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Foreword

This document (CEN/TR 15367-1:2014) has been prepared by Technical Committee CEN/TC 19 “Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin”, the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TR 15367-1:2007. The update primarily addresses quality issues that can be associated with blends of diesel fuels and Fatty Acid Methyl Esters (FAME) and by low-level contaminants in diesel fuel that can be picked up in supply and distribution systems. These low level contaminants, such as sodium and other inorganic contaminants, have recently been implicated in the formation of internal diesel injector deposits (IDID).

CEN/TR 15367 consists of the following parts, under the general title *Petroleum products - Guidelines for good housekeeping*:

— *Part 1: Automotive diesel fuels*

— *Part 2: Automotive petrol fuels*

— *Part 3: Prevention of cross-contamination*

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This part of this Technical Report describes the distribution of automotive fuels in general and diesel in specific detail. Part 2 was subsequently published to provide guidance on petrol distribution and specifically to address ethanol issues. Finally, Part 3 was published to provide additional guidance on preventing cross-contamination of fuel products in common supply and distribution systems. For further information on the relationship between and the history behind each of the parts, see the Introduction to this document.

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Introduction

During its meeting held in Cannes on June 27 2003, WG 24 “Specification for Automotive diesel” decided that a guidance document on good housekeeping could be instrumental in preventing potential motoring problems caused by contamination in the supply chain. This was endorsed by CEN/TC 19 resolution 24.5 and resulted in an effective publication of the first Technical Report in March 2006.

When a similar guideline for petrol was being drafted, it was decided to link these two. The best option was to publish them as separate parts of the same CEN document, which is achieved by revising the original CEN/TR 15367:2006 *Petroleum products — Automotive Diesel Fuels — Guide for good housekeeping* as part 1. Apart from some harmonization of wording no changes have been incorporated.

Two additional reports have now been published in this series regarding Automotive Petrol Fuels (Part 2) and the Prevention of Cross Contamination (Part 3).The work on these three documents has been carried out with support from CONCAWE and other stakeholders.

Automotive fuel specifications generally apply at the point of delivery to the customer. To ensure the quality at this point, the best practice is to make sure that the product meets specification when it is dispatched from the refinery and to have systems in place to ensure that it cannot go off-specification on its way to the customer. There will be more than one method or procedure to handle many of the potential contamination issues throughout the distribution chain, thus the advice in this document outlines principles to apply, but does not specify the precise detail of the methods to be adopted in all cases. Nevertheless, it is strongly recommended that all the procedures or measures to be applied along the distribution chain should be defined using a Total Quality Assurance methodology.

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1 Scope

This Technical Report provides general guidance on diesel fuel housekeeping. It does not pre-empt national or local regulations but addresses the issues of contamination by water, sediment, inorganic contaminants, or microbial growth that may occur in the supply chain during manufacture, blending, storage and transportation. It does not address contamination by other fuel products nor does it address possible contamination by water or sediment that may occur on-board vehicles. An informative note on vehicle factors is presented in Annex A, however.

2 Normative references

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

EN 590, *Automotive fuels - Diesel - Requirements and test methods*

3 Supply chain definition

For the purposes of this document, the supply chain is considered to consist of the following four parts:

— refineries,

— terminals,

— filling stations (including retail and industrial customer sites), and

— transportation from refineries to terminals and from terminals to filling stations.

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Information on additives beyond the supply chain is given in Annex B.

4 Potential sources of water and sediment in the supply chain

4.1 Water

Water may be picked up by the diesel fuel product at various stages of the supply chain and can be present either as free water or as an emulsion with small droplets of water suspended in fuel. The presence of FAME can increase fuel/water emulsions. The presence of free water can be a contributory cause of corrosion and biological contamination. Entry points for water include:

a) **dissolved or emulsified water** can occur during diesel fuel or FAME manufacturing. Dissolved or emulsified water can remain suspended in fuel or may separate and become free water further along the supply chain depending on the composition of the fuel and storage conditions. Cooling of the fuel blend can cause the dissolved water to coalesce and separate from the fuel;

b) **free water** can occur due to ingress or leaks as a result of, for example, heavy rainfall or through cracks in equipment;

c) **water vapour** (humid air) can enter storage tanks through air vents followed by cooling or condensation on tank walls or vehicle tanks;

Because it is virtually impossible to stop water from entering the supply chain, proper water management is essential. Tank inspections should routinely look for free water at the bottom of storage tanks. Free water, along with emulsified fuel, should be drained to ensure that the remaining fuel is clear and bright and free of extraneous material.

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4.2 Potential sources of sediment

Sediment may be due to inorganic or organic contaminants in the fuel. Inorganic contaminants can consist of rust, dirt, dust, corrosion products, and trace materials retained from fuel and FAME production. Organic contaminants can consist of oxidation products, biological growth, and trace materials from fuel and FAME production. Sediments may form over a long period of time under storage conditions.

4.3 Potential sources of biological contamination

Biological contamination can result from the action of microorganisms, such as bacteria, fungi, and yeasts, which are ubiquitous in the environment. Microbes can bloom whenever there is a source of water, air (oxygen), and fuel (as food). The presence of FAME in fuel can encourage growth. As a result, biological contamination is more common in diesel fuels containing FAME than in gasoline containing bio-products.

Biological contamination can lead to bio-derived films and sediments in storage tanks, pipelines, and filters, potentially causing serious operational problems including filter-blocking and fuel dispenser malfunctions. While good housekeeping, including the elimination of water bottoms in tanks, reduces biological growth, severely contaminated tanks may require more severe treatment, including biocide additives.

4.4 Adulterants and contaminants

Diesel fuel shall be free from any adulterant or contaminant that may render the fuel unacceptable for use in diesel engine vehicles.

Sodium at trace levels in diesel fuel has been found to cause deposit problems in some types of diesel fuel injectors resulting in engine failures. Trace sodium can originate from many sources, cannot be easily controlled or corrected in a multi-product distribution system, and cannot be routinely measured at historical concentrations except in a very well-equipped analytical laboratory. Due diligence is therefore advised for ensuring the integrity of vehicle fuel systems by controlling potential sources of sodium and other deposit-forming materials in fuel. Potential sources for sodium in diesel fuel are pipeline corrosion inhibitors, refinery process additives, import terminal or refinery salt driers, refinery processing units, biodiesel blending, contamination from sea water due to logistics systems or airborne sodium in coastal locations (sea salt). See for more detail CEN/TR 16680 [1]. There are currently no known or intended limits for sodium concentrations in diesel fuel.

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Other metal ions of concern are zinc, copper and lead. Zinc has a tendency to accumulate in spray-holes and contributes to nozzle coking. Lead is attacked by fuel acids and forms voluminous soap precipitates. Copper is known to catalytically accelerate fuel oxidation.

For more information on preventing contamination by water or sediment that may occur in the supply chain or for avoiding cross contamination, it is advisable to evaluate the ‘good housekeeping’ practices recommended in CEN/TR 15367-3 and to check the report on the investigation regarding internal diesel injector sticking deposits mechanisms [1].

5 Housekeeping guidelines

5.1 Elements of good housekeeping

5.1.1 Operations

Proper attention to detail during all operating activities from product manufacturing to final delivery is essential to guarantee product quality. Operating procedures should be in place covering receipt, delivery, sampling, inspection, testing, and tank draining. These procedures should be reviewed and updated as required, when product quality changes are taking place as a result of new regulations or the introduction of new fuel types.

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It is essential that personnel involved at each step in fuel transfers, both company employees and contractors, are properly trained so that they are aware of and understand the importance of applying and continuously improving operating procedures.

If the use of chemicals is considered anywhere in the supply chain for housekeeping purposes (e.g. corrosion protection or biological remediation) the potential impact on fuel quality and performance should be investigated thoroughly. Non-chemical solutions are generally preferred.

5.1.2 Hardware

The age and design of existing hardware along the supply chain vary widely and yet it is possible to control product quality properly with differently engineered installations. Quality control, however, is much easier if hardware is first designed with the intention to facilitate good housekeeping as described in the following sections.

5.1.3 Maintenance

No matter how well designed an installation may be, equipment faults can develop over time if the equipment is not inspected and properly maintained. Inadequate maintenance can eventually affect the ability of the operator to maintain product quality at the required level.

5.2 Detailed recommendations

5.2.1 General

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Recommendations in this section are divided into four sections covering various elements related to refineries, terminals, filling stations and transportation. This guidance represents current industry best practices but is largely based on experience handling hydrocarbon-only diesel fuels.

5.2.2 Refineries

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5.2.2.1 Testing

Batches of diesel fuel should first be visually assessed for clear and bright appearance with no free water and free from visible sediment. When testing for visual appearance, the prevailing ambient temperature should be considered. Alternative methods such as online haze meters may be used. The product shall meet the water content and total contamination requirements of EN 590.

When a sample is not visually acceptable, it should be analysed to quantify the problem. Analysis at this point enables any issues to be resolved at the refinery and avoid the problem becoming more widespread. Product imports at terminals should be tested using the same procedures recommended for terminals (see 5.2.3). Batches that are delivered by barge or by sea-going vessels should receive special attention to ensure that they conform to quality specifications. Test records and retained samples should be kept for a sufficient period to cover market needs.

5.2.2.2 Sampling

Upper, middle and bottom samples should be taken from fixed off-take storage tanks for visual assessment and analysis. All three samples should be examined for visual appearance, including confirmation that the blend is not layered. Composite samples may be used for the other routine specification tests.

No special requirements are specified with respect to settling time, after blending and before sampling. If product samples do not satisfy the visual appearance, water content or sediment tests, allowing time for settling is one measure that can be employed to bring the product on specification. It should be noted, however, that settling time alone is unlikely to alleviate high water contents in diesel fuels containing FAME. Water can remain dispersed in the fuel increasing the potential for water accumulation or biological contamination problems elsewhere in the supply chain.