

**דלק לרכב מנועי: אסטרים מתיליים של חומצות שומניות  
(FAME) למנועי דיזל (ביודיזל) - דרישות ושיטות בדיקה**

Automotive fuels: Fatty acid methyl esters (FAME) for diesel engines  
(biodiesel) - Requirements and test methods

תקן זה הוכן על ידי ועדת מומחים בהרכב זה:  
 משה בוסאני (יו"ר), עזרא ברגר, איתן גייסמן, אבי מושל, אבנר פלור

תקן זה אושר על ידי הוועדה הטכנית 310 - נפט ומוצריו, בהרכב זה:

איגוד לשכות המסחר בישראל	-	יהודה רודד
המבדקה הכימית	-	עדינה לביא (יו"ר)
המועצה הישראלית לצרכנות	-	ראובן רוזן
המכון הישראלי לאנרגיה ולסביבה	-	עמוס ברקת
המשרד להגנת הסביבה	-	אבי מושל
התאחדות התעשיינים בישראל	-	משה בוסאני, רונן כהן, רותי שרון
חברת החשמל לישראל	-	אהוד סוצקובר
משרד התחבורה	-	אבנר פלור
משרד התשתיות הלאומיות	-	עמרם אזולאי
צה"ל - חיל התחזוקה	-	איתן גייסמן
רשות ההסתדרות לצרכנות	-	יואב ערמוני

כמו כן תרמו להכנת התקן: אנה אבייב, יוספה בן אשר, משה וטשטיין, שרית קלדרון, ערן רכס, מקס שופטן.  
 לינה בוכור ריכזה את עבודת הכנת התקן.

*The national standard SII 5731:January 2008 is an implementation of EN 14214:July 2003 with modifications and is reproduced with the permission of CEN, rue de Stassart 36, B-1050 Brussels. All exploitation rights of the European Standards in any form and by any means are reserved world-wide to CEN and its National Members, and no reproduction may be undertaken without expressed permission in writing by CEN through the Standards Institution of Israel*

---

**הודעה על מידת התאמת התקן הישראלי לתקנים או למסמכים זרים**

תקן זה, למעט השינויים והתוספות המצוינים בו,  
זהה לתקן האירופי EN 14214:July 2003  
(Incorporates corrigendum December 2003)

---

**מילות מפתח:**

דלק, דלק לרכב מנועי, שמנים צמחיים, חומצות שומניות, אסטרים, דלק למנועי דיזל, ביודיזל, מנועי דיזל.

**Descriptors:**

fuel, automotive fuels, vegetable oils, fatty acids, esters, diesel fuels, biodiesel, diesel engines.

---

**עדכניות התקן**

התקנים הישראליים עומדים לבדיקה מזמן לזמן, ולפחות אחת לחמש שנים, כדי להתאימם להתפתחות המדע והטכנולוגיה. המשתמשים בתקנים יוודאו שבידיהם המהדורה המעודכנת של התקן על גיליונות התיקון שלו. מסמך המתפרסם ברשומות כגיליון תיקון, יכול להיות גיליון תיקון נפרד או תיקון המשולב בתקן.

---

**רשמיות התקן**

יש לבדוק אם המסמך רשמי או אם חלקים ממנו רשמיים. תקן רשמי או גיליון תיקון רשמי (במלואם או בחלקם) נכנסים לתוקף 60 יום מפרסום ההודעה ברשומות, אלא אם בהודעה נקבע מועד מאוחר יותר לכניסה לתוקף.

---

**סימון בתו תקן**



כל המייצר מוצר, המתאים לדרישות התקנים הישראליים החלים עליו, רשאי, לפי היתר ממכון התקנים הישראלי, לסמנו בתו תקן:

---

**זכויות יוצרים**

© אין לצלם, להעתיק או לפרסם, בכל אמצעי שהוא, תקן זה או קטעים ממנו, ללא רשות מראש ובכתב ממכון התקנים הישראלי.

## הקדמה לתקן הישראלי

תקן ישראלי זה הוא התקן האירופי EN 14214 מיולי 2003 (שמשולב בו corrigendum מדצמבר 2003), שאושר כתקן ישראלי בשינויים ובתוספות.

בשפה העברית מובאים:

- סעיף חלות התקן בשינויים ובתוספות
- פירוט השינויים והתוספות לסעיפי התקן האירופי

לאחר החלק העברי מובא התקן האירופי כלשונו.

## חלות התקן (סעיף 1 של התקן האירופי בשינויים ובתוספות)

תקן זה קובע דרישות ושיטות בדיקה עבור אסטרים מתיליים של חומצות שומניות (FAME) למנועי דיזל (להלן: ביודיזל) המיועדים לשיווק ולהספקה, ואשר אמורים לשמש כדלק לרכב מנועי בעל מנוע דיזל - כאשר הם מסופקים בריכוז של 100%, או כמרכיב של הדלק לרכב מנועי בעל מנוע דיזל - בהתאם לדרישות התקן הישראלי ת"י 107 חלק 1<sup>(א)</sup>. כאשר ביודיזל מסופק בריכוז של 100%, תקן זה חל על הדלק המיועד לשמש בכלי רכב בעלי מנוע דיזל שנתפנו או שהותאמו בשלב מאוחר יותר לתדלוק בביודיזל בריכוז של 100%.

## פירוט השינויים והתוספות לסעיפי התקן האירופי

### 2. Normative references

הסעיף חל בשינויים ובתוספות אלה:

- התקן האירופי EN 590:1999 אינו חל, ובמקומו יחול:  
התקן הישראלי ת"י 107 חלק 1 - סולר: סולר למנועי דיזל
- הצעת התקן האירופי prEN 14538:2002 אינה חלה, ובמקומה יחול (בשינוי הכותר):  
EN 14538:2006 - Fat and oil derivatives - Fatty acid methyl ester (FAME) -  
Determination of Ca, K, Mg and Na content by optical emission  
spectral analysis with inductively coupled plasma (ICP OES)
- הצעת התקן הבין-לאומי prEN ISO 3679:2002 אינה חלה, ובמקומה יחול:  
EN ISO 3679:2004
- הצעת התקן הבין-לאומי prEN ISO 20846:2002 אינה חלה, ובמקומה יחול:  
EN ISO 20846:2004
- הצעת התקן הבין-לאומי prEN ISO 20884:2002 אינה חלה, ובמקומה יחול:  
EN ISO 20884:2004

- בסוף הסעיף יוסף:

<sup>(א)</sup> התקן הישראלי ת"י 107 חלק 1 זהה, בשינויים ובתוספות, לתקן האירופי EN 590 מינואר 2004.

- ASTM D 3244 - Practice for utilization of test data to determine conformance with specifications
- ASTM D 4057 - Practice for manual sampling of petroleum and petroleum products
- ASTM D 4177 - Practice for automatic sampling of petroleum and petroleum products
- IP 309 - Cold filter plugging point of diesel and domestic heating fuels

### 3. Sampling

הסעיף חל בתוספת זו:

בשורה הראשונה בסעיף, לאחר המילים "EN ISO 3170 or EN ISO 3171", יוסף:  
או כמתואר בתקן של האגודה האמריקנית לבדיקות ולחומרים ASTM D 4057 או ASTM D 4177.

### 4. Pump marking

בהתאם להוראת סעיף זה בתקן האירופי, שלפיה כל מדינה תקבע בתקן או בתקנות את הדרישות לסימון משאבות הניפוק המשמשות להספקת ביודיזל, להלן הדרישות למדינת ישראל:  
- המשאבות יסומנו בעברית במילים: 100% ביודיזל, ובאזרה שלהלן:

מיועד רק לרכב המותר על פי היצרן לתדלוק ב-100% ביודיזל.



- הסימון יהיה בולט וגובה האותיות יהיה כמפורט להלן:  
במשאבה מכנית - 50 מ"מ לפחות;  
במשאבה אלקטרונית - 27 מ"מ לפחות.

### 5. Requirements and test methods

הסעיף חל בשינויים ובתוספות אלה:

#### 5.1. Dyes and markers

- המילים: "dyes or" אינן חלות.  
- בסוף הסעיף יוסף:  
לא יוסף לביודיזל חומר צובע.

### 5.3. Generally applicable requirements and related test methods

Table 1

#### Generally applicable requirements and test methods

הטבלה חלה בשינויים ובתוספות אלה:  
- בעמודת "Test method", אחרי המילים: "Test method", יוסף ציון של הערה לטבלה, a1, ולהערות לטבלה תוסף הערה a1, כמפורט להלן:

אם יש שיטת בדיקה שפורסמה על-ידי ASTM או IP הזוהה לאחת משיטות הבדיקה שבתקן, מותר לבדוק בשיטה של ASTM או IP.

- בשורת התכונה: "Flash point" (השורה הרביעית שמתחת לשורת הכותרת), בעמודה "Test method", המילים: "prEN ISO 3679" אינן חלות, ובמקומן יחול:

EN ISO 3679

- בשורת התכונה: "Sulfur content" (השורה החמישית שמתחת לשורת הכותרת), בעמודה "Test method", המילים:

"prEN ISO 20846"

"prEN ISO 20884"

אינן חלות, ובמקומן יחול:

EN ISO 20846

EN ISO 20884

- בשורת התכונה: "Carbon residue" (השורה השישית שמתחת לשורת הכותרת), בעמודה "Property", המילים: "(on 10% distillation residue)", לרבות ציון ההערה לטבלה f והכתוב בהערה אינם חלים, ובמקומם יחול:

שארית הפחמן ב-100% מוצר.

- באותה שורה, בעמודה: "Limits", עמודת המשנה: "maximum", הערך: "0.30" אינו חל, ובמקומו יחול: 0.03.

- בשורת התכונה: "Group I metals (Na+K)" (בתא השני מסוף הטבלה), בעמודה "Test method", הכתוב חל בתוספת זו:

EN 14538

במקרה של חילוקי דעות, השיטות הקובעות הן:

EN 14108

EN 14109

- בשורת התכונה: "Group II metals (Ca+Mg)" (בתא השני מסוף הטבלה), בעמודה "Test method", המילים: "prEN 14538" אינן חלות, ובמקומן יחול:

EN 14538.

#### 5.4 Climate dependent requirements and related test methods

5.4.2. בהתאם להוראת סעיף זה בתקן האירופי שלפיה, כל מדינה תקבע את הדרישות בהתאם לאקלימה, הדרישות מפורטות בטבלה 2a שלהלן, המותאמת לתנאי ישראל.

## טבלה 2a - Temperate climates (מותאמת לתנאי ישראל)

שיטת הבדיקה <sup>(א)</sup>	דרישה		התכונה הנבדקת
	בקיץ (1 באפריל עד 14 בנובמבר)	בחורף (15 בנובמבר עד 31 במרס)	
EN 116 IP 309	+5° <sup>(א)</sup>	-5°	נקודת הסנינות בקור CFPP <sup>(ב)</sup> (מעלות צלזיוס), מקסי
<p>הערות לטבלה:</p> <p>(א) שתי שיטות הבדיקה הרשומות בעמודה זו זהות.</p> <p>(ב) Cold Filter Plugging Point</p> <p>(ג) על אף האמור לעיל, על ביודיזל המשווק במסופי הניפוק בלבד (כגון מפעל הייצור) יחולו דרישות אלה: - בתקופה שבין 1 בנובמבר עד 14 בנובמבר, נקודת הסנינות בקור תהיה 5°- צ' מקסימום; - בשאר תקופות השנה יהיו הדרישות כמפורט לעיל.</p>			

Table 2b

## Arctic climates

הטבלה אינה חלה.

## 5.5 Precision and dispute

הסעיף חל בתוספת זו: לאחר המילים: "EN ISO 4259", בכל מקום בסעיף שבו הן מובאות, יוסף:

או ASTM D 3244.

## Bibliography

- [1] EN 14331<sup>3)</sup>, *Liquid petroleum products – Separation and characterisation of fatty acid methyl esters (FAME) from middle distillate fuels by liquid chromatography/gas chromatography (LC/GC)*.
- [2] *The official Methods and Recommended Practices of the AOCS*, 5<sup>th</sup> edition, 1998, Champaign, IL, USA.
- [3] J. Rathbauer & A. Bachler, *Physical Properties of Vegetable Oil Methyl Esters*, International Conference on Standardization and Analysis of Biodiesel, November 6<sup>th</sup> – 7<sup>th</sup>, 1995, Vienna.

---

<sup>3)</sup> To be published following prEN 14331:2002



**Annex C**  
**(Normative)**  
**Correction factor for calculation of density of FAME**

The conversion factor for the correction of density, determined by EN ISO 3675 over a range of temperatures from 20 °C to 60 °C, to density at 15 °C is based on data published at the International Conference on Standardization and Analysis of Biodiesel, Vienna, November 1995 [3].

The density of seven samples of FAME was measured by pycnometer at 6 temperatures over the range 20 °C to 60 °C. The mean correction factor over the range was calculated as 0,723 kg/(m<sup>3</sup> °C), with a standard deviation of 1,2 %. The average density of the FAME samples at 15 °C was calculated as 886,5 kg/m<sup>3</sup>.

The following equation shall be used for the calculation of density of FAME at 15 °C ( $\rho_{(15)}$ , given in kg/m<sup>3</sup>), using the density ( $\rho_{(T)}$ ) at a certain temperature ( $T$ ), determined by EN ISO 3675 over the range of temperatures from 20 °C to 60 °C:

$$\rho_{(15)} = \rho_{(T)} + 0,723(T - 15) \quad (\text{C.1})$$

**Table B.2**  
**CALCULATION EXAMPLE**

Methyl ester of the following acids	Percentage % m/m	Factor	Contribution
Myristic C14:0	0,3	0	0
Palmitic C16:0	4,0	0	0
Palmitoleic C16:1	1,1	0,950	1,0
Stearic C18:0	2,0	0	0
Oleic C18:1	60,5	0,860	52,0
Linoleic C18:2	19,8	1,732	34,3
Linolenic C18:3	9,4	2,616	24,6
Eicosanoic C20:0	0,4	0	0
Eicosenoic C20:1	0,7	0,785	0,6
Docosanoic C22:0	0,7	0	0
Docosenoic C22:1	1,1	0,723	0,8
Calculated Iodine Value			113,3

#### B.4 Expression of the result

$$\text{Iodine value (calculated from the methyl ester composition)} = X \text{ g iodine} / 100 \text{ g} \quad (\text{B.1})$$

The result shall be reported to one decimal place.

NOTE 1 In 1994 the AOCS Uniform Methods Committee reviewed the coefficients used and concluded that no changes were necessary at that time. The present procedure uses the coefficients selected in the past for use in calculating the iodine value in triglyceride blends. The reasoning behind that choice is that triple the molecular weight of a methyl ester is almost identical to the molecular weight of the corresponding triglyceride.

NOTE 2 For samples with unsaponifiable content greater than 0,5% (m/m) or those containing a significant additive content, the calculated value tends to be higher than the true value.

NOTE 3 The calculated result tends to be lower than the true value in samples with a lower iodine value.

## Annex B (Normative) Calculation of Iodine Value

NOTE This method is adapted for biodiesel from the AOCS recommended practice Cd 1c – 85 for the determination of the iodine value of edible oil from its fatty acid composition [2].

### B.1 Scope

This method describes a procedure for calculating the iodine value of neat biodiesel or biodiesel extracted from blends with diesel fuel. In case of dispute on the iodine value this method shall not be used as a substitute for EN 14111.

### B.2 Definition

This method is used to calculate the iodine value expressed in g I<sub>2</sub>/100 g sample from the percentage by mass of methyl esters as determined by either EN 14103 (neat biodiesel) or EN 14331 [1] (biodiesel extracted from blends with diesel fuel).

### B.3 Procedure

The methyl ester composition of the sample is checked using the appropriate method as described in paragraph 2.

NOTE The total methyl esters thus revealed should equal 100 after the deduction of the methyl ester C17 used for internal standard in EN 14103.

The percentage by mass thus obtained is then used to calculate the sample's iodine value, being the sum of the individual contributions of each methyl ester, obtained by multiplying the methyl ester percentage by its respective factor (Table B.1), as indicated in the example in Table B.2.

The factor for each constituent of biodiesel is given in Table B.1.

**Table B.1  
METHYL ESTER FACTORS**

<b>Methyl ester</b>	<b>Factor</b>
Methyl ester of saturated fatty acids	0
Methyl hexadecenoate (Methyl palmitoleate) C16:1	0,950
Methyl octadecenoate (Methyl oleate) C18:1	0,860
Methyl octadecadienoate (Methyl lineolate) C18:2	1,732
Methyl octadecatrenoate (Methyl linolenate) C18:3	2,616
Methyl eicosenoate C20:1	0,785
Methyl docasenoate (Methyl erucate) C22:1	0,723

An example of the calculation of iodine value from the percentage by mass of methyl esters is given in Table B.2

**Annex A**  
(Normative)  
**Details of interlaboratory test programme**

The precision data given in Table A.1 apply in the case of FAME, as far as not already indicated in the standard. In Table A.1 only those data for requirements from EN-ISO methods that differ from ISO/TC 28 precision data are given.

**Table A.1 Precision data from interlaboratory test programme**

Property	Test method	Unit	CEN/TC19 data for pure FAME
Viscosity at 40 °C	EN ISO 3104	mm <sup>2</sup> /s	r = 0,001 1 X R = 0,018 X
Sulfur content	prEN ISO 20846	mg/kg	r = 0,028 5 X + 2 R = 0,108 8 X + 2
	prEN ISO 20884		r = 0,026 X + 1,356 R = 0,056 7 X + 1,616
Distillation	ASTM D 1160	°C	r = 2,0 R = 3,0 (90% distilled)
Cetane number	EN ISO 5165		r = 2,4 R = 5,0
Sulfated ash content	ISO 3987	% (m/m)	r = 0,06 X <sup>0,85</sup> R = 0,142 X <sup>0,85</sup>
Total contamination	EN 12662 <sup>a</sup>	mg/kg	r = 2,24 R = 13,6
CFPP	EN 116	°C	not available
Sum of Na + K	EN 14108	mg/kg	r = -0,017 X + 0,512
	EN 14109		R = 0,305 X + 1,980
where:			
r is repeatability (EN ISO 4259)			
R is reproducibility (EN ISO 4259)			
X is the mean of two results being compared			
<sup>a</sup> to be re-investigated			

## 5.4 Climate dependent requirements and related test methods

**5.4.1** For climate-dependent requirements options are given to allow for seasonal grades to be set nationally. The options are for temperate climates six CFPP (cold filter plugging point) grades and for arctic climates five different classes. Climate-dependent requirements are given in Table 2. Table 2 is divided into two sections, one for temperate climates (Table 2a) and one for arctic climates (Table 2b). When tested by the methods given in the Tables 2a and 2b, FAME "as fuel for diesel engines" shall be in accordance with the limits specified in these tables.

**5.4.2** In a national annex to this European Standard each country shall detail requirements for a summer and a winter grade and may include (an) intermediate and/or regional grade(s) which shall be justified by national meteorological data.

**Table 2 - Climate-related requirements and test methods**

**Table 2a - Temperate climates**

Property	Unit	Limits						Test method <sup>a</sup>
		Grade A	Grade B	Grade C	Grade D	Grade E	Grade F	
CFPP	°C, max.	+5	0	-5	-10	-15	-20	EN 116
<sup>a</sup> See also 5.5.1.								

**Table 2b - Arctic climates**

Property	Units	Limits					Test method <sup>a</sup>
		class 0	class 1	class 2	class 3	class 4	
CFPP	°C, max.	-20	-26	-32	-38	-44	EN 116
<sup>a</sup> See also 5.5.1.							

## 5.5 Precision and dispute

**5.5.1** All test methods referred to in this European Standard include a precision statement according to EN ISO 4259. In cases of dispute, the procedures described in EN ISO 4259 shall be used for resolving the dispute, and interpretation of the results based on the test method precision shall be used. However, the methods currently available for total contamination, ester content, triglyceride content, free glycerol and Group I metals (Na + K) do not meet the 2R requirement of EN ISO 4259 at the limit in Table 1.

**5.5.2** In cases of dispute concerning density, EN ISO 3675 shall be used with the determination carried out at 15 °C.

In cases of dispute concerning free glycerol, EN 14105 shall be used.

**5.5.3** For the determination of cetane number alternative methods may also be used in cases of dispute, provided that these methods originate from a recognized method series, and have a valid precision statement, derived in accordance with EN ISO 4259, which demonstrates precision at least equal to that of the referenced method. The test result, when using an alternative method, shall also have a demonstrable relationship to the result obtained when using the reference method.

Table 1 - Generally applicable requirements and test methods

Property	Unit	Limits		Test method <sup>a</sup>
		minimum	maximum	
Ester content <sup>a</sup>	% (m/m)	96,5 <sup>b</sup>		EN 14103
Density at 15 °C <sup>c</sup>	kg/m <sup>3</sup>	860	900	EN ISO 3675 EN ISO 12185
Viscosity at 40 °C <sup>d</sup>	mm <sup>2</sup> /s	3,50	5,00	EN ISO 3104
Flash point	°C	120	–	prEN ISO 3679 <sup>e</sup>
Sulfur content	mg/kg	–	10,0	prEN ISO 20846 prEN ISO 20884
Carbon residue (on 10 % distillation residue) <sup>f</sup>	% (m/m)	–	0,30	EN ISO 10370
Cetane number <sup>g</sup>		51,0		EN ISO 5165
Sulfated ash content	% (m/m)	–	0,02	ISO 3987
Water content	mg/kg	–	500	EN ISO 12937
Total contamination <sup>h</sup>	mg/kg	–	24	EN 12662
Copper strip corrosion (3 h at 50 °C)	rating	class 1		EN ISO 2160
Oxidation stability, 110 °C	hours	6,0	–	EN 14112
Acid value	mg KOH/g		0,50	EN 14104
Iodine value	g iodine/100 g		120	EN 14111
Linolenic acid methyl ester	% (m/m)		12,0	EN 14103
Polyunsaturated (>= 4 double bonds) methyl esters <sup>i</sup>	% (m/m)		1	
Methanol content	% (m/m)		0,20	EN 14110
Monoglyceride content	% (m/m)		0,80	EN 14105
Diglyceride content	% (m/m)		0,20	EN 14105
Triglyceride content <sup>j</sup>	% (m/m)		0,20	EN 14105
Free glycerol <sup>j</sup>	% (m/m)		0,02	EN 14105 EN 14106
Total glycerol	% (m/m)		0,25	EN 14105
Group I metals (Na+K) <sup>k</sup>	mg/kg		5,0	EN 14108 EN 14109
Group II metals (Ca+Mg) <sup>l</sup>	mg/kg		5,0	prEN 14538
Phosphorus content	mg/kg		10,0	EN 14107

<sup>a</sup> See 5.5.1  
<sup>b</sup> The addition of non-FAME components other than additives is not allowed, see 5.2.  
<sup>c</sup> Density may be measured by EN ISO 3675 over a range of temperatures from 20 °C to 60 °C. Temperature correction shall be made according to the formula given in Annex C. See also 5.5.2  
<sup>d</sup> If CFPP is -20 °C or lower, the viscosity measured at -20 °C shall not exceed 48 mm<sup>2</sup>/s. In this case, EN ISO 3104 is applicable without the precision data owing to non-Newtonian behaviour in a two-phase system.  
<sup>e</sup> A 2 ml sample and apparatus equipped with a thermal detection device shall be used  
<sup>f</sup> ASTM D 1160 shall be used to obtain the 10% distillation residue.  
<sup>g</sup> See 5.5.3.  
<sup>h</sup> Pending development of a suitable method by CEN/TC 19, EN 12662 shall be used. The precision of EN 12662 is however poor for FAME products  
<sup>i</sup> Suitable test method to be developed  
<sup>j</sup> See also 5.5.1.  
<sup>k</sup> See 5.5.1. Method under development. See Annex A for precision data for sum of Na + K  
<sup>l</sup> Method under development. See Annex A for precision data for sum of Ca + Mg.

## 4 Pump marking

Information to be marked on dispensing pumps used for delivering FAME diesel fuel, and the dimensions of the mark shall be in accordance with the requirements of national standards or regulations for the marking of pumps for automotive diesel fuel. Such requirements shall be set out in detail or shall be referred to by reference in a national annex to this European Standard.

## 5 Requirements and test methods

### 5.1 Dyes and markers

The use of dyes or markers is allowed.

### 5.2 Additives

In order to improve the performance quality, the use of additives is allowed. Suitable fuel additives without known harmful side effects are recommended in the appropriate amount, to help to avoid deterioration of driveability and emissions control durability. Other technical means with equivalent effect may also be used.

NOTE Deposit forming tendency test methods suitable for routine control purposes have not yet been identified and developed.

### 5.3 Generally applicable requirements and related test methods

**5.3.1** When tested by the methods indicated in Table 1, fatty acid methyl esters (FAME) shall be in accordance with the limits specified in Table 1. The test methods listed in Table 1 have been shown to be applicable to fatty acid methyl esters in an interlaboratory test programme. Precision data from this programme are given in normative Annex A, where these were found to be different from the precision data given in the test methods for petroleum products.

**5.3.2** In case of a need for identification of FAME, a recommended method based on separation and characterisation of fatty acid methyl esters by LC/GC is EN 14331 [1].

**5.3.3** In case of a need for a check upon FAME quality, iodine value of FAME may be calculated by the method presented in Annex B (normative), but this method does not constitute an alternative to the iodine value requirement of Table 1.

**5.3.4** The limiting value for the carbon residue given in Table 1 is based on product prior to addition of ignition improver, if used. If a value exceeding the limit is obtained on finished fuel in the market, EN ISO 13759 shall be used as an indicator of the presence of a nitrate-containing compound. If an ignition improver is thus proved present, the limit value for the carbon residue of the product under test cannot be applied. The use of additives does not exempt the manufacturer from meeting the requirement of maximum 0,30 % (*m/m*) of carbon residue prior to addition of additives.

EN ISO 2160:1998, *Petroleum products - Corrosiveness to copper - Copper strip test (ISO 2160:1998)*.

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

EN ISO 3104:1996/AC:1999, *Petroleum products - Transparent and opaque liquids - Determination of kinematic viscosity and calculation of dynamic viscosity (ISO 3104:1994, including Cor. 1:1997)*

EN ISO 3170<sup>1)</sup>, *Petroleum liquids – Manual sampling*.

EN ISO 3171:1999, *Petroleum liquids – Automatic pipeline sampling (ISO 3171:1988)*.

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

prEN ISO 3679:2002<sup>2)</sup>, *Determination of flash point - Rapid equilibrium closed cup method (ISO/DIS 3679:2002)*.

EN ISO 4259:1995, *Petroleum products - Determination and application of precision data in relation to methods of test (ISO 4259:1992, including Cor. 1:1993)*.

EN ISO 5165:1998, *Petroleum products - Diesel fuels - Determination of the ignition quality of diesel fuels - Cetane engine method (ISO 5165:1998)*.

EN ISO 10370:1995, *Petroleum products - Determination of carbon residue - Micro method (ISO 10370:1993)*.

EN ISO 12185:1996/C1:2001, *Crude petroleum and petroleum products - Determination of density - Oscillating U-tube method (ISO 12185:1996, including Cor. 1:2001)*.

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

EN ISO 13759:1996, *Petroleum products – Determination of alkyl nitrate in diesel fuels – Spectrometric method (ISO 13759:1996)*.

prEN ISO 20846:2002, *Petroleum products – Determination of the sulfur content of automotive fuels – Energy-dispersive X-ray fluorescence spectrometry (ISO/DIS 20846:2002)*.

prEN ISO 20884:2002, *Petroleum products – Determination of low sulfur content of automotive fuels – Wavelength-dispersive X-ray fluorescence spectrometry (ISO/DIS 20884:2002)*.

ISO 3987:1994, *Petroleum products - Lubricating oils and additives - Determination of sulfated ash*.

ASTM D 1160:1999, *Distillation of Petroleum Products at Reduced Pressure*.

### 3 Sampling

Samples shall be taken as described in EN ISO 3170 or EN ISO 3171 and/or in accordance with the requirements of national standards or regulations for the sampling of automotive diesel fuel. The national requirements shall be set out in a national annex to this European Standard, either in detail or by reference only.

In view of the sensitivity of some of the test methods referred to in this European Standard, particular attention shall be paid to compliance with any guidance on sampling containers, which is included in the test method standard.

---

<sup>1)</sup> To be published (revision of EN ISO 3170:1998)

<sup>2)</sup> Revision of ISO 3679:1983



## 1 Scope

This European Standard specifies requirements and test methods for marketed and delivered fatty acid methyl esters (FAME) to be used either as automotive fuel for diesel engines at 100% concentration, or as an extender for automotive fuel for diesel engines in accordance with the requirements of EN 590. At 100% concentration it is applicable to fuel for use in diesel engine vehicles designed or subsequently adapted to run on 100% FAME.

NOTE For the purposes of this European Standard, the term "% (m/m)" is used to represent the mass fraction.

## 2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 116:1997, *Diesel and domestic heating fuels – Determination of cold filter plugging point*

EN 590:1999, *Automotive fuels - Diesel - Requirements and test methods*

EN 12662:1998, *Liquid petroleum products - Determination of contamination in middle distillates*

EN 14103:2003, *Fat and oil derivatives - Fatty Acid Methyl Esters (FAME) – Determination of ester and linolenic acid methyl ester contents*

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

EN 14105:2003, *Fat and oil derivatives – Fatty Acid Methyl Esters (FAME) – Determination of free and total glycerol and mono-, di- and triglyceride content –(Reference method)*

EN 14106:2003, *Fat and oil derivatives – Fatty Acid Methyl Esters (FAME)– Determination of free glycerol content*

EN 14107:2003, *Fat and oil derivatives – Fatty Acid Methyl Esters (FAME) – Determination of phosphorus content by inductively coupled plasma (ICP) emission spectrometry*

EN 14108:2003, *Fat and oil derivatives - Fatty Acid Methyl Esters (FAME) – Determination of sodium content by atomic absorption spectrometry*

EN 14109:2003, *Fat and oil derivatives - Fatty Acid Methyl Esters (FAME) – Determination of potassium content by atomic absorption spectrometry*

EN 14110:2003, *Fat and oil derivatives – Fatty Acid Methyl Esters (FAME) - Determination of methanol content*

EN 14111:2003, *Fat and oil derivatives – Fatty Acid Methyl Esters (FAME) – Determination of iodine value*

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

prEN 14538:2002 *Fat and oil derivatives – Fatty acid methyl esters (FAME) – Determination of Ca and Mg content by optical emission spectral analysis with inductively coupled plasma (ICP OES).*

## Foreword

This document EN 14214:2003 has been prepared by Technical Committee CEN/TC 19 "Petroleum products, lubricants and related products", the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

This European standard exists in parallel with: EN 590 "Automotive fuels - Diesel - Requirements and test methods".

This standard gives all relevant characteristics, requirements and test methods for FAME, which are known at this time to be necessary to define the product to be used as automotive diesel fuel, including iodine value. The stability characteristics of FAME are under investigation in an EU-funded research programme 'BIOSTAB', and suitable limits and test methods may be incorporated into an amended version of this standard upon successful conclusion of this programme, including a possible replacement for iodine value.

Many of the test methods included in this standard were the subject of interlaboratory testing to determine the applicability of the method and its precision in relation to different sources of fatty acid methyl esters. These fatty acid methyl esters were produced from rapeseed and sunflower oil.

Annex A is normative and contains the precision data generated on the test methods which are the result of the interlaboratory testing as mentioned above, carried out by working groups of CEN/TC 19. Annex B and C, also normative, contain details on calculations.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

## Contents

Foreword .....	3
1 Scope .....	4
2 Normative references .....	4
3 Sampling .....	5
4 Pump marking .....	6
5 Requirements and test methods .....	6
5.1 Dyes and markers .....	6
5.2 Additives .....	6
5.3 Generally applicable requirements and related test methods .....	6
5.4 Climate dependent requirements and related test methods .....	8
5.5 Precision and dispute .....	8
Annex A (Normative) Details of interlaboratory test programme .....	9
Annex B (Normative) Calculation of Iodine Value .....	10
B.1 Scope .....	10
B.2 Definition .....	10
B.3 Procedure .....	10
B.4 Expression of the result .....	11
Annex C (Normative) Correction factor for calculation of density of FAME .....	12
Bibliography .....	13

English version

**Automotive fuels - Fatty acid methyl esters (FAME) for diesel engines - Requirements and test methods**

Carburants pour automobiles - Esters méthyliques d'acide gras (EMAG) pour moteurs diesel - Exigences et méthodes d'essais

Kraftstoffe für Kraftfahrzeuge - Fettsäure-Methylester (FAME) für Dieselmotoren - Anforderungen und Prüfverfahren

This European Standard was approved by CEN on 14 February 2003.

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 Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels