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English version

Fuels and biofuels - Pure plant oil fuel for diesel engine concepts - Requirements and test methods

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Foreword

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties on 2011-10-11, the constitution of which was supported by CEN following the public call for participation made on 2011-01-27.

The Secretariat of Workshop 56, is held by the Netherlands Standardization Institute (NEN). A list of the individuals and organizations which supported the technical consensus represented by the CEN Workshop Agreement is available to purchasers from the CEN-CENELEC Management Centre. These organizations were drawn from the following organisations:

ACRO-KHLim, Belgium	MatureDevelopment., the Netherlands
Bearth Energy Solutions, the Netherlands	VZW Zonnewindt / PPO.Be, Belgium
EPPOA, France	Solaroilsystems, the Netherlands
FR Cuma Rhône-Alpes, France	VWP, Germany
IESPM, France	Waldland, Austria
John Deere, Germany	

The final internal review round for this CWA was started on 22 September 2010 (first phase) and on 18 January 2011 (second phase) and was successfully closed on 22 June 2011. The final draft was submitted to public enquiry using CEN/TC 19 expertise on 30 June 2011 and the overall endorsement of the text being finalised on 11 October 2011. The final text of this CWA was submitted to CEN, after confirmation of consensus by all participants, for publication on 13 November 2011.

In this edition of CWA 16379 all relevant characteristics, requirements and test methods are specified. These specifications are relevant for the driveability of the vehicles and are currently known to prevent harm to the vehicles and their powertrains. National adaptations of this document may choose differently based on local conditions and / or updated knowledge. Climate dependent requirements of this document may vary according to national situations.

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Comments or suggestions from the users of the CEN Workshop Agreement are welcome and should be addressed to the CEN-CENELEC Management Centre.

Introduction

This CEN Workshop Agreement has been laid down to define a specification for Pure Plant Oil (PPO) or Pure Vegetable Oil (PVO), a liquid fuel from vegetable origin that is optimized in terms of base product and pressing process. Virgin Oil Liquid Fuel (VOLF) is an example of a cold pressed PPO. The fuels are intended for (adapted) modern diesel type engines and can be produced, treated and used locally without large investments. Fuel classes are specified for at least two different emission requirements: a class that is directly processed and is aimed to fulfil at maximum Tier 3a requirements (PPO1) and a class that should fulfil all current emission requirements using advanced engine concepts (PPO2). The PPO2 class fuel has a lower metal elements' content than the PPO1 class, resulting in less ash forming elements and therefore less negative effects on eventual exhaust after-treatment system.

At its 2009 plenary meeting, the European fuel specification drafting committee, CEN/TC 19, agreed that there was no need for a European wide EN standard and that the industry can apply a CWA as a tool to develop a specification.

With the Renewable Energy Directive (RED - EC/2009/28 [1]) and the amended Fuels Quality Directive (FQD - EC/2009/30 [2], [3]) there is an increasing demand for bio-based fuels. PPO does not meet the current diesel fuel specification, EN 590 [4], or the current biodiesel (FAME) specification, EN 14214 [5]. From an environmental perspective, vegetable oil fuel is a high quality, clean burning fuel. When used in adapted diesel engines, vegetable oil fuel can substantially reduce regulated emissions. In order to have the greatest possible emission reduction, a specific design and/or calibration of engines may be necessary. PPO fuel will also offer a meaningful contribution to the target of increased renewable content in transportation fuel pool.

PPO is a pure, bio-based product and cannot be characterized according to diesel specifications. Therefore, EN 590, or the current biodiesel (FAME) specification EN 14214 do not suffice. This specification is based on DIN 51605 [6]. Additional qualities have been introduced and made feed-stock independent, as DIN 51605 was still rapeseed oil oriented¹⁾ The objectives of vegetable oil fuel specifications are achieving less emission, expanding the market that is local nowadays, decreasing dependence of energy supply, and improving social economic situation of rural communities. PPO used as engine fuel has potential for the most comprehensive ecologic, economic and social benefits of all biofuels.

Blending with other diesel type fuels, such as petroleum based diesel, FAME or paraffinic diesel is not covered in this document.

The production of PPO according to the requirements of this document takes place by mechanical cold or hot extraction or by mechanical extraction with aid of solvents. In any case control measures like refining or solid-liquid separation are aimed to minimize content of undesirable contaminants and solid particles in the PPO (see also Table 1).

The CWA will be usable on a voluntary basis for engine clearance, fuel acceptance and where necessary fuelling station allowance, supporting both local regulations and international trade. In the longer term, further work in this area, including moves towards a more formal standard, will depend on whether PPO and the adapted engines become available as a general automotive concept. The Workshop will in this respect maintain close contact with CEN/TC 19 "Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin". In 2014 more severe emission restrictions will apply for non-road vehicles. Based on the knowledge gathered around that time, it is expected that further revision steps will be made.

1) During the drafting of this Workshop Agreement, the German Standardization Institute developed a revised plant oil specification [7]. This Workshop Agreement differs at some points with this DIN specification.

1 Scope

This CEN Workshop Agreement specifies those properties of pure plant oil (PPO) that are at least necessary to achieve smooth deployment of this fuel in diesel engines with/without exhaust gas after-treatment, compatible for PPO combustion. In this document two pure plant oil fuel classes are defined. These are effectively tailored towards use in diesel engines without and diesel engines with exhaust gas after treatment (catalyst, filter). Both classes are intended for, but not limited to, use in heavy duty vehicles²⁾. The specification is valid at the point of delivery.

EXAMPLE The delivery can be from an oil mill to a purchaser or from a fuelling station to a driver.

Since experience for long term and failure free use of PPO compatible combustion engines is limited, this document is not yet a comprehensive specification, but more limited to specific properties. Only those properties that are seen as necessary for minimum quality requirements in the current technical discussion have been included.

NOTE 1 The main differences between PPO and automotive diesel are in the areas of density, viscosity, contamination level and flash point.

Any oil seeds can equally be used for the production of PPO, when the produced plant oil fulfils all individual requirements of the properties and limits mentioned in this workshop agreement.

NOTE 2 This document has mainly been based on experience with seeds of the following oil plants: rape, canola, sunflower, Camelina sativa and Jatropha.

This document lays down properties and values for the use of PPO at present deemed necessary, along with the test methods for these properties to be applied. Application of the in this document defined PPO for vegetable oil compatible combustion engines is only allowed when warranties have been given accordingly from the engine or equipment manufacturer. Further properties can be included in later versions of this document as they become available from successful technical and analytical test results.

The specification is valid at the point of sale. Blending with diesel fuel or FAME is not covered in this edition of the CEN Workshop Agreement. If the need arises for blends of PPO with diesel a revision process will be considered.

NOTE 3 For the purposes of this Workshop Agreement, the terms "% (m/m)" and "% (V/V)" are used to represent respectively the mass fraction, μ , and the volume fraction, φ .

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12662:2008, *Liquid petroleum products — Determination of contamination in middle distillates*

EN 14104:2003, *Fat and oil derivatives — Fatty Acid Methyl Esters (FAME) — Determination of acid value*

EN 14112:2003, *Fat and oil derivatives — Fatty Acid Methyl Esters (FAME) — Determination of oxidation stability (accelerated oxidation test)*

2) Generally it is experienced that with a content of P or (Ca+Mg) lower than required in PPO1 also deposits in fuel filters and on injectors, piston, piston rings etc. can be reduced. Therefore any oil quality below the required parameters of P or (Ca+Mg) will have a positively impact on engine life span.

EN 15751:2009, *Automotive fuels — Fatty acid methyl ester (FAME) fuel and blends with diesel fuel — Determination of oxidation stability by accelerated oxidation method*

EN ISO 2719:2002, *Determination of flash point — Pensky-Martens closed cup method (ISO 2719:2002)*

EN ISO 3104:1996, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity (ISO 3104:1994)*

EN ISO 3170:2004, *Petroleum liquids — Manual sampling (ISO 3170:2004)*

EN ISO 3675:1998, *Crude petroleum and liquid petroleum products — Laboratory determination of density or relative density — Hydrometer method (ISO 3675:1998)*

EN ISO 3679:2004, *Determination of flash point — Rapid equilibrium closed cup method (ISO 3679:2004)*

EN ISO 4259:2006, *Petroleum products — Determination and application of precision data in relation to methods of test (ISO 4259:2006)*

EN ISO 12185:1996, *Crude petroleum and petroleum products — Determination of density — Oscillating U-tube method (ISO 12185:1996)*

EN ISO 12937:2000, *Petroleum products — Determination of water — Coulometric Karl Fisher titration method (ISO 12937:2000)*

prEN ISO 13032, *Petroleum products — Determination of low concentration of sulfur in automotive fuels — Energy-dispersive X-ray fluorescence spectrometric method (ISO/DIS 13032:2010)*

EN ISO 20846:2011, *Petroleum products — Determination of sulfur content of automotive fuels — Ultraviolet fluorescence method (ISO 20846:2011)*

EN ISO 20884:2011, *Petroleum products — Determination of sulfur content of automotive fuels — Wavelength-dispersive X-ray fluorescence spectrometry (ISO 20884:2011)*

DIN 51627-6, *Automotive Fuels — Test methods — Part 6: Direct determination of trace elements in vegetable oils by inductively coupled plasma optical emission spectroscopy (ICP OES)*

DIN 51750-1, *Sampling of petroleum products; general information*

DIN 51750-2, *Sampling of liquid petroleum products*

DIN 51900-1, *Testing of solid and liquid fuels - Determination of gross calorific value by the bomb calorimeter and calculation of net calorific value - Part 1: Principles, apparatus, methods*

DIN 51900-2, *Testing of solid and liquid fuels — Determination of the gross calorific value by the bomb calorimeter and calculation of the net calorific value — Part 2: Method using isoperibol or static jacket calorimeter*

DIN 51900-3, *Testing of solid and liquid fuels — Determination of gross calorific value by the bomb calorimeter and calculation of net calorific value — Part 3: Method using adiabatic jacket*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply

3.1

chemically unmodified

not trans-esterified