Asia-Pacific Economic Cooperation

Department of Alternative Energy Development and Efficiency
MINISTRY OF ENERGY

MTEC
a member of NSTDA

Discussion on/Way forward for guidelines toward high biodiesel blend diesel

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The 1st APEC Workshop on Guidelines toward High Biodiesel Blend Diesel (eg B20) Specification in the APEC Region

13-14 December 2017

CC405, Thailand Science Park, Thailand

Outline

- International Review of Biodiesel Standards
- Prior Initiative on Harmonization of International Standards: Technical Standards
- Discussion

International Review of Biodiesel Standards

ASTM standard for biodiesel

D975: diesel (up to B5)

D7467: B6-B20

D6751 biodiesel (B100)

ASTM

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D975 – 17

Standard Specification for Diesel Fuel Oils[1]

This standard is issued under the fixed designation D975; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers seven grades of diesel fuel oils suitable for various types of diesel engines. These grades are described as follows:

1.1.1 *Grade No. 1-D S15*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 15 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S15 fuel.[2]

1.1.2 *Grade No. 1-D S500*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 500 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S500 fuel.[2]

1.1.3 *Grade No. 1-D S5000*—A special-purpose, light middle distillate fuel for use in diesel engine applications requiring a fuel with 5000 ppm sulfur (maximum) and higher volatility than that provided by Grade No. 2-D S5000 fuels.

1.1.4 *Grade No. 2-D S15*—A general purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 15 ppm sulfur (maximum). It is especially suitable for use in applications with conditions of varying speed and load.[3]

1.1.5 *Grade No. 2-D S500*—A general-purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 500 ppm sulfur (maximum). It is especially suitable for use in applications with conditions of varying speed and load.[3]

1.1.6 *Grade No. 2-D S5000*—A general-purpose, middle distillate fuel for use in diesel engine applications requiring a fuel with 5000 ppm sulfur (maximum), especially in conditions of varying speed and load.

1.1.7 *Grade No. 4-D*—A heavy distillate fuel, or a blend of distillate and residual oil, for use in low- and medium-speed diesel engines in applications involving predominantly constant speed and load.

Note 1—A more detailed description of the grades of diesel fuel oils is given in X1.2.

Note 2—The Sxxx designation has been adopted to distinguish grades by sulfur rather than using words such as "Low Sulfur" as previously because the number of sulfur grades is growing and the word descriptions were thought to be not precise. S5000 grades correspond to the so-called "regular" sulfur grades, the previous No. 1-D and No. 2-D. S500 grades correspond to the previous "Low Sulfur" grades. S15 grades were not in the previous grade system and are commonly referred to as "Ultra-Low Sulfur" grades or ULSD.

1.2 This specification, unless otherwise provided by agreement between the purchaser and the supplier, prescribes the required properties of diesel fuels at the time and place of delivery.

1.2.1 Nothing in this specification shall preclude observance of federal, state, or local regulations which can be more restrictive.

Note 3—The generation and dissipation of static electricity can create problems in the handling of distillate diesel fuel oils. For more information on the subject, see Guide D4865.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[5]

D56 Test Method for Flash Point by Tag Closed Cup Tester

D86 Test Method for Distillation of Petroleum Products and

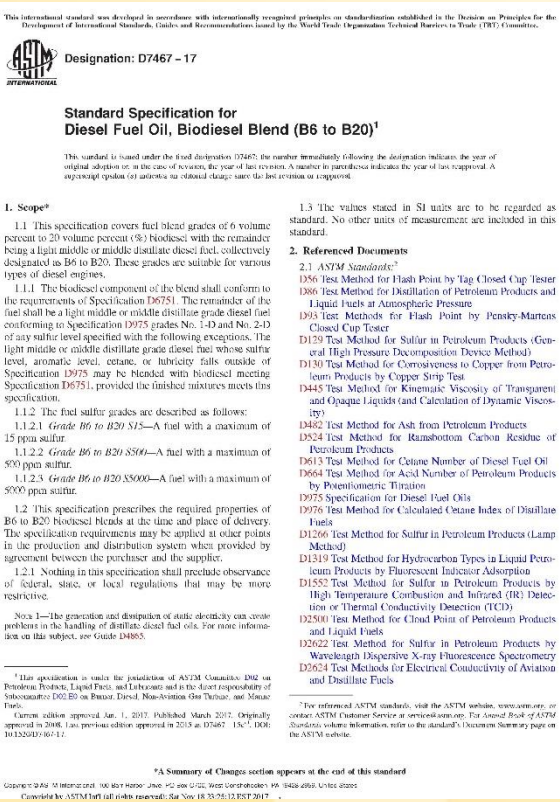
[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.E0 on Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels.

Current edition approved Mar. 1, 2017. Published May 2017. Originally approved in 1948. Last previous edition approved in 2016 as D975 – 16a. DOI: 10.1520/D0975-17.

[2] This fuel complies with 40 CFR Part 80—Control of Air Pollution from New Motor Vehicles: Heavy Duty Engines and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements: Final Rule, Regulation of Fuels and Fuel Additives: Fuel Quality Regulations for Highway Diesel Fuel Sold in 1993 and Later Calendar Years.

[5] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard



This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D7467 – 17

Standard Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)[1]

This standard is issued under the fixed designation D7467; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This specification covers fuel blend grades of 6 volume percent to 20 volume percent (%) biodiesel with the remainder being a light middle or middle distillate diesel fuel, collectively designated as B6 to B20. These grades are suitable for various types of diesel engines.

1.1.1 The biodiesel component of the blend shall conform to the requirements of Specification D6751. The remainder of the fuel shall be a light middle or middle distillate grade diesel fuel conforming to Specification D975 grades No. 1-D and No. 2-D of any sulfur level specified with the following exceptions. The light middle or middle distillate grade diesel fuel whose sulfur level, aromatic level, cetane, or lubricity falls outside of Specification D975 may be blended with biodiesel meeting Specification D6751, provided the finished mixtures meets this specification.

1.1.2 The fuel sulfur grades are described as follows:

1.1.2.1 *Grade B6 to B20 S15*—A fuel with a maximum of 15 ppm sulfur.

1.1.2.2 *Grade B6 to B20 S500*—A fuel with a maximum of 500 ppm sulfur.

1.1.2.3 *Grade B6 to B20 S5000*—A fuel with a maximum of 5000 ppm sulfur.

1.2 This specification prescribes the required properties of B6 to B20 biodiesel blends at the time and place of delivery. The specification requirements may be applied at other points in the production and distribution system when provided by agreement between the purchaser and the supplier.

1.2.1 Nothing in this specification shall preclude observance of federal, state, or local regulations that may be more restrictive.

Note 1—The generation and dissipation of static electricity can create problems in the handling of distillate diesel fuel oils. For more information on this subject, see Guide D4865.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D56 Test Method for Flash Point by Tag Closed Cup Tester

D86 Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

D129 Test Method for Sulfur in Petroleum Products (General High Pressure Decomposition Device Method)

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D482 Test Method for Ash from Petroleum Products

D524 Test Method for Ramsbottom Carbon Residue of Petroleum Products

D613 Test Method for Cetane Number of Diesel Fuel Oil

D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D975 Specification for Diesel Fuel Oils

D976 Test Method for Calculated Cetane Index of Distillate Fuels

D1266 Test Method for Sulfur in Petroleum Products (Lamp Method)

D1319 Test Method for Hydrocarbon Types in Liquid Petroleum Products by Fluorescent Indicator Adsorption

D1552 Test Method for Sulfur in Petroleum Products by High Temperature Combustion and Infrared (IR) Detection or Thermal Conductivity Detection (TCD)

D2500 Test Method for Cloud Point of Petroleum Products and Liquid Fuels

D2622 Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

D2624 Test Methods for Electrical Conductivity of Aviation and Distillate Fuels

[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.E0 on Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels.

Current edition approved Jan. 1, 2017. Published March 2017. Originally approved in 2008. Last previous edition approved in 2015 as D7467 – 15c[1]. DOI: 10.1520/D7467-17.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D6751 – 15c[ε1]

Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels[1]

This standard is issued under the fixed designation D6751; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

ε[1] NOTE—Subsection X1.2.1 was corrected editorially in February 2016.

1. Scope*

1.1 This specification covers four grades of biodiesel (B100) for use as a blend component with middle distillate fuels. These grades are described as follows:

1.1.1 *Grade No. 1-B S15*—A special purpose biodiesel blendstock intended for use in middle distillate fuel applications which can be sensitive to the presence of partially reacted glycerides, including those applications requiring good low temperature operability, and also requiring a fuel blend component with 15 ppm sulfur (maximum).

1.1.2 *Grade No. 1-B S500*—A special purpose biodiesel blendstock intended for use in middle distillate fuel applications which can be sensitive to the presence of partially reacted glycerides, including those applications requiring good low temperature operability, and also requiring a fuel blend component with 500 ppm sulfur (maximum).

1.1.3 *Grade No. 2-B S15*—A general purpose biodiesel blendstock intended for use in middle distillate fuel applications that require a fuel blend component with 15 ppm sulfur (maximum).

1.1.4 *Grade No. 2-B S500*—A general purpose biodiesel blendstock intended for use in middle distillate fuel applications that require a fuel blend component with 500 ppm sulfur (maximum).

1.2 This specification prescribes the required properties of diesel fuels at the time and place of delivery. The specification requirements may be applied at other points in the production and distribution system when provided by agreement between the purchaser and the supplier.

1.3 Nothing in this specification shall preclude observance of federal, state, or local regulations which may be more restrictive.

Note 1—The generation and dissipation of static electricity can create problems in the handling of distillate fuel oils with which biodiesel may be blended. For more information on the subject, see Guide D4865.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

D189 Test Method for Conradson Carbon Residue of Petroleum Products

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D524 Test Method for Ramsbottom Carbon Residue of Petroleum Products

D613 Test Method for Cetane Number of Diesel Fuel Oil

D664 Test Method for Acid Number of Petroleum Products by Potentiometric Titration

D874 Test Method for Sulfated Ash from Lubricating Oils and Additives

D974 Test Method for Acid and Base Number by Color-Indicator Titration

D975 Specification for Diesel Fuel Oils

D976 Test Method for Calculated Cetane Index of Distillate Fuels

D1160 Test Method for Distillation of Petroleum Products at Reduced Pressure

D1266 Test Method for Sulfur in Petroleum Products (Lamp Method)

D1796 Test Method for Water and Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)

[1] This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.E0 on Burner, Diesel, Non-Aviation Gas Turbine, and Marine Fuels.

Current edition approved Dec. 1, 2015. Published January 2016. Originally approved in 1998 as PS 121 – 98. Adopted as a standard in 2002 as D6751 – 02. Last previous edition approved in 2015 as D6751 – 15b. DOI: 10.1520/D6751-15C01.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For Annual Book of ASTM Standards volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

D975: diesel (up to B5) D7467: B6-B20 D6751: B100

EN standard for biodiesel

EN590: diesel (up to B7)

EN16734: B10

EN16709: B20/B30

EN14214: biodiesel (B100)

EN

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 590

September 2013

Incorporating corrigendum March 2014

ICS 75.160.20

English Version

Automotive fuels - Diesel - Requirements and test methods

Carburants pour automobiles - Carburants pour moteur diesel (gazole) - Exigences et méthodes d'essai

Kraftstoffe für Kraftfahrzeuge - Dieselkraftstoff - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 26 July 2013.

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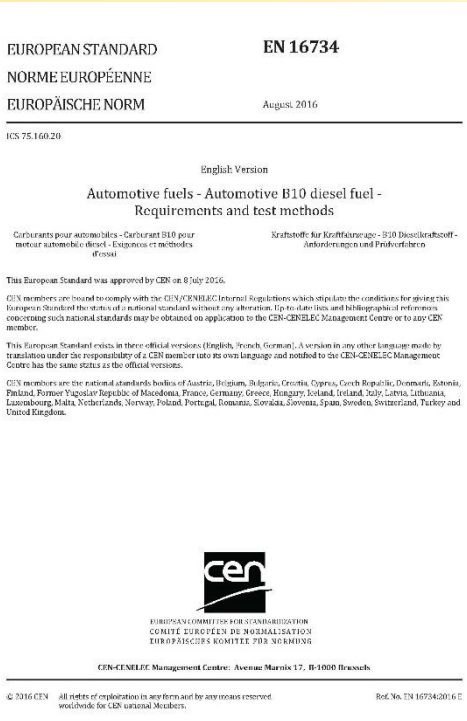
Ref. No. EN 590:2013:E



EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 16734

August 2016

ICS 75.160.20

English Version

Automotive fuels - Automotive B10 diesel fuel - Requirements and test methods

Carburants pour automobiles - Carburant B10 pour moteur automobile diesel - Exigences et méthodes d'essai

Kraftstoffe für Kraftfahrzeuge - B10 Dieselkraftstoff - Anforderungen und Prüfverfahren

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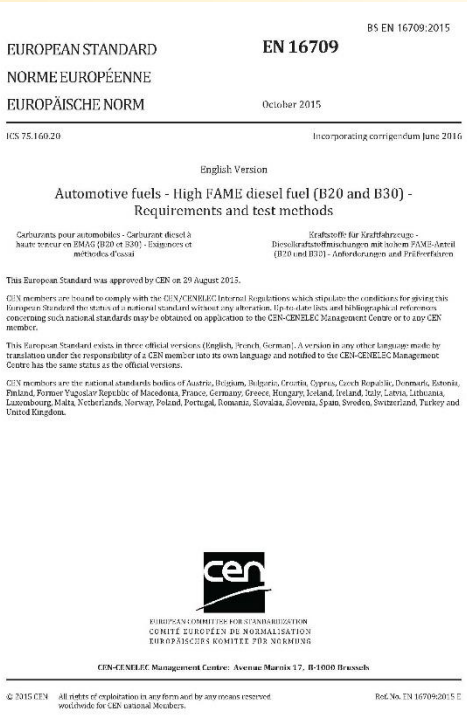

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 16709

October 2015

ICS 75.160.20

Incorporating corrigendum June 2016

English Version

Automotive fuels - High FAME diesel fuel (B20 and B30) - Requirements and test methods

Carburants pour automobiles - Carburant diesel à haute teneur en EMAG (B20 et B30) - Exigences et méthodes d'essai

Kraftstoffe für Kraftfahrzeuge - Dieselkraftstoffmischungen mit hohem FAME-Anteil (B20 und B30) - Anforderungen und Prüfverfahren

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CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 16709:2015:E

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 14214:2012+A1

January 2014

Incorporating corrigendum October 2014

ICS 75.160.20

English Version

Liquid petroleum products - Fatty acid methyl esters (FAME) for use in diesel engines and heating applications - Requirements and test methods

Produits pétroliers liquides - Esters méthyliques d'acides gras (EMAG) pour moteurs diesel et comme combustible de chauffage - Exigences et méthodes d'essai

Flüssige Mineralölerzeugnisse - Fettsäure-Methylester (FAME) zur Verwendung in Dieselmotoren und als Heizöl - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 20 July 2012 and includes Amendment 1 approved by CEN on 10 November 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

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Ref. No. EN 14214:2012+A1:2014:E

EN590: diesel (up to B7)

EN16734: B10

EN16709: B20/B30

EN14214: B100

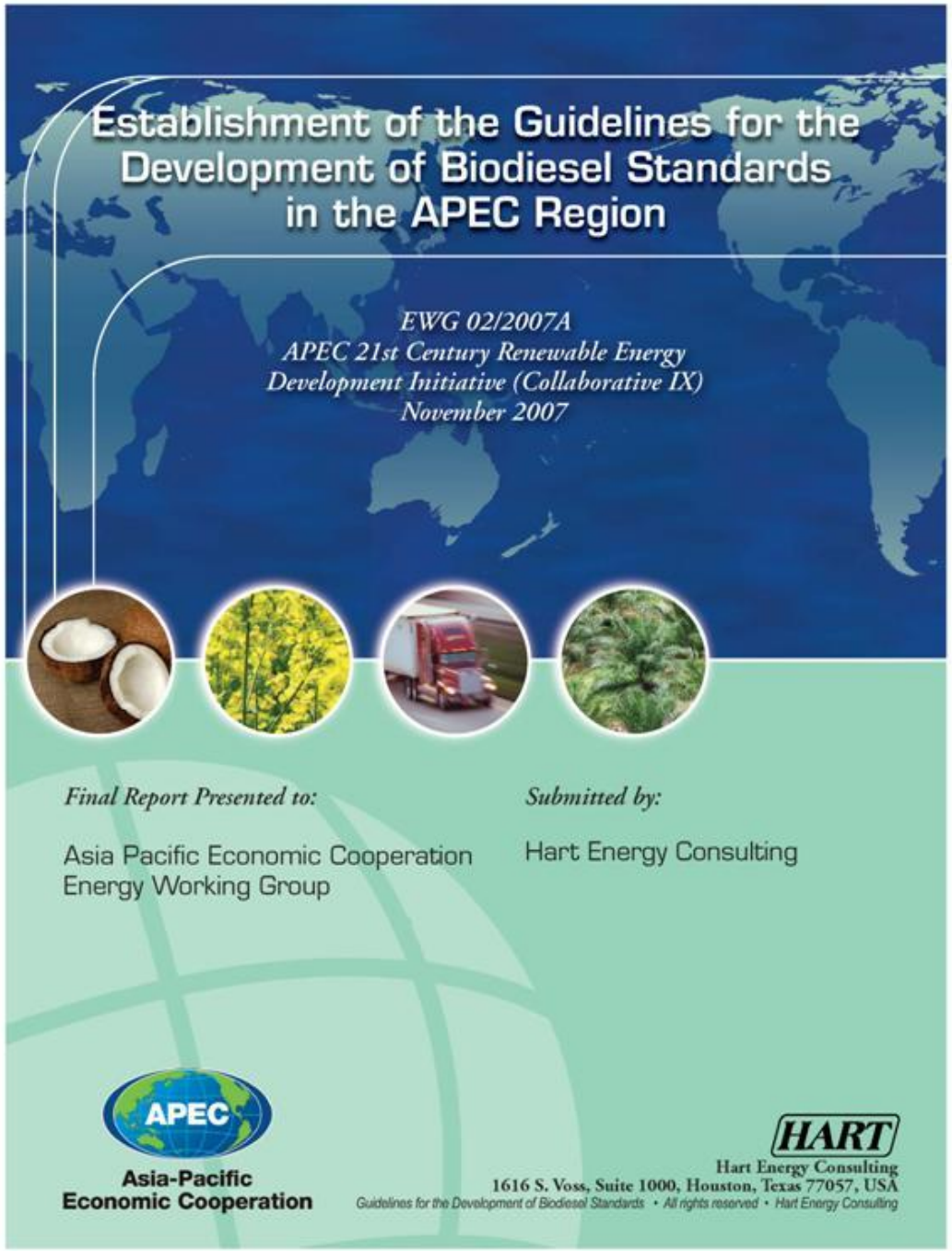
EN specification for Bxx

No	property	Unit	Limits	Diesel	B10	B20	B30	B100	Test method
1	Cetane number	-	minimum	51.0	51.0	51.0	51.0	51.0	EN ISO 5165 (B100 only) EN 15195/EN 16144 EN 16715 (B10 also)
2	Cetane index	-	minimum	46	46	-	-	-	EN ISO 4264
3	Density at 15 ° C	kg/m^3	minimum maximum	820.0 845.0	820.0 845.0	820.0 860.0	825.0 865.0	860 900	EN ISO 3675 EN ISO 12185
4	Polycyclic aromatic hydrocarbons	%(m/m)	maximum	8.0	8.0	8.0	8.0	-	EN 12916
5	Sulfur content	mg/kg	minimum maximum	- 10.0	- 10.0	- 10.0	- 10.0	- 10.0	EN ISO 20846 EN ISO 20884 EN ISO 13032
6	Manganese content	mg/l	maximum	2.0	2.0	2.0	2.0	-	EN 16576
7	Flash point	° C	minimum	55.0	55.0	55.0	55.0	101	EN ISO 2719
8	Carbon residue (on 10 % distillation residue)	%(m/m)	maximum	0.30	0.30	-	-	-	EN ISO 10370
9	Ash content	%(m/m)	maximum	0.010	0.010	0.010	0.010	-	EN ISO 6245
10	Water content	mg/kg	maximum	200	200	260	290	500	EN ISO 12937
11	Total contamination	mg/kg	maximum	24	24	24	24	24	EN 12662
12	Copper strip corrosion (3 h at 50 ° C)	rating	minimum	Class 1	Class 1	-	-	Class 1	EN ISO 2160
13	Fatty acid methyl ester (FAME) content	%(V/V)	minimum maximum	- 7.0	- 10.0	14.0 20.0	24.0 30.0	96.5 %(m/m)	EN 14078 EN 14103 (B100)
14	Oxidation stability	g/m3 h	maximum minimum	25 20	25 20	- 20,0	- 20,0	 8,0	EN ISO 12205 EN 15751
15	Lubricity, corrected wear scar diameter (wsd 1,4) at 60 ° C	µm	maximum	460	460	-	-	-	EN ISO 12156 -1
16	Viscosity at 40 ° C	mm2/s	minimum maximum	2.000 4.500	2.000 4.500	2.000 4.620	2.000 4.650	3.50 5.00	EN ISO 3104
17	Distillation %(V/V) recovered at 250 ° C % (V/V) recovered at 350 ° C 95 % (V/V) recovered at	%(V/V) %(V/V) ° C	 maximum minimum maximum	 65 85 360	 65 85 360.0	 65 85 360.0	 65 85 360.0	-	EN ISO 3405 EN ISO 3924

Prior Initiative on Harmonization of International Standards: Technical Standards

Outline

- Current initiatives on harmonization
  - EN → already successful
  - APEC (Asia Pacific Economic Cooperation)
  - TriPartite (Brazil, EU, US)
  - WWFC (Worldwide Fuel Charter)
  - EAS (East Asian Summit)
  - AAF (Asean Automotive Federation)
- Lesson learned and common ground
  - Difficult to enforce mandatory specification like EU
  - Even mutual agreement on voluntary basis still difficult
    - ✓ Oxidation stability
    - ✓ Blend limit
  - Could be used as
    - ✓ Bargaining power from the region
    - ✓ Non-tariff barrier



- Under APEC 21st Century Renewable Energy Development Initiative (Collaborative IX),
  - Energy Working Group formulate Expert Group on New and Renewable Energy Technologies (EGNRET) under EWG 02/2007A to establish guideline for common BDF standard

EWG 02/2007A, Establishment of the Guidelines for the Development of Biodiesel Standards in the APEC Region (2007), http://www.biofuels.apec.org/pdfs/ewg_biodiesel_standards.pdf

APEC Harmonization Approach

- Requiring diesel blends that contain biodiesel to comply with:
  - Applicable diesel specification – This raises further issue as to what extent are APEC or national or global diesel specs aligned. There is a convergence occurring, if with some lag, due to globalization;
  - Applicable biodiesel specifications, possibly with certain waivers provided to enable use of varying biodiesels, at varying treat rates; and
  - A new biodiesel blend standard – This is as suggested for B10 in Europe and B20 in the U.S., although it includes the caveat that the biodiesel must comply with the EN 14214 and ASTM D6751 standards respectively. The informal B30 standard in France requires EN 14214 compliant biodiesel to be blended.
- Establishing a B100 standard that can:
  - Ensure successful use in the market as B100. This is the European approach using EN 14214. This is vehicle dependent, and blends higher than B5 or B20 are usually not available to the public and are predominantly supplied to captive fleets and niche markets;
  - Ensure a satisfactory product when blended with on specification mineral diesel. The blend rate limits would be set, i.e. B2, B5 as is the current European case; B10 and B20, the current U.S case; and
  - Provide a biodiesel blend component that meets an agreed quality standard and has known characteristics, so that it can be blended with other biodiesel components, and/or additives and/or a blendstock diesel resulting in a finished fuel blend that complies with the applicable diesel specifications. This represents the Brazilian approach, which requires optimization of the blend, including blend rates of the biodiesel (and other components), and certifying/testing of the resultant blend.

EWG 02/2007A, Establishment of the Guidelines for the Development of Biodiesel Standards in the APEC Region (2007), http://www.biofuels.apec.org/pdfs/ewg_biodiesel_standards.pdf

Table 12: APEC Biodiesel Quality Standard and Harmonization Initiative

	ASTM D6751	EN 14214	Typical APEC Economy	Discussion & Conclusions
Regulatory and Emissions				
Max Sulfur (ppm)	15 / 500	10	10 - 500	Regulatory requirement per economy Buyer-seller specified
Min Flash Point (^{O}C)	130 / 93 1	120	93 - 130	For non-hazardous classification in U.S. min of 93^{O}C is required. To show methanol controlled certify at >130^{O}C
Max T90 Distillation (^{O}C)	360	-	The Philippines, Australia Indonesia @ 360 ^{O}C	Other (performance) tests control contaminants Biodiesel reduces PM and HC emissions so test not required for emissions reasons
Engine and Aftertreatment Performance				
Cetane Number	47	51	47 - 51	Higher than 47 (EN) is required for emissions. This is based on diesel tests, so not necessarily applicable to biodiesel. Higher minimum ambient temperatures reduce start-up emissions. Blending not necessarily linear Additives can be used
Min-Max Density @15 ^{O}C, kg/m^{3}	_	860 – 900	820 - 900	Agreement
Min-Max Viscosity @ 40 ^{O}C, cSt	1.9 – 6.0	3.5 – 5.0	1.9 – 3.5 min 4.5 – 6.0 max	Coconut below 3.5, and tallow and palm can exceed 5 Requirement should be for the final blend

	ASTM D6751	EN 14214	Typical APEC Economy	Discussion & Conclusions
Max phosphorus ppm	10	10	10 China no spec	Agreed
Max Alkali metals (Na + K), ppm	5	5	No spec, report, 5	Depends on after-treatment
Max Ca + Mg, ppm	5	5	No spec, report or 5	Depends on after treatment
Max CFPP, ^{O}C	_	+5 to - 44	No spec Chinese Taipei =0 Indonesia = +18	Requirement should be for the blend
Max cloud point ^{O}C	Report	-	No spec The Philippines = Report	Not needed
Direct Usability and/or Durability				
Max CCR 10%, wt%	-	0.3	0.1 – 0.3 The Philippines no spec	Difficult for biodiesel to fractionate 10 %, so not recommended.
Max CCR 100%, wt%	0.05	-	Korea, Chinese Taipei, Thailand, Japan, China =no spec	Recommended to use
Max water and sediment , vol%	0.05	-	Japan, NZ, Chinese Taipei, Thailand, China =no spec	Agreed to replace by separate testing
Max water, ppm	-	500	Australia, Indonesia, The Philippines, Korea = no spec	Agreed
Max Ash, wt%	0.02	0.02	0.01 – 0.02	Agreed at 0.02 May reduce later
Total Contamination, ppm	-	24	China, Indonesia, The Philippines, Korea = no spec	Agreed

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	ASTM D6751	EN 14214	Typical APEC Economy	Discussion & Conclusions
Max Cu corrosion, 3 hr at 50 ^{O}C	3	1	1 Indonesia, The Philippines = 3	Needs further work for alignment. In practice biodiesel complies easily
Max Methanol content, wt%	0.2	0.2	China, The Philippines = no spec	Agreed
Max free glycerine, wt%	0.02	0.02	Korea = no spec	Agreed
Min oxidation stability @ 110 ^{O}C, hrs	3	6	No spec, 3 or 6 Japan = 10	Needs further work
Max total glycerin, wt%	0.24	0.25	0.24 – 0.25	Agreed and 0.24 recommended
Indirect (Derived) Usability and/or Durability				
Min Ester Content	-	96.5	China, The Philippines, US = No spec	Method developed for RME, so does not show lower molecular weight from CME
Max non-ester	-	None except additives	No spec	Agreed to exclude
Max acid value	0.5	0.5	0.5 – 0.8	Simple test. Agreed to include. Limit not agreed.
Max glycerides – mono, di, tri	-	0.8; 0.2; 0.2	No spec	No agreement. Prefer direct tests of performance
Max linolenic acid methyl ester	-	12	Australia, China, Indonesia, The Philippines, Korea, U.S. = No spec	Limits certain feedstocks with no clear reason. No agreement. Prefer direct tests of performance
Max polyunsaturated methyl ester	-	1	No Spec, Chinese Taipei = 1	No agreement. Prefer direct tests of performance

	ASTM D6751	EN 14214	Typical APEC Economy	Discussion & Conclusions
Max iodine number	-	120	115 - 120 Australia, China, The Philippines, Korea, U.S. = No spec	Limits certain feedstocks without certain reason. Max limit of 130 preferred. No agreement. Prefer direct tests of performance
Mandated detergents & additives	-	-	-	No agreement. Further discussion required

Remarks

- Lesson learned
  - Difficult to get consensus agreement
  - Imply limited biodiesel trade between economies
  - Wide range of emission regulation among APEC members make harmonization difficult (e.g. Sulfur & Phosphorous)
  - Data testing with mostly RME, SME and PME on Euro 0 to 2 vehicles
- Future work
  - conduct an assessment of testing facilities and laboratories in member economies.;
  - establish accredited test facilities for round-robin testing between APEC economies;
  - review all available test data for feedstock dependant variables, and identify further research work required in support of performance based specifications;
  - include the FIE manufacturers in further discussion

TriPartite†

- Brazil, EU & US started TriPartite Task Force
  - In 2006, Govt of Brazil, EU & US discussed on international trade in biofuel, which would require internationally recognized standard
  - In Feb 2007, conference organized by CEN with US National Institute of Standards and Technology (NIST) and Brazil National Institute of Metrology, Standardization, and Industrial Quality (INMETRO) to discuss on potential barrier from different standard
  - Publish 'white paper on internationally compatible biofuel standards' in Dec 2007
- Classification of biofuel properties
  - Category A: specifications that are already similar;
  - Category B: specifications with significant differences between parameters and methods, but which might be aligned by work on documentary standards and measurement standards; and
  - Category C: specifications with fundamental differences, perhaps due to emissions or environmental regulations within one or more regions, which are not deemed bridgeable in the foreseeable future

†http://ec.europa.eu/energy/res/biofuels_standards/doc/white_paper_icbs_final.pdf

Remark on BDF Properties

- Biodiesel is defined as
  - mono-alkyl esters of long chain fatty acids derived from plant oils or animal fats and used, for example, as fuel for compression ignition, internal combustion piston engines.
- Comparisons of Brazilian, EU and USA are made on the standards in place at the end of the year 2007.
- Brazil and US standard are acceptable for FAEE while EU only FAME
- Brazil and US standard are for blending while EU could use B100

†http://ec.europa.eu/energy/res/biofuels_standards/doc/white_paper_icbs_final.pdf

Classification of BDF Properties

Category A *similar*	Category B *significant differences*	Category C *fundamental differences*
sulfated ash	total glycerol content	sulfur content
alkali and alkaline earth metal content	phosphorus content	cold climate operability
free glycerol content	carbon residue	cetane number
copper strip corrosion	ester content	oxidation stability
methanol & ethanol content	distillation temperature	mono, di-, tri-acylglycerides
acid number	flash point	density
	total contamination	kinematic viscosity
	water content & sediment	iodine number
		linolenic acid content
		polyunsaturated methyl ester

†http://ec.europa.eu/energy/res/biofuels_standards/doc/white_paper_icbs_final.pdf

Rating of Alignment

- A = easily done,
  B = feasible with effort,
  C = not feasible at the present
- Order:
  BR / EU / US

Category A Parameters Misalignment Impact (MI)	Category B Parameters Misalignment Impact (MI)	Category C Parameters Misalignment Impact (MI)
Sulfated ash (A / A / A) MI: very minor	Total glycerol (A / A / A) for limit value (B / B / B) for method MI: minor	Sulfur content (C / C / C) MI: medium to major
Alkali & alkaline earth metals (A / A / A) MI: very minor	Phosphorus content (A / B / A) MI: medium	Cold climate operability (C / C / C) MI: very minor
Free glycerol (A / B / A) MI: minor	Carbon residue (B / B / B) MI: very minor	Cetane number (C / C / C) MI: major
Copper strip corrosion (A / A / B) MI: none	Ester content (B / B / B) MI: very minor	Oxidation stability (B / C / C) MI: medium
Methanol & ethanol content (A / A / A) MI: medium	Distillation temperature (B / B / B) MI: very minor	Mono, di-, tri-acylglycerides (B / B / C) MI: minor
Acid number (A / B / A) MI: very minor	Flash point (B / B/ / B) MI: minor	Density (C / C / C) MI: very minor
	Total contamination (B / B / B) MI: minor	Kinematic viscosity (C / C / C) MI: very minor
	Water content & sediment (B / B / B) MI: medium/major	Iodine number (A / C / A) MI: major
		Linolenic acid (A / C / A) MI: major
		Polyunsaturated methyl ester (C / C / C) MI: major

Tri-partite Alignment on BDF

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2.5.5.5 ANNEX 2: Tri-partite Task Force on Biodiesel Standards

Comparison of Brazilian, European and United States biodiesel parameters					
	Property Comparison				
Property	Easily aligned (A)	Alignment possible with discussion or work (B)	Very Different (C)	Comments	Test Methods
Free glycerol	USA, BR	EU		Decimal place to be clarified. Work needed to overcome changing the significant digits.	BR needs new test method applicable to castor oil FAME and FAEE to achieve precision needed for redefined limit.
Sulfated ash	BR EU USA			Decimal place to be clarified, minor issue if more decimal places used as this changes the specification, major issue if not. EU and BR could consider modifying limit to 0.020.	ISO method to be checked for validity of precision for adjusted limit value
Group I metals (Na+K)	BR EU USA			Brazil discussing adoption of same limits as EU and USA, considered probable.	ICP method is being balloted in EU as acceptable test method. In BR, an ICP method is being defined.
Group II metals (Ca+ Mg)	BR EU USA			Brazil discussing adoption of same limits as EU and USA, considered probable.	In BR, an ICP method is being defined.

Tri-partite Alignment on BDF

Property	Property Comparison (A)	(B)	(C)	Comments	Test methods
Carbon residue		BR USA EU		Limit values for BR USA can be aligned. EU could consider a limit value on basis of changed test method. US could investigate significant digits.	EU could consider a test method based on 100% sample rather than 10% distillation residue
Flash point		BR EU USA		Discussions needed to align the limit value. Depends if method used for control of methanol & flash, or flash alone for safety and handling. Work needed to align methods, and regulations category may affect limit alignment possibilities.	Methods different in US and EU which could be major issue for US (D93 vs. D3828). EU will ballot both methods due to new precision data. BR adopts NBR 14598 based on D93, but considers D93 and EN ISO 3679.
Copper strip corrosion	BR EU	USA		Confirmation needed that USA could agree to the deletion of this parameter. Removal could be considered; need to confirm with heating oil group at ASTM. ASTM does not have separate biodiesel standard for heating oil. All regions will examine opportunity to delete this parameter	

Tri-partite Alignment on BDF

Property	Property Comparison (A)	(B)	(C)	Comments	Test methods
Phosphorus content	BR USA	EU (if current spec changed)		Limit value reduction now under ballot in EU. Present day limit values may be aligned if BR discussions conclude on this. Possible differences between B100 as a neat fuel and B100 as blend stock for Brazil and US. EU vehicle producers insisting low values needed for exhaust emissions reasons	.
Total glycerol	BR EU USA (for limit value)	BR EU USA (for test method) (Medium Term)		BR considers new method to be reviewed there allowing not only castor oil but also other feedstocks will allow alignment of three regions	Method alignment discussion is necessary as calculations in the methods provide different results.
Methanol ~~or Ethanol content~~	BR, EU, USA (methanol only)	(Ethanol methods in this category)		BR considering alignment on EU. USA could consider adding significant digit to align with Brazil and EU limits, and asks to include ethanol for the case of ethyl esters. For USA, parameter will be met if flash point used for methanol presence.	New method for measuring ethanol is being developed in Brazil.
Acid number	BR EU USA (for limit)	USA (for method)		EU and USA limits are aligned, BR considering alignment with them. USA could consider aligning with Brazil and EU method.	Methods are dramatically different.

Tri-partite Alignment on BDF

Property	Property Comparison (A)	(B)	(C)	Comments	Test methods
Distillation temperature 90%		BR EU USA (Medium Term)		BR and USA are aligned, EU does not have a limit, but in Brazil the elimination of this specification is under discussion. Rationale for limit needs to be discussed to achieve three regions alignment. Limit used to detect fraud.	USA could consider removing T-90 if precision of ester content test method is improved. Efforts are ongoing in EU to do this.
Ester content		BR EU USA (Medium Term)		EU alone has a limit, BR may align with EU. USA could align with BR and EU if test method precision is improved.	BR method for Lauric oils being developed. Precision of the existing EU method under review. EU method under development to include other oils.
Water content and Sediment		BR EU USA (Medium Term)		BR and USA have aligned combined standard. EU has separate water and sediment (total contamination) standards. BR may align with EU at production site only and not downstream. USA could consider aligning with BR and EU.	
Water content		BR EU USA (Medium Term)		BR could align with EU at 500ppm, at production plant only and not downstream. US will consider alignment; eventual limit will depend on methods choice.	

Tri-partite Alignment on BDF

Property	Property Comparison (A)	(B)	(C)	Comments	Test methods
Total contamination (solids)		BR EU USA (Medium Term)		No limit for BR & USA, but BR and USA may align with EU limit. CEN considering a limit change further to a method precision improvement.	ASTM and EU efforts to develop and evaluate modified methods.
Oxidation stability	BR EU (short term)	BR EU USA (Long Term)	USA (short term)	Important performance parameter. EU and USA far apart on limit values EU discussion to modify limits. USA limits based on blend stock use only.	EU discussing methods covering blends as well as pure fuel.
Mono-, di- & tri-acylglycerols		BR EU	USA	USA does not have limits, BR report only, but BR has developed new methods for biodiesel based on castor. EU looking at mono- in relation to cold climate deposit formation. US and BR could consider individual limits if additional work completed.	Can BR methods be accepted by EU and USA? BR wants castor oil biodiesel to be taken into account in method.
Sulfur content			BR EU USA	Limits based on regional regulations. Lowest common denominator probably not possible. May be contractually decided level depending on region importing from elsewhere.	

Tri-partite Alignment on BDF

Property	Property Comparison (A)	(B)	(C)	Comments	Test methods
Cold climate operability (Cloud & CFPP)			BR EU USA	Limits based on regional, climatic conditions. May be contractually decided depending on region importing from elsewhere. Final fuel distributor will take local quality responsibility. "Report" is suggestion. Difference exists between pure fuel use and blendstock use.	
Density			BR EU USA	EU has upper/lower limits, BR & USA report only. EU may limit feedstock range. Value of parameter questioned, may hinder coconut or castor oil biodiesel.	
Kinematic viscosity			BR EU USA	EU has narrow limits; USA has wide limits, BR reports only. BR suggests compromise limits to allow wider feedstocks. Fundamental issue of blend component versus finished fuel requirements.	
Cetane number			BR EU USA	Wide divergence in limit values based on regional regulations. BR suggests report only, leaving limit values to be defined in commercial agreements. High values may hinder feedstock choice.	

Tri-partite Alignment on BDF

Property	Property Comparison (A)	(B)	(C)	Comments	Test methods
Iodine number	BR USA		EU	EU limit value seen as reducing feedstock choice. EU discussing a moderately higher limit value. BR and USA disagree with iodine number parameter, and rely on stability limit. Oxidation stability test would then be of prime importance. EU unwilling to delete the parameter as suggested by BR & US but willing to discuss limit values.	
Linolenic acid methyl ester	BR USA		EU	EU has limit value, BR & USA do not. BR considers it excludes some promising oils. BR & USA suggest relying on oxidation stability parameter.	
Polyunsaturated (≥4 double bonds) methyl esters	BR USA		EU	EU has limit value, BR & USA do not. BR considers it excludes some promising oils. BR & USA suggest relying on oxidation stability parameter.	EU method needs to be verified and balloted.

Comparison of BDF standard among Tri-partite

2.5.5.6 Annex 3: Biodiesel Specification Requirements

Property	Test Methods			Limits			
	USA ASTM D6751	EU EN 14214	Brazil ANP 42	Units	USA ASTM D 6751	EU EN 14214	Brazil ANP 42
Sulfated Ash	D874	ISO 3987	ABNT NBR 6294/ ISO 3987/ ASTM D874	% mass	0.020 max	0.02 max	0.02 max
Group I Metals (Na + K)	UOP 391	EN 14108/ EN 14109	EN 14108/ EN 14109	mg/kg	5 max	5 max	10 max
Group II Metals (Ca + mg)	UOP 389	EN 14538	EN 14538	mg/kg	5 max	5 max	Report
Methanol or Ethanol Content	-	EN 14110	ABNT NBR 15343/ EN 14110	% mass		0.20 max	0.50 max
Acid Number	D664	EN 14104	ABNT NBR 14448/ EN 14104/ ASTM D664	mgKOH/g	0.50 max	0.50 max	0.80 max
Free Glycerol	D6584	EN 14105/ EN 14106	ABNT NBR 15341/ EN 14105/ EN 14106	% mass	0.02 max	0.02 max	0.02 max
Total Glycerol	D6584	EN 14105	ABNT NBR 15344/ EN 14105/ ASTM D6584	% mass	0.24 max	0.25 max	0.38 max
Copper Strip Corrosion	D130	EN 2160	ABNT NBR 14359/ EN 2160/ ASTM D130	Rating	Class 3	Class 1	Class 1

Comparison of BDF standard among Tri-partite

Property	Test Methods			Units	Limits		
Phosphorus Content	D4951	EN 14107	EN 14107/ ASTM D4951	% mass	0.001 max	0.0010 max	Report
Carbon Residue (on 100% Sample)	D4530	EN 10370	EN 10370/ ASTM D4530	% mass	0.050 max		0.10 max
Ester Content	-	EN 14103	ABNT NBR 15342/ EN 14103	% mass	-	96.5 min	Report
Distillation Temperature, 90% Recovered	D1160	-	D1160	°C	360 max	-	360 max
Flash Point	D93	EN 3679	ABNT NBR 14598/ EN 3679/ ASTM D93	°C	130.0 min	120 min	100 min
Total Contamination	-	EN 12662	EN 12662	mg/kg	-	24 max	Report
Water and Sediment	D2709	-	D2709	% volume	0.050 max		0.050 max
Water Content		EN 12937		mg/kg	-	500 max	
Oxidation Stability, 110°C	EN 14112	EN 14112	EN 14112	hours	3.0 min	6.0 min	6.0 min

Comparison of BDF standard among Tri-partite

Property	Test Methods			Units	Limits		
Monoacylglycerol Content	-	EN 14105	ABNT NBR 15342/ EN 14105	% mass		0.80 max	-
Diacylglycerol Content	-	EN 14105	ABNT NBR 15342/ EN 14105	% mass		0.20 max	-
Triacylglycerol Content	-	EN 14105	ABNT NBR 15344/ EN 14105	% mass		0.20 max	-
Sulfur Content	D5453	EN 20846/ EN 20884	EN 20846/ EN 20884/ ASTM D5453	mg/kg	15/500	10	500 (note 3)
Cloud Point	D2500	EN 23015		°C	Report		
Cold Filter Plugging Point	D6371	EN 116	ABNT NBR14747/ ASTM D6371	°C		(5 max (Grade A) 0 max (Grade B) -5 max (Grade C) -10 max (Grade D) -15 max (Grade E) -20 max Grade F)	
Density at 15°C		EN 3675/ EN 12185		kg/m^3		860 - 900	
Density at 20°C			ABNT NBR 7148/ ABNT NBR 14065/ ASTM D1298/ ASTM D4052	kg/m3			Report
Linolenic Acid Methyl Ester	-	EN 14103	-	% mass	-	12.0 max	-

Comparison of BDF standard among Tri-partite

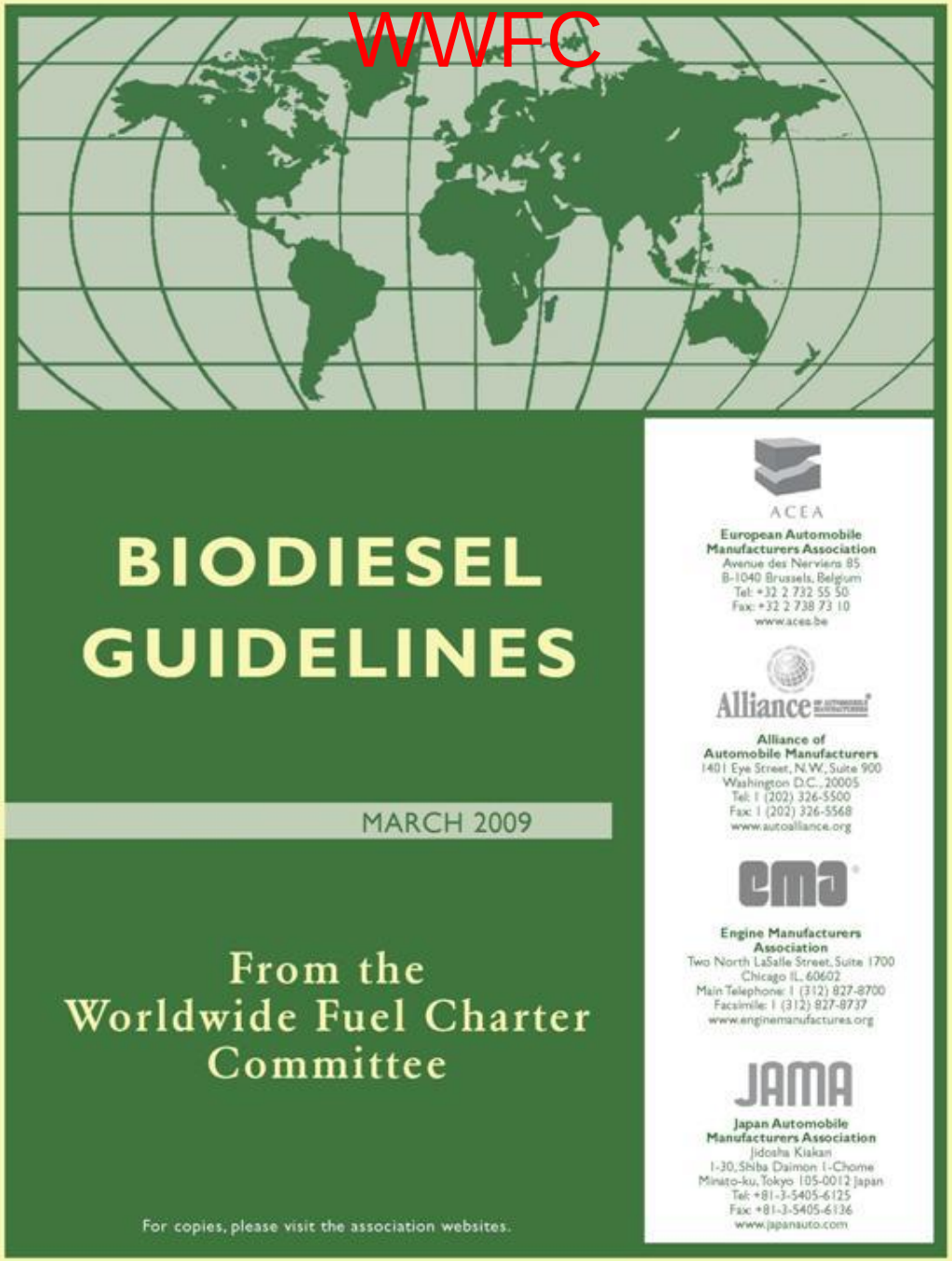
Property	Test Methods			Units	Limits		
Polyunsaturated (≥ 4 double bonds) Methyl Esters				% mass	-	1 max	-
Cetane Number	D 613	EN 5165	EN 5165 / D613		47 min	51.0 min	Report
Iodine Value	-	EN 14111	EN ISO14111	g iodine/ 100 g	-	120 max	-

WWFC

ACEA

European Automobile Manufacturers Association

Alliance OF AUTOMOBILE MANUFACTURERS



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JAMA

ence and Technology Capability

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- Members
  - **ACEA** (European Automobile Manufacturers Association / www.acea.be / Brussels, Belgium;) representing: BMW, DAF Trucks, Fiat Auto, Ford of Europe, General Motors Europe, MAN Nutzfahrzeuge, DaimlerChrysler, Porsche, PSA Peugeot Citroen, Renault, Scania, Volkswagen, Volvo.
  - **Alliance of Automobile Manufacturers** / www.autoalliance.org / Washington D.C., USA) representing: BMW of North America, DaimlerChrysler, Isuzu Motors America, Mazda North America, Mitsubishi Motor America, Nissan North America, Porsche Cars North America, Toyota Motor North America, Volkswagen of North America.
  - **EMA** (Engine Manufacturers Association / www.enginemanufacturers.org / Chicago, USA) representing: Briggs & Stratton, Caterpillar, Cummins, DaimlerChrysler, Deere, Detroit Diesel, Deutz, Ford Motor, General Motors, Hino Motors, International Truck & Engine, Isuzu Motor, Kohler, Komatsu, Kubota, Mitsubishi Engine, Mitsubishi Fuso Truck, Onan-Cummins Power, Volvo Powertrain, Waukesha Engine, Dresser, Yamaha Motor, Yanmar Diesel.
  - **JAMA** (Japan Automobile Manufacturers Association / www.japanauto.com / Tokyo, Japan) representing: Daihatsu Motor, Fuji Heavy Industries, General Motors Japan, Hito Motors, Honda Motor, Isuzu Motor, Kawasaki Heavy Industries, Mazda Motors, Mitsubishi Motors, Nissan Diesel Motor, Nissan, Motor, Suzuki Motor, Toyota Motor, Yamaha Motor.

WWFC

- Associated members
  - AIAM (Association of International Automobile Manufacturers)
  - AIAMC (Association of International Automobile Manufacturers of Canada)
  - AMIA (Associacion Mexicana de la Industria Automotriz)
  - ANFAVEA (Brazilian Association of Motor Vehicles)
  - CVMA (Canadian Vehicle Manufacturers'Association)
  - CAMPI (Chamber of Automobile Manufacturers of the Philippines)
  - CAAI (Chinese Association of Automotive Industry)
  - IAF (Indonesia Automotive Federation)
  - KAMA (Korean Automobile Manufacturers Association)
  - NAAMSA (National Association of Automobile Manufacturers of South Africa)
  - MAA (Malaysian Automotive Association)
  - TAIA (Thai Automotive Industry Association)
  - Vietnam Automobile Manufacturers Association (VAMA)

Definition of Fuel Properties

- **Category 1** fuels represent the lowest quality and can be found in markets with no or first level of emission control.
  - A category 1 diesel fuel is characterized by a cetane number of min. 48.0 and a sulfur content of max. 3000 mg/kg.
- **Category 2** fuels represent an improved quality level and can be found in markets with stringent requirements for emission control (e.g. US Tier 0 or 1, EURO 1 and 2). **Could allow up to 5% blend**
  - A category 2 diesel fuel is characterized e.g. by a cetane number of min. 53.0 and a sulfur content of max. 300 mg/kg.
- **Category 3** fuels represent a further improved quality and can be found in markets with advanced requirements for emission control (e.g. US California LEV, ULEV and EURO 3 and 4).
  - A category 3 diesel fuel is characterized by e.g. a cetane number of min. 55 and a Sulfur content of max. 30 mg/kg.
- **Category 4** fuels represent further advanced requirements for emission control, to enable sophisticated NOx and PM after-treatment technologies (e.g. US California LEV-II, US EPA Tier 2, EURO 4 in conjunction with increased fuel efficiency constraints).
  - A category 4 diesel fuel is characterized by a sulfur content of max. 10 mg/kg.

Guideline Summary (1)

Summary of Guidelines

Property	*Value*	*Units*	*Test Methods*
Ester content	96.5 min	% m/m	EN 14103 mod Other: ABNT NBR 15342
Linolenic Acid Methyl Ester	12.0 max	% m/m	EN 14103 mod
Polyunsaturated acid methyl ester (≥4 double bonds)	1 max	% m/m	prEN 15779
Oxidation Stability: Induction Period	10 min	hr	prEN 15751 or EN 14112 as alternative
Iodine Number	130 max[1]	g I_2/100 g	EN 14111
Total Acid Number	0.5 max	mg KOH/g	ISO 6618 ASTM D664, D974 JIS K2501 Other: ABNT NBR 14448
Methanol	0.20 max	% m/m	EN 14110 JIS K2536 Other: ABNT NBR 15343
Glycerides			EN 14105
Mono-glyceride	0.80 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15342
Di-glyceride	0.20 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15342
Tri-glyceride	0.20 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15342
Glycerin (glycerol)			
Free glycerin	0.02 max	% m/m	EN 14105/14106 ASTM D6584 Other: ABNT NBR 15341
Total glycerin	0.25 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15344
Density	report	g/ml	EN ISO 3675 ASTM D4052 JIS K2249 Other: EN ISO 12185, ABNT NBR 7148/14065
Kinematic Viscosity@40°C	2.0 - 5.0[2]	mm^2/s	EN ISO 3104 ASTMD445 JIS K2283

[1] This limit may unnecessarily preclude certain feedstocks. Some engine technologies may need a more stringent limit.

[2] For temperatures at or below –20°C, viscosity should be at or below 48 mm^2/s to avoid potentially dangerous loads on the fuel injection pump drive system.

- %ME, Linolenic acid ME, Polyunsat. acid ME → fuel filter plugging by sludge
- Oxidation stability → peroxide damages part & acid corrodes
- Iodine number → no. of double bond as indicator for oxidation stability
- TAN → acid from process or degradation could harm injection system & metal parts
- Methanol → lower flash point, decrease lubricity, corrode injector
- Mono/di/tri-glycerine & Free/total glycerin → filter pluggging, injector deposit; settling glycerin at tank bottom can attract polar compound (water)

Guideline Summary (2)

Summary of Guidelines

Property	*Value*	*Units*	*Test Methods*
Ester content	96.5 min	% m/m	EN 14103 mod Other: ABNT NBR 15342
Linolenic Acid Methyl Ester	12.0 max	% m/m	EN 14103 mod
Polyunsaturated acid methyl ester (≥4 double bonds)	1 max	% m/m	prEN 15779
Oxidation Stability: Induction Period	10 min	hr	prEN 15751 or EN 14112 as alternative
Iodine Number	130 max[1]	g I_2/100 g	EN 14111
Total Acid Number	0.5 max	mg KOH/g	ISO 6618 ASTM D664, D974 JIS K2501 Other: ABNT NBR 14448
Methanol	0.20 max	% m/m	EN 14110 JIS K2536 Other: ABNT NBR 15343
Glycerides			EN 14105
Mono-glyceride	0.80 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15342
Di-glyceride	0.20 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15342
Tri-glyceride	0.20 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15342
Glycerin (glycerol)			
Free glycerin	0.02 max	% m/m	EN 14105/14106 ASTM D6584 Other: ABNT NBR 15341
Total glycerin	0.25 max	% m/m	EN 14105 ASTM D6584 Other: ABNT NBR 15344
Density	report	g/ml	EN ISO 3675 ASTM D4052 JIS K2249 Other: EN ISO 12185, ABNT NBR 7148/14065
Kinematic Viscosity@40°C	2.0 - 5.0[2]	mm^2/s	EN ISO 3104 ASTMD445 JIS K2283

[1] This limit may unnecessarily preclude certain feedstocks. Some engine technologies may need a more stringent limit.

[2] For temperatures at or below –20°C, viscosity should be at or below 48 mm^2/s to avoid potentially dangerous loads on the fuel injection pump drive system.

- Density → used as indicator of contamination by unwanted compounds
- Kinematic viscosity → injector lubrication & fuel atomization

Guideline Summary (3)

Property	*Value*	*Units*	*Test Methods*
			Other: ABNT NBR 10441
Flash Point	100 min	°C	ISO 3679 ASTM D93
Cetane Number	51 min		ISO 5165 ASTM D613 JIS K2280
Water	500 max	mg/kg (ppm)	EN 12937
Water and Sediment	0.05 max	% v/v	ASTM D2709
Total Contamination	24 max	mg/kg	EN 12662 ASTM D2276, D5452, D6217
Ash Content	0.001 max	% m/m	ISO 6245 ASTM D482 JIS K2272
Sulfated Ash	0.005 max	% m/m	ISO 3987 ASTM D874 Other: ABNT NBR 984
Carbon Residue: Ramsbottom, on 100% distillation residue	0.05 max	% m/m	ASTM D4530
Corrosion: Ferrous	light rusting, max	Rating	ASTM D665 Procedure A
Sulfur	10 max	ppm	EN 20846/20884 ASTM D5453/D2622 JIS K3541-1, -2, -6 or -7
Phosphorus	4 max	mg/kg	EN 14107 ASTM D4951, D3231
Alkali metals (Na+K)	5 max	mg/kg	EN 14108/14109, EN 14538
Alkaline metals (Ca+Mg)	5 max	mg/kg	EN 14538
Trace Metals	no addition		ASTM D7111

- Flash point → safety handling (storage & transport), also indicator for methanol contamination
- Cetane → too low cetane causes hard starting, rough operation & increased smoke
- Water/Water and sediment/ Total contamination → water ↑ oxidation & corrosivity, promote microbial growth, filter plugging
- Ash content/Sulfate ash → measure of metal/inorganic contaminant, engine deposit, filter plugging & shorten DPF
- Carbon residue → tendency to form deposit on injector

Guideline Summary (4)

Property	*Value*	*Units*	*Test Methods*
			Other: ABNT NBR 10441
Flash Point	100 min	°C	ISO 3679 ASTM D93
Cetane Number	51 min		ISO 5165 ASTM D613 JIS K2280
Water	500 max	mg/kg (ppm)	EN 12937
Water and Sediment	0.05 max	% v/v	ASTM D2709
Total Contamination	24 max	mg/kg	EN 12662 ASTM D2276, D5452, D6217
Ash Content	0.001 max	% m/m	ISO 6245 ASTM D482 JIS K2272
Sulfated Ash	0.005 max	% m/m	ISO 3987 ASTM D874 Other: ABNT NBR 984
Carbon Residue: Ramsbottom, on 100% distillation residue	0.05 max	% m/m	ASTM D4530
Corrosion: Ferrous	light rusting, max	Rating	ASTM D665 Procedure A
Sulfur	10 max	ppm	EN 20846/20884 ASTM D5453/D2622 JIS K3541-1, -2, -6 or -7
Phosphorus	4 max	mg/kg	EN 14107 ASTM D4951, D3231
Alkali metals (Na+K)	5 max	mg/kg	EN 14108/14109, EN 14538
Alkaline metals (Ca+Mg)	5 max	mg/kg	EN 14538
Trace Metals	no addition		ASTM D7111

- Corrosion → metal compatibility
- Sulfur → compatibility with emission control system
- Phosphorous → could come from fertilizer or natural phospholipid, which affect emission control system
- Group I&II metals → residual metals form deposit. Possible ash formation by Na&K
- Trace elements → no metal or other contaminants

Test Methods

Summary of Test Methods[3]
(see main text for additional notes)

Property	Units	CEN/ISO	ASTM	JIS	Other
Ester content	% m/m	EN 14103 mod			ABNT NBR 15342
Linolenic Acid Methyl Ester	% m/m	EN 14103 mod			
Polyunsaturated acid methyl ester (≥4 double bonds)	% m/m				prEN 15779
Oxidation Stability: Induction Period	hr	prEN 15751 or EN 14112 as alternative			
Iodine Number	g I_2/100 g	EN 14111			
Total Acid Number	mg KOH/g	ISO 6618	D664, D974	K2501	ABNT NBR 14448
Methanol	% m/m	EN 14110		K2536	ABNT NBR 15343
Glycerides	% m/m	EN 14105			
Mono-glyceride	% m/m	EN 14105	D6584		ABNT NBR 15342
Di-glyceride	% m/m	EN 14105	D6584		ABNT NBR 15342
Tri-glyceride	% m/m	EN 14105	D6584		ABNT NBR 15342
Glycerin (glycerol)					
Free glycerin	% m/m	EN 14105, EN 14106	D6584		ABNT NBR 15341
Total glycerin	% m/m	EN 14105	D6584		ABNT NBR 15344
Density	g/ml	EN ISO 3675	D4052	K2249	EN ISO 12185 ABNT NBR 7148/14065
Kinematic Viscosity	mm^2/s	EN ISO 3104	D445	K2283	ABNT NBR 10441
Flash Point	°C	ISO 3679	D93		
Cetane Number		ISO 5165	D613	K2280	
Water	mg/kg	EN 12937			
Water and Sediment	% v/v		D2709		
Total Contamination	mg/kg	EN 12662	D2276, D5452, D6217		
Ash Content	% m/m	ISO 6245	D482	K2272	
Sulfated Ash	% m/m	ISO 3987	D874		ABNT NBR 984
Carbon Residue: Ramsbottom, on 100% distillation residue	% m/m		D4530		
Ferrous Corrosion	rating		D665 Procedure A		
Sulfur	ppm	EN 20846/20884	D5453/D2622	K3541-1, -2, -6 or -7	
Phosphorus	mg/kg	EN 14107	D4951, D3231		
Alkali metals (Na, K)	mg/kg	EN 14108/EN 14109, EN 14538			
Alkaline metals (Ca, Mg)	mg/kg	EN 14538			
Trace metals			D7111		

[3] Test methods may be used with B100; consult method to determine if also applicable to blends.

ERIA-EAS Biodiesel Standard (EEBS: 2008)


Palm


Jatropha


Coconut


Rapeseed


Soybean

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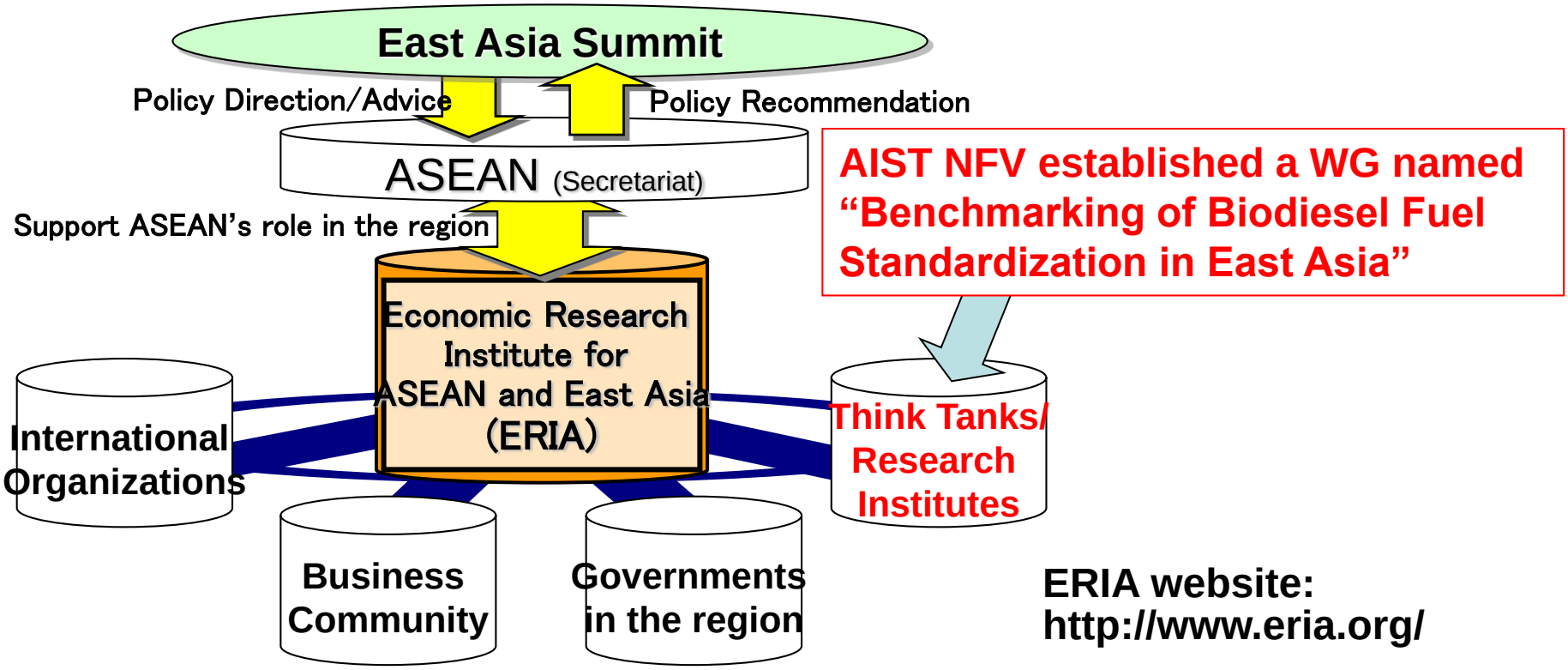
What is ERIA?

- ERIA is a new kind of international organization to conduct policy research and make policy recommendations to promote economic integration in East Asia.
- ERIA will intellectually support the role of the ASEAN Secretariat to give shape to regional policy directed by leaders at the East Asia Summit.
- ERIA will make policy recommendations as a “Center of Excellence” in the region in strong partnership with governments in the region, other related international organizations, research institutes and the business community.

Intellectual Contribution for Economic Integration in East Asia



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Concepts of Harmonized Specification

- **Based on EU's standard (EN14214)**
  - Cover a whole of factor in BDF
  - EU's standard: Focusing Rapeseed oil only

- **Consideration of various oils**
  - Coconut : Viscosity and Flashpoint
  - Soybean : Iodine number

- **Oxidation stability**
  - Critical impact on metal fuel tanks
  - Metal tanks are popular for vehicles in Asia
  - Oxidation stability of 10 hours prevented metal tank corrosion in Japanese conformity test

- **Polyunsaturated components**
  - Mainly included in fish oil
  - Risk of sludge formation
  - Measurement method hasn't developed yet

Output of the Activity in 2007/2008

EAS-ERIA Biodiesel Fuel Benchmark Standard

Items	Units	U.S. ASTM D6751-07b	EU EN14214:2003	Japan JIS K2390:2008	EAS-ERIA BDF Standard (EEBS):2008
Ester content	mass%	-	96.5 min.	96.5 min.	96.5 min.
Density	kg/m3	-	860-900	860-900	860-900
Viscosity	mm2/s	1.9-6.0	3.50-5.00	3.50-5.00	2.00-5.00
Flashpoint	deg. C	93 min.	120 min.	120 min.	100 min.
Sulfur content	mass%	0.0015 max.	0.0010 max.	0.0010 max.	0.0010 max.
Distillation, T90	deg. C	360 max.	-	-	-
Carbon residue (100%) or Carbon residue (10%)	mass%	0.05 max. -	- 0.30 max.	- 0.3 max.	0.05 max. 0.3 max.
Cetane number		47 min.	51.0 min.	51.0 min.	51.0 min.
Sulfated ash	mass%	0.02 max.	0.02 max.	0.02 max.	0.02 max.
Water content	mg/kg	0.05[vol%] max.	500 max.	500 max.	500 max.
Total contamination	mg/kg	-	24 max.	24 max.	24 max.
Copper corrosion		No.3	Class-1	Class-1	Class-1
Acid value	mgKOH/g	0.50 max.	0.50 max.	0.50 max.	0.50 max.
Oxidation stability	hrs.	3 min.	6.0 min.	(**)	10.0 min. (****)
Iodine value		-	120 max.	120 max.	Reported (***)
Methyl Linolenate	mass%	-	12.0 max.	12.0 max.	12.0 max.
Polyunsaturated FAME (more than 4 double bonds)	mass%	-	1 max.	N.D.	N.D. (***)
Methanol content	mass%	0.2 max. (*)	0.20 max.	0.20 max.	0.20 max.
Monoglyceride content	mass%	-	0.80 max.	0.80 max.	0.80 max.
Diglyceride content	mass%	-	0.20 max.	0.20 max.	0.20 max.
Triglyceride content	mass%	-	0.20 max.	0.20 max.	0.20 max.
Free glycerol content	mass%	0.020 max.	0.02 max.	0.02 max.	0.02 max.
Total glycerol content	mass%	0.240 max.	0.25 max.	0.25 max.	0.25 max.
Na+K	mg/kg	5 max.	5.0 max.	5.0 max.	5.0 max.
Ca+Mg	mg/kg	5 max.	5.0 max.	5.0 max.	5.0 max.
Phosphorous content	mg/kg	10 max.	10.0 max.	10.0 max.	10.0 max.

(*) 130deg.C of flashpoint is available instead of measuring methanol content
(**) Meet diesel oil specification
(***) Need data check and further discussion
(****) Need more data & discussion from 6 to 10 hrs.

ASEAN AUTOMOTIVE FEDERATION

- History
  - ASEAN Automotive Federation (AAF) was first established in 1976, but activities ceased in 1983 (each focus on national auto industry)
  - In 1996 with the implementation of AFTA and its schemes, the ASEAN Automotive Federation was revived as a common platform to work with ASEAN Governments and ASEAN Secretariat towards achieving AFTA.
- Vision
  - "ASEAN with a strong and integrated vehicle and parts & components market supported by globally competitive automotive manufacturing industry".
- Mission
  - "To promote automotive market integration and growth, cooperation and investments in the ASEAN region".
- Goal
  - "To increase ASEAN market share and industry capability in the global automotive business".

A Driving Force for National Scien

http://www.asean-autofed.com/

ASEAN AUTOMOTIVE FEDERATION TECHNICAL COMMITTEES

Biofuel standard

Name	TC - 1	TC - 2	TC - 3	TC - 4	TC - 5
Scope	Economic Cooperation	Supporting Industries & Human Resource	Technical Development	Statistics & Information	Motorcycle
Chair	INDONESIA Hadi S.	PHILIPPINES Rey D Hernando	THAILAND Pitak P.	MALAYSIA Aishah Ahmad	PHILIPPINES Rolando F Cruz
Vice Chair	MALAYSIA Azhar A Wahab THAILAND Supawan P.	VIETNAM Dang Phan Thu Huong INDONESIA Budi P.S.	INDONESIA Eko Rudianto MALAYSIA Raymond Chow	SINGAPORE Michael Wong INDONESIA Leman N.	MALAYSIA KY Leong THAILAND Pongdej S.
Secretary	INDONESIA Benawati Abas	PHILIPPINES Wilma P.	THAILAND Prasert A./ Ms.Ruth W.	MALAYSIA Jennie Ong	PHILIPPINES Elvie/.Yeza B.

- Working Group 1 (Environment & Fuel)
- Working Group 2 (Certification)
- Working Group 3 (Safety, others)

PROPOSED AAF SPEC FOR B100 (FAME) FOR UP TO B5 BLEND

MTEC a member of NSTDA

Items		AAF Recommend	
Properties	unit		Priority
Ester content	mass%	96.5 min	★★
Density	g/ml	**Report**	★
Kinematic Viscosity	mm2/s	2.0 - 5.0	★
Flash Point	℃	100 min	★
Sulfur	ppm	10 max	★★
Carbon Residue 10%	mass%	0.3 max	★
Carbon Residue 100%	mass%	0.05 max	★
Cetane Number		51 min	★
Sulfated Ash	mass%	**0.02 max**	★★
Ash	mass%	-	
Water	ppm	500 max	★★
Total Contamination	ppm	24 max	★★
Water and Sediment	vol%	-	
Copper Corrosion		1 max	★
Total Acid Number	mgKOH/g	0.50 max	★★
Oxidation Stability	hrs	**10 min**	★★★
Iodine Number	gI2/100g	**120 max**	★★
Linolenic acid methyl ester	mass%	12.0 max	★
Polyunsaturated acid methyl ester	mass%	-	
Methanol	mass%	0.20 max	★
Mono glyceride	mass%	0.80 max	★★
Di glyceride	mass%	0.20 max	★★
Tri glyceride	mass%	0.20 max	★★
Free glycerine	mass%	0.02 max	★★
Total glycerine	mass%	0.25 max	★★
Metals (Na + K)	ppm	5 max	★★★
Metals (Ca + Mg)	ppm	5 max	★★★
Phospourus	ppm	**4 max**	★★
T90	℃	-	

Discussion on how to develop guideline in APEC


Thank you
ขอบคุณ