

Petroleum products – CME-blended automotive diesel oil (ADOB4) - Specification

**Foreword**

This Philippine National Standard PNS/DOE QS 017:2021, Petroleum products - CME-blended automotive diesel oil - Specification was prepared by the Department of Energy through the Technical Committee on Petroleum Products and Additives (DOE/TCPA) and was approved for adoption as Philippine National Standard by the Bureau of Philippine Standards.

This standard addresses the technical requirement of automotive diesel oil containing 4% v/v CME or CME-blended automotive diesel oil (ADOB4) and suitable test methods.

This standard will also support future energy policies towards the integration of higher biofuels blends in the petroleum/fuel sector. This is also in line with the continuing program of the government towards the use of cleaner fuels and promoting the use of indigenous and renewable energy resources with the end view of reducing dependence of imported oil.

Further, it also considers the current requirement of the industry, its users and manufacturers vis-à-vis the continuing commitment in ensuring supply availability and safeguard the health and welfare of the people.

This entire standard is subject for review and/or revision when necessary.

## 1 Scope

This standard specifies the requirements for CME-blended diesel oil suitable for various types of automotive diesel engines.

## 2 References

The titles of the standard publications referred to in this standard are listed on the inside back cover.

## 3 Definitions

For the purpose of this standard, the following definitions apply:

### 3.1

#### **automotive diesel oil (ADO)**

refers to diesel oil used for on-road vehicles, i.e. driven on both public and private roads.

### 3.2

#### **base diesel oil**

refers to diesel oil that shall be blended with CME to produce CME-blended diesel oil.

### 3.3

#### **Coconut Methyl Esters (CME)**

refers to fatty acid methyl esters (FAME) derived from coconut oil whose alkyl groups range in varying percentages from C<sub>8</sub> to C<sub>18</sub> suitable for compression ignition engines and other similar types of engines.

### 3.4

#### **diesel oil**

refers to refined petroleum distillates, which may contain small amount of hydrocarbon or non-hydrocarbon additives to improve ignition qualities or other characteristics, suitable for compression ignition engines and other suitable types of engines.

### 3.5

#### **CME-blended automotive diesel oil (ADOB4)**

refers to quality grade of automotive diesel oil blended with 4% v/v CME

### 3.6

#### **FAME**

refers to fatty acid methyl ester (FAME), or biodiesel, defined as mono-alkly esters derived from vegetable oils or animal fats and other biomass derived oils.

#### 4 Requirements

CME-blended automotive diesel oil (ADOB4) shall conform to the chemical and physical requirements specified in Table 1.

Annex 1 provides minimum reference specification for base diesel oil

**Table 1 – Chemical and physical requirements for CME-blended automotive diesel oil (ADOB4)**

Property	Limits	Test Methods
Cetane number <sup>a</sup> , min. or Derived cetane number, min.	50	PNS ASTM D 613  PNS ASTM D 6890 or PNS ASTM D 7170 or PNS ASTM D7668
Carbon residue on 10% Distillation residue, % mass, max.  Conradson or Ramsbottoms or Micro	0.15	   PNS ASTM D 189 or PNS ASTM D 524 or PNS ASTM D 4530
Color, ASTM, max	2.5	PNS ASTM D 1500
Copper strip corrosion, 3 h at 50°C, max.	No.1	PNS ASTM D 130 or PNS ISO 2160
Density at 15°C, kg/L	0.820 - 0.860	PNS ASTM D 1298 or PNS ASTM D 4052 or PNS ASTM D 7777
Distillation, 90% recovered, °C, max.	370	PNS ASTM D 86
FAME <sup>b</sup> , content, % vol.	3.7 – 4.2	EN 14078 or PNS/DOE TM 01 or PNS/DOE TM 02 PNS ASTM D7371 or PNS ASTM D7806
Flash point, Pensky-Marten, °C, min.	55	PNS ASTM D 93
Kinematic viscosity, mm <sup>2</sup> /s at 40°C	2.0 – 4.5	PNS ASTM D 445 PNS ASTM D 7042
Lubricity, (HFRR), wear scar dia. @60°C, micron, max.	460	PNS ASTM D 6079
Methyl laurate (C12 ME), % mass, min.	1.6	PNS/DOE TM 01
Sulfur, %mass, max.	0.005	PNS ASTM D 4294 or PNS ASTM D 2622 or PNS ASTM D5453 PNS ASTM D7039
Water, % volume, max.	0.05	PNS ASTM D 6304 or PNS ISO 12937 or PNS ASTM E 203
Water and sediment, % volume, max.	0.10	PNS ASTM D 2709
<sup>a</sup> Where ASTM D613 is not available, ASTM D4737 can be used as an alternative test method (see <i>item 8</i> Additional Note). However, ASTM D4737 shall not be applicable for regulatory compliance <sup>b</sup> As per latest PNS/DOE QS 002 for B100		

**6 Sampling**

CME-blended automotive diesel oil shall be sampled in accordance with PNS ASTM D 4057.

**7 Test methods**

CME-blended automotive diesel oil shall be tested in accordance with the methods specified in Table 1.

**8 Additional Note/s**

Where cetane number by test method ASTM D 613 is not available, Test Method ASTM D 4737 can be used as an approximation. Although biodiesel blends are excluded from the scope of test method ASTM D 4737, the results of Test Method ASTM D 4737 for up to B5 blends can be used as an approximation.

**Annex 1 – Minimum reference specification for base diesel oils**

<b>Property</b>	<b>ADO</b>	<b>Test Methods</b>
Calculated cetane index, min.  or  Cetane number, min.	50	PNS ASTM D 976 or PNS ASTM D 4737  PNS ASTM D 613
Carbon residue on 10% distillation residue, % mass, max.  Conradson or Ramsbottoms or Micro	0.15	PNS ASTM D 189 or PNS ASTM D 524 or PNS ASTM D 4530
Color, ASTM, max.	2.5	PNS ASTM D 1500
Copper strip corrosion 3 h at 50°C, max.	No.1	PNS ASTM D 130 or PNS ISO 2160
Density at 15°C, kg/L.	0.820 - 0.860	PNS ASTM D 1298 or PNS ASTM D 4052 or PNS ASTM D 7777
Distillation, 90% recovered, °C, max.	370	PNS ASTM D 86
Flash point, Pensky-Marten, °C, min.	55	PNS ASTM D 93
Kinematic viscosity, mm <sup>2</sup> /s at 40°C	2.0 – 4.5	PNS ASTM D 445 or PNS ASTM D 7042
Lubricity, (HFRR), wear scar dia. at 60°C, micron, max.	460	PNS ASTM D 6079
Sulfur, %mass, max.	0.005	PNS ASTM D 4294 or PNS ASTM D 2622 or PNS ASTM D5453 or PNS ASTM D7039
Water, % volume, max.	0.05	PNS ASTM D 6304 or PNS ISO 12937 or PNS ASTM E 203
Water and sediment, % volume, max.	0.10	PNS ASTM D 2709

**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.

PNS ASTM D86:2017 (ASTM published 2017) Standard Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure

PNS ASTM D93:2017 (ASTM published 2016a) Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

PNS ASTM D130:2015 (ASTM published 2012) Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

PNS ASTM D189:2015 (ASTM published 2006 reapproved 2014) Standard Test Method for Conradson Carbon Residue of Petroleum Products

PNS ASTM D445:2017 (ASTM published 2017a) Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

PNS ASTM D524:2015 (ASTM published 2015) Standard Test Method for Ramsbottom Carbon Residue of Petroleum Products

PNS ASTM D613:2017 (ASTM published 2017b) Standard Test Method for Cetane Number of Diesel Fuel Oil

PNS ASTM D976:2017 (ASTM published 2006 reapproved 2016) Standard Test Method for Calculated Cetane Index of Distillate Fuels

PNS ASTM D1298:2015 (ASTM published 2012b) Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

PNS ASTM D1500:2015 (ASTM published 2012) Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)

PNS ASTM D2622:2017 (ASTM published 2016) Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

PNS ASTM D2709:2017 (ASTM published 2016) Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge

PNS ASTM D4052:2017 (ASTM published 2016) Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter

PNS ASTM D4057:2015 (ASTM published 2012) Standard Practice for Manual Sampling of Petroleum and Petroleum Products

PNS ASTM D4294:2017 (ASTM published 2016e1) Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry

PNS ASTM D 4530:2015 (ASTM published 2015) Standard Test Method for Determination of Carbon Residue (Micro Method)

PNS ASTM D4737:2017 (ASTM published 2010 reapproved 2016) Standard Test Method for Calculated Cetane Index by Four Variable Equation

PNS ASTM D5453:2017 (ASTM published 2016e1) Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence

PNS ASTM D6079:2017 (ASTM published 2011 reapproved 2016) Standard Test Method for Evaluating Lubricity of Diesel Fuels by the High-Frequency Reciprocating Rig (HFRR)

PNS ASTM D6304:2017 (ASTM published 2016e1) Standard Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration

PNS ASTM D6890:2017 (ASTM published 2016e1) Standard Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuel Oils by Combustion in a Constant Volume Chamber

PNS ASTM D7039:2015 (ASTM published 2015a) Standard Test Method for Sulfur in Gasoline, Diesel Fuel, Jet Fuel, Kerosine, Biodiesel, Biodiesel Blends, and Gasoline-Ethanol Blends by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry

PNS ASTM D7042:2017 (ASTM published 2016e1) Standard Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)

PNS ASTM D7170:2017 (ASTM published 2016) Standard Test Method for Determination of Derived Cetane Number (DCN) of Diesel Fuel Oils—Fixed Range Injection Period, Constant Volume Combustion Chamber Method

PNS ASTM D7371:2017 (ASTM published 2014) Standard Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) Content in Diesel Fuel Oil Using Mid Infrared Spectroscopy (FTIR-ATR-PLS Method)

PNS ASTM D7668:2017 (ASTM published 2017) Standard Test Method for Determination of Derived Cetane Number (DCN) of Diesel Fuel Oils—Ignition Delay and Combustion Delay Using a Constant Volume Combustion Chamber Method

PNS ASTM D7777:2017 (ASTM published 2013) Standard Test Method for Density, Relative Density, or API Gravity of Liquid Petroleum by Portable Digital Density Meter

PNS ASTM D7806:2017 (ASTM published 2012) Standard Test Method for Determination of the Fatty Acid Methyl Ester (FAME) Content of a Blend of Biodiesel and Petroleum-Based Diesel Fuel Oil Using Mid-Infrared Spectroscopy

PNS ASTM E 203:2017 (ASTM published 2016) Standard Test Method for Water Using Volumetric Karl Fischer Titration



PNS ISO 2160:2017 (ISO published 1998) Petroleum Products – Corrosiveness to Copper – Copper Strip Test

PNS ISO 12937:2017 (ISO published 2000) Petroleum Products – Determination of Water – Coulometric Karl Fischer Titration Method

PNS EN 14078:2003 (modified), Liquid Petroleum Products – Determination of Fatty Acid Methyl Ester (FAME) Content in Middle Distillates – Infrared Spectrometry Method

PNS/DOE TM 01:2015 – Determination of Ester and Lauric Acid Content in Fatty Acid Methyl Esters (FAME) by Gas Chromatography

PNS//DOE TM 02:2009 - Separation of Fatty Acid Methyl Esters (FAME) from FAME-Blended Diesel Oil by Liquid Adsorption Chromatography and Characterization by Gas Chromatography

### **Abbreviations**

PNS	-	Philippine National Standard
ASTM	-	American Society for Testing and Materials
ISO	-	International Standard Organization
EN	-	Euro Norm (Regional Standard of European Countries)

**Department of Energy**  
**Technical Committee on Petroleum Products and Additives**

**Chairpersons**

- |  |   |
|--|---|
| 1 Rino E. Abad<br>Alvin David T. Lim*<br>Ricardo S. Infante*<br>Department of Energy | 2 Metodio Turbella<br>Edwin Romel Navaluna*<br>Department of Environment and<br>Natural Resources |
|--|---|

**Members**

*Petroleum Manufacturers Sector:*

- 3 Ronald Q. Chiong  
Cristina Banogon\*  
Petron Corporation
- 4 Stephen Cruz  
Mike Velasco\*  
Pilipinas Shell Petroleum Corp.

*Petroleum Marketers Sector:*

- 5 Jemma Aguado  
Chevron (Phils.), Inc.
- 6 Bernadette Raymundo  
Tanya Samillano\*  
Independent Philippine Petroleum  
Companies Association (IPPCA)
- 7 Dennis Yao  
Haidenel Macaraig\*  
Total Phils. Corporation
- 8 Jaime Diago, Jr.  
Phoenix Petroleum Phils. Inc
- 9 Leo P. Bellas  
Jetti Petroleum Inc.
- 10 Raffy C. Capinpin  
Petroleum Institute of Philippines

*End-Users:*

*Car Manufacturers Sector:*

- 11 Benjie Dionela  
Jover Pagpaguitan\*  
Chamber of Automotive Manufacturer  
of the Phils., Inc.

*Motorcycle Sector:*

- 12 Magnus Mateo  
Kasper P. Castro\*  
Motorcycle Development Program  
Participants Association Inc.

*Agricultural Machineries Sector:*

- 13 Joel Panagsagan  
Chris C. Rubiano\*  
Agricultural Machinery Manufacturers  
and Distributors Association

*NGO/Consumer Sector:*

- 14 Alexander P. Loinaz  
Filipino Car Foundation/  
Coalition of Clean Air (CCA)
- 15 Edgardo G. Alabastro  
Air and Waste Management Association

*Academe Sector:*

- 16 Rafael F. Diaz  
Florello C. Galindo\*  
Asian Institute of Petroleum Studies, Inc.
- 17 Sheila Flor D. Javier  
Carmelita J. Villanueva\*  
University of the Philippines, National  
Center for Transportation Studies

*Government Agencies:*

- 18 Myra Magabilin  
Clarence Andrion\*  
Bureau of Philippine Standards, DTI
- 19 Corazon G. Magpantay  
Industrial Technology Development  
Institute, DOST
- 20 Amelia M. de Guzman  
Virginia S. Llamo\*  
Energy Research & Testing Laboratory  
Services, DOE
- 21 Arthus T. Tenazas  
Legal Services, DOE

*Professional Institution/Expert Sector:*

- 22 Whitman L. Uy-Matiao
- 23 Willy Toledo

**Secretariat**

Oil Industry Standards & Monitoring Division,  
Oil Industry Management Bureau  
Department of Energy

\* Alternate