisions are upcoming to improve the quality and cleanliness of B100.

Recommendations for Use of Biodiesel Blends

Navistar recommends that users of B20 select a BQ9000 certified fuel supplier and request proof from the supplier that the fuel meets the EMA B20 Test Fuel Specification. Fuels not meeting the EMA specification may cause fuel system deposits,

Recommendations for Use of Biodiesel Blends (cont.)

plugged filters, contaminated engine oil, and fuel degradation.

If providers and customers follow correct storage and maintenance procedures for fuel and equipment, blends up to B20 that meet the EMA B20 Test Fuel Specification should perform satisfactorily in International® and International® MaxxForce™ diesel engines.

Navistar recommends the following:

- Storage tanks should be thoroughly cleaned of residue and microbial growth before storing biodiesel fuel and tanks should be inspected periodically for cleanliness. Residue, water or microbial growth will compound in stored biodiesel fuel, causing increased fuel deposits that clog fuel filters prematurely. Adding biocides will reduce microbial growth during storage, but this is not a substitute for cleaning storage tanks.
 - Vehicle fuel tanks should be thoroughly cleaned and dried before using biodiesel blends.
 - Since biodiesel blends tend to dissolve deposits in fuel tanks and fuel lines, new fuel filters should be installed on used engines, before using biodiesel blends.
 - Install new fuel filter during every oil change (at half the normal service interval), when using biodiesel to improve water separation.
 - Because biodiesel has a higher boiling point, check oil level more frequently and shorten oil change interval when fuel dilution raises the oil level under the following conditions:
 - Use of aftertreatment systems
 - Biodiesel blends closer to B20
 - Low Load usage
 - For cold climate conditions, Navistar recommends that an appropriate fuel heater be installed.
- Water separation from biodiesel fuel blends is more difficult than water separation from diesel fuel. Users should be careful to prevent water from accumulating in the fuel system. If possible, an additional fuel filter/water separator should be installed in the fuel system to remove water.
 - Biodiesel blends should be used within six months of the date of manufacture, because the oxidation stability of biodiesel is lower than diesel fuel.
 - If equipment fueled with biodiesel is to be stored for more than three months, the fuel system should be drained, cleaned, and dried.
 - Fuel system seals, used in 2006 and earlier engines may degrade prematurely. When replacing seals, Viton® seals or equivalent seals are recommended.
 - The following materials should be monitored if older engines operate with biodiesel: Natural rubber, butyl rubber, nitrile, copper, tin, and lead. These materials can degrade prematurely and cause deposits that clog fuel lines and filters.

Impact of Biodiesel Blends on Engine Emissions

B20 biodiesel blends are used in fleets in nonattainment areas to reduce visible smoke, particulate emissions, and diesel exhaust odor.

Biodiesel blends can reduce emission levels of HC (hydrocarbons) and CO (carbon monoxide); however, biodiesel blends may somewhat increase emission levels of NO_x (oxides of nitrogen) in some engines.

Biodiesel blends, used in new, low emissions engines do not significantly affect emissions.

Tests have shown that biodiesel blends help the self-regeneration of diesel particulate filters.