

## 4.04. Fuel specification for DAF diesel engines

Date of issue: May 1999

Modification date: 05-02-2008

### All DAF engines

The growing interest in alternative diesel fuel is reason to publish this SEI. It describes the obligatory diesel fuel specification for DAF engines. A number of specifications, including diesel fuel, are mentioned in the "driver" and "oil and grease specification" manuals which can be found via the Service RAPIDO button on the Dealernet website.

#### ● Fuel specification for DAF diesel engines

Based on the present status of DAF engine development, the fuel (compositions) used must meet certain international standards to be assured of the required engine performance, durability and emission goals. Therefore DAF prescribes for all its engines that:

- Any diesel or diesel fuel mixture must comply with European Fuel Standard EN 590
- 100% Biodiesel must comply with European Biodiesel Standard EN14214.  
Check applicability of this fuel on following pages.

#### ● Why alternative fuels?

The world-wide demand for less pollutant engine emissions in combination with the growing use of renewable energy sources, to diminish our dependency on fossil raw material, are the main reasons why alternative fuels are being developed. Some of the alternative fuels developed are:

- **Biodiesel (FAME)\*:** is fuel manufactured using agricultural products such as rapeseed oil, soybean oil, sugar beet, sun flower oil and palm oil. Widely used are Rape Methyl Ester (RME), Soybean Methyl ester (SME) and Palm Methyl Ester (PME). Collectively they are known as Fatty Acid Methyl Esters (FAME). The fatty oils are chemically modified by reaction with mostly methanol (esterification), during which the long tri-glycerides molecules are split into short fatty acid methyl ester molecules, producing a common diesel-like product with glycerine as a (waste) by-product. The bio "fuel" can be blended with fossil diesel fuel demanding only minor or no engine modification (concentrations < 5%) but intensified maintenance and sometimes exchange of rubbers when a biodiesel concentration above 5% is applied.

\*) Biodiesel can also be made from non-vegetable oils although this form is not preferred.

- **Straight vegetable oil (SVO):** (Pure Plant Oil = PPO is one of the possible derivative products) is fuel that can be extracted from a range of agricultural products of which rapeseed oil is most commonly used. In contrast to biodiesel fuel the SVO fuel types do not receive the esterification treatment. As a result they remain a very (high) viscous liquid even at normal and low temperatures which makes a preheated engine fuel supply system indispensable to improve or even enable a cold engine start. At operating temperature engines will run but the fuel will lead to increased emissions and deposits in the combustion chambers and reduced performance and durability of the fuel injecting equipment. The use of SVO is not allowed as fuel in combustion engines because the above mentioned issues will lead to unacceptable damages and (reduced) engine life expectations.
- **City-diesel:** is fuel, like the current everyday diesel fuel refined from fossil raw material, but improved in composition during the refinery process. Sulphur reduction and lower aromatic content are common for all City-diesel fuels which, together with possible other chemicals changes during the refinery process, finally results in a virtually sulphur-free emission with reduced particles (PM) and nitrogen oxide (NOx) content. City-diesel is also referred to as ULSD (Ultra Low Sulphur Diesel).

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### ● Characteristic of biodiesel

Some advantages are:

- It contains almost zero sulphur and no aromatics, resulting in generally lower particulate exhaust emissions
- It is biodegradable and non-toxic; however, its biodegradability is nearly lost when blended with standard diesel.

Some disadvantages are:

- biodiesel is not stable and will deteriorate (at higher temperatures).
- reduced cold start performance at low ambient temperatures
- less evaporating effect when heated, resulting in a negative effect on the oil change interval
- due to its high oxygen content, it produces higher NOx levels during combustion
- it has lower volumetric energy density than diesel leading to higher fuel consumption ( $\pm 10\%$ ) and power losses (6-8%)
- biodiesel is hygroscopic leading to water absorption during a storage period. Bacteria and fungi will grow on interface of water and biodiesel leading to corrosion of the FIE components and filter blocking
- biodiesel is a good solvent and can affect lacquer and elastomers
- biodiesel has a high pour point
- that phosphorous, sodium and potassium can attack the catalyst unit in SCR systems

### ● Effects sorted by fuel composition

Each variant of the refined diesel fuel has a different and unique 'physical' quality. Qualities, such as density, differentiation of the aromatic and other components, which inevitably determine the 'behaviour' of the fuel during the combustion process and the amount of energy delivered.

The fuel itself and the engine combustion efficiency are responsible for the output performance, fuel consumption and composition of emitted gasses.

Some results from engine tests are:

- the absence of sulphur as such has no significant effect on the engine fuel consumption
- blends with standard diesel with higher 'biodiesel' concentration than 5% (by volume) can cause a number of problems to parts of the fuel injection system such as:
  - corrosion of fuel injection equipment
  - pump seizure due to high fuel viscosity at low ambient temperatures
  - fuel injector spray hole blockage
  - elastomeric seal failures
  - increased injection pressure
  - increased dilution and polymerisation of engine sump oil
  - a reduced cold start performance
  - filter plugging through microbiologic life, displacement of formed deposits, high viscosity at low temperatures

Ongoing engine and fuel system developments will improve the component resistibility against the influences of biodiesel type fuels. Check for the current set of conditions and guidelines the sections that follow.

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### ● General guidelines for alternative fuel per engine type

Based on gathered knowledge concerning the effects of alternative fuels, DAF supports the following rule:

Alternative fuels and mixtures of diesel fuel for DAF vehicles are allowed, if all conditions that are mentioned below are met.

Indication of current and non-current engine types and vehicle series descriptions:

Engine type	Euro Emission Class	Series
BE – CE	Euro 3 (and earlier)	LF and CF65
PE	Euro 3 (and earlier)	CF75
XE	Euro 3 (and earlier)	95XF
XE	Euro 3 (and earlier)	CF85 - XF95
FR – GR	Euro 4 / 5	LF and CF65
PR	Euro 4 / 5	CF75
MX	Euro 4 / 5	CF85 - XF

### Summary of conditions:

- There may be no negative (destructive) chemical reaction of the fuel on any of the engine or fuel system components.
- All of the official effectuated EN590 Fuel Standard requirements must be met.
- **LF vehicles** with BE, CE engines: according to Euro 3 emissions class:  
Only official produced diesel according to EN590 and mixtures of diesel according EN590 with a maximum of 20% biodiesel according to EN14214 are allowed
- **LF vehicles** with FR, GR engines:  
Only official produced diesel or blends with alternative fuel up to 5% biodiesel according standard EN590 is allowed.
- **95XF vehicles** with XE engines:  
Only official produced diesel or blends with alternative fuel up to 5% biodiesel according standard EN590 is allowed.
- **XF95 vehicles** with XE engines:  
Only official produced diesel according to EN590 or Biodiesel according to EN14214 and mixtures of these 2 products are allowed
- **CF75/85 vehicles** with PE and XE engines before chassis number 0E552890:  
Only official produced diesel or blends with alternative fuel up to 5% biodiesel according standard EN590 is allowed.
- **CF75/85 vehicles** with PE and XE engines after chassis number 0E552891:  
Only official produced diesel according to EN590 or Biodiesel according to EN14214 and mixtures of these 2 products are allowed
- **CF75/85 and XF105 Vehicles** with PR and MX engines:  
Only official produced diesel according to EN590 or Biodiesel according to EN14214 and mixtures of these 2 products are allowed.
- Fuel produced from straight vegetable oil (SVO) is **not** allowed.

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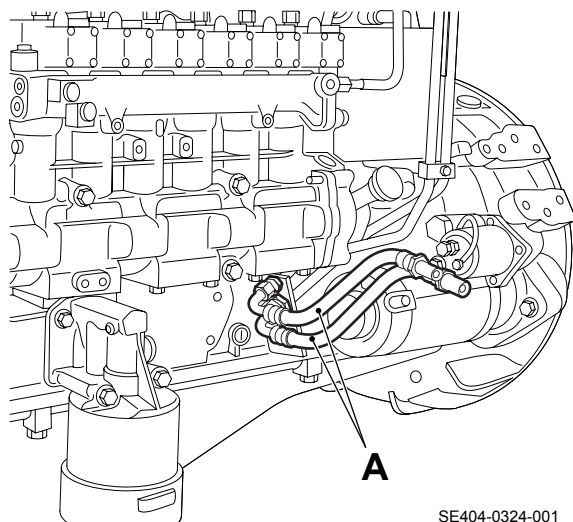
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### @ Additional conditions and requirements:

For engine types where blends of standard diesel fuel with 5% up to 100% biodiesel are used the following additional conditions are applicable:

- the fuel hoses "A" which run from the connection in the chassis member to the engine (see below) need to be replaced. For the part numbers of biodiesel resistant fuel hoses\* see the table on the right.



Biodiesel resistant fuel hoses <sup>1)</sup>	
Engine type	DAF Part Number
PR	Supply hose: 1782404 Return hose: 1782405
MX	Supply hose: 1782406 Return hose: 1782417

(1) These fuel hoses are only available via the After Sales Parts department.

- the sealing of the fuel filler cap may cause leakage; if so it needs timely replacement.
- the oil drain and fuel filter change interval must be diminished by half.
- extended oil drain intervals are not allowed.
- under cold weather circumstances the fuel may cause problems in the fuel system; this can be prevented by heating the fuel, the use of (a higher percentage of) normal diesel or the use of additives. Solutions to this have to be consulted with the supplier of the biodiesel fuel.
- for the Euro 4 / 5 catalytic converter (silencer unit) on vehicles that operate on fuel blends with more than 5% up to 100% biodiesel the warranty is stopped after 1 year or 150.000 km, whichever comes first.

- @ - the fuel tank content must be checked regularly (monthly) for water, deposits bacteria growth, etc. and cleaned if necessary. Also, if fuel tank fillings change from diesel to biodiesel according to the EN14214 standard then the tank must be cleaned thoroughly before taken into service. See notes below.
- the additional fuel pump that is used in the dual tank layout must frequently be checked for leakage and replaced when necessary.
- the installation of a heated water separator unit is mandatory.
- Blends of diesel fuel with water are not allowed

**Important:** In case fuel blends with >5% biodiesel are used on Euro 4 or 5 chassis then a minimum Care + R&M package is compulsory. This package covers the required engine oil drain and oil filter change requirements and necessary additional dealer inspections.

- @ **Notes:**
  - The service intervals are related to the nature of the vehicle operation (urban and off-road, regional distribution and long distance); check for details the service maintenance schedule.
  - **Biodiesel has dissolving characteristics so that the change from diesel to biodiesel may cause deposits in the fuel system to dissolve and clog the filter. Check the filters after 1 or 2 tank fillings and replace if necessary.**

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### Comments to warranty conditions:

- Replacement of leaking hoses, fuel cap and the (two tank lay out) fuel pump is not covered under warranty.
- Replacement of the catalytic converter unit (silencer) when ineffective in NOx reduction, due to poisoning by chemical elements in the fuel used, is not covered under warranty
- A non compliance with the conditions mentioned above will make DAF's guarantee null and void. A non compliance is assumed by the appearance of:
  - the known degradation products of aged bio diesel or
  - known fuel system defects caused by non standard bio diesel, such as, but not limited to, filter plugging, corrosion, coking, fuel leakage, injector blocking, deposits, etc.

### ● Additional information for (biodiesel) fuel consumers

- Night heaters of the type D1LC compact and D3LC compact accept 100% biodiesel fuel.
- The Hydronic 10 and AirtronicD2 night heaters are released for blends of standard diesel with up to a maximum of 5% biodiesel.
- The AirtronicDS4 night heater accepts 100% biodiesel fuel.

### Notes:

- 1) When using 100% biodiesel, the heater should be operated twice a year with diesel fuel (in the middle and at the end of a heating period) to burn off any possible contaminating deposits. To do so, let the vehicle tank run almost empty and fill with diesel fuel without adding any biodiesel. While running on this tank filling, switch the heater on 2 to 3 times for 30 minutes at a time at the highest temperature setting.  
**Note:** check the fuel tank cleaning instruction on previous page.
- 2) When operating with diesel / biodiesel mixtures of up to 50 % biodiesel, intermediate operation with pure diesel fuel is not necessary.  
**Note:** check the fuel tank cleaning instruction on previous page.

### ● Storage and use of fuel

- 1) Users are reminded that fuel Standards apply to the fuel only to the point of delivery from the distribution network. From this point on it is the user's responsibility to protect the fuel in storage tanks, in supply systems and during use on the vehicle from free water and dirt contamination to enable engines to achieve the designed performance, emission, and durability targets.
- 2) Biodiesel fuel is not stable and will deteriorate at higher temperatures. Storage time must therefore be limited to a maximum period of:
  - 4 weeks in fuel tanks on vehicles that are temporarily out of service.
  - 6 months when stored in storage tanks and supply systems

# Sales Engineering Information



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