Gas-oil: Gas-oil for diesel engines

This Standard shall come into force as of

This document is only a proposal

The Standards Institution of Israel

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This Standard was prepared and approved by Technical Committee 310 on Petroleum and its Derivatives, and the Committee consisted of the following participants:

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On behalf of the Chemical Testing Laboratory - Ariela Kfir (Chairwoman)
On behalf of the Israel Consumer Council - Rina Bransburg
On behalf of the Israeli Institute of Energy & Environment - Oded Levy
On behalf of the Ministry of Environmental Protection - Amir Salzberg
On behalf of the Manufacturers Association of Israel - Moshe Bussani, Naftali Brodetzki, Arik Hendel
On behalf of the Israel Electric Corporation - Sarit Kalderon
On behalf of the Ministry of Transports - Idan Abudi
On behalf of the Ministry of National Infrastructures, Energy and Water - Yehuda Gassner
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Michal Philosoph coordinated the Standard preparation work.
Notification on the compatibility of Israeli Standard to foreign standards or documents
This Israeli Standard, but for national alterations and additions indicated therein, is identical to the Standard of the European Committee for Standardization (CEN)

Revision Notification
This Israeli Standard replaces Israeli Standard SI 107, Part 1, November 2011

EN 590, September 2013

Descriptors:
Petroleum products, fuels, automotive fuel, gas-oil, diesel engines, tests

Standard up-to-dateness
Israeli Standards are subject to reviews from time to time, and at least once every five years, so as to make sure that they are compatible with recent science and technology developments.

Standard users shall verify that they have, on the revision sheets, the up-to-date edition of the Standard.

A document published on Reshumot (The gazette of record for the State of Israel) as a revision sheet may be a separate revision sheet or a revision integrated with the Standard.

Standard Officiality
It’s mandatory to check whether the document is official, or whether parts thereof are official. An official Standard or an official revision sheet (either fully or partially) enters into force 60 days as from the publication of the notification on Reshumot (The gazette of record for the State of Israel), unless a later date has been determined as that for it coming into force in the notification.

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Preface to the Israeli Standard
This Israeli Standard is the September 2013 EN 590 Standard of the European Committee for Standardization (CEN), which was approved as an Israeli Standard in the scope of National Alterations and Additions.

The Standard includes, as per the below-described order, the following components:
- Translation of the European Standard Applicability Section (in Hebrew)
- Detailing of the National Alterations and Additions to the sections of the European Standard (in Hebrew)
- Translation of the Hebrew part of the standard (in English)
- The European Standard (in English)

National Notes with respect to the Israeli Standard are included as footnotes and mentioned in alphabetic characters.

This edition of the Israeli Standard replaces the November 2011 edition of the Israeli Standard 107 part 1, which adopted, within the scope of the National Alterations and Additions, the February 2010 EN 590:2009+A1 Standard of the European Committee for Standardization (CEN).

For the user’s convenience, the main changes between this edition of the Israeli Standard and the previous edition are mentioned below:
- The Table of Requirements and Testing Methods was rearranged;
- A reference to the MMT Additive was added;
- The Section referring to Fatty Acid Methyl Esters (FAME) was updated;
- For details about additional changes see the Foreword Section of the European Standard.

For a meticulous comparison of all the changes done between the different editions, see their full version.

This Standard is part of a series of Standards dealing with Diesel Fuel.
The series’ parts are the following ones:
SI 107 Part 1 – Diesel Fuel: Diesel Fuel for Diesel Engines
SI 107 Part 2 – Diesel Fuel: Diesel Fuel for Heating and Diesel Fuel for use in Gas Turbines

Standard Applicability (Translation of Section 1 of the European Standard)

Note:
The National Alterations and Additions included in this section are rendered with a different font.
This Standard specifies requirements and testing methods for motorized vehicle diesel fuel designated for marketing and supply.
The Standard applies to motorized vehicle diesel fuel intended to be used in vehicles equipped with diesel fuel engines designed to function by means of motorized vehicle diesel fuel containing up to (v/v) 7% of Fatty Acid Methyl Esters (FAME).

Note:
For the purposes of this Standard, the terms “%(m/m)” and “%(v/v)” are used for mass percentage and volume percentage representation, respectively.
Creation and discharge of static electricity may bring about problems in diesel fuel transportation. For information with regard to this matter, please refer to Israeli Standard SI 60079 Part 32, as well as to the directives included in the ASTM D4865 American Standard, the directives included in the IP Part 21 document of the British Energy Institute and the directives of the Israeli Fuel and Gas Administration.

Detailing of the National Alterations and Additions made to the sections of the European Standard

2. Normative References

- Instead of the European Standard mentioned in the Standard and specified in this section, an Israeli Standard applies as specified below:

<table>
<thead>
<tr>
<th>The European Standard referred to</th>
<th>The Israeli Standard which applies instead</th>
<th>Notes</th>
</tr>
</thead>
</table>

A note regarding the table:

(a) The Standard is presently under revision. The Standard in force applies to Fatty Acid Methyl Esters (FAME) for Diesel Engines only. In its new edition, the applicability of the Standard has been expanded and thus it also applies to Fatty Acid Methyl Esters (FAME) for heating purposes.

The following shall be added to the section:

Israeli Standards
SI 60079 Part 32 – Explosive Atmospheres: Electrostatic Hazards

National Standards

- ASTM D86 – Test method for distillation of petroleum products at atmospheric pressure
- ASTM D93 – Test methods for flash-point by Pensky-Martens closed cup tester
- ASTM D130 – Test methods for corrosiveness to copper from petroleum products by the copper strip test
- ASTM D189 – Test method for Conradson carbon residue of petroleum products
- ASTM D445 – Test method for kinematic viscosity of transparent and opaque liquids (and the calculation of dynamic viscosity)
- ASTM D482 – Test method for ash from petroleum products
- ASTM D524 – Test method for Ramsbottom carbon residue of petroleum products
- ASTM D613 – Test method for cetane number of diesel fuel oil
- ASTM D1298 – Test method for density, relative density, or API gravity of crude petroleum and liquid petroleum products by hydrometer method
- ASTM D2274 – Test method for oxidation stability of distillate fuel oil (accelerated method)
- ASTM D2622 – Test method for sulfur in petroleum products by wavelength dispersive X-ray fluorescence spectrometry
- ASTM D3244 – Practice for utilization of test data to determine conformance with specifications
ASTM D3831 – Test Method for Manganese in Gasoline by Atomic Absorption Spectroscopy
ASTM D4046 – Test method for alkyl nitrate in diesel fuels by spectrophotometry
ASTM D4052 – Test method for density, relative density, and API gravity of liquids by digital density meter
ASTM D4057 – Practice for manual sampling of petroleum and petroleum products
ASTM D4177 – Practice for automatic sampling of petroleum and petroleum products
ASTM D4530 – Test method for determination of carbon residue (micro method)
ASTM D4737 – Test method for calculated cetane index by four variable equation
ASTM D4865 – Guide for generation and dissipation of static electricity in petroleum fuel systems
ASTM D5453 – Test method for determination of total sulfur in light hydrocarbons, spark ignition engine fuel, diesel engine fuel, and engine oil by ultraviolet fluorescence
ASTM D6304 – Test method for determination of water in petroleum products, lubricating oils, and additives by coulometric Karl Fischer titration
ASTM D6371 – Test method for cold filter plugging point of diesel and heating fuels
ASTM D6591 – Test method for determination of aromatic hydrocarbon types in middle distillates – high performance liquid chromatography method with refractive index detection
ASTM D7371 – Test method for Determination of Biodiesel (Fatty Acids Methyl Esters) content in Diesel Fuel Oil using Mid Infrared Spectroscopy (FTIR-ATR-PLS Method)
NF M 07-075 – Liquid petroleum products-Determination of the foaming tendency of diesel fuels

Foreign Documents
*CEC F-23-01 – Procedure for diesel engine injector nozzle coking test (PSA XUD9A/L 1.9 litre 4 cylinder indirect injection diesel engine)
CEC-F-98-08 – Direct injection, common rail diesel engine nozzle coking test
IP 4 – Petroleum products-Determination of ash (ISO 6245:2001)
IP 41 – Petroleum products-Determination of ignition quality of diesel fuels – Cetane engine method
IP 71 – Petroleum products-Transparent and opaque liquids - Determination of Kinematic viscosity and calculation of dynamic viscosity
IP 123 – Petroleum products-Determination of distillation characteristics at atmospheric pressure
IP 154 – Petroleum products - Corrosiveness to copper – copper strip test
IP 160 – Crude petroleum and liquids petroleum products – Laboratory determination of density – Hydrometer method
IP 309 – Diesel and domestic heating fuels - Determination of cold filter plugging point
IP 380 – Petroleum products – Calculation of cetane index of middle distillate fuels by the four - variable equation
IP 388 – Petroleum products – Determination of the oxidation stability of middle distillate fuels
IP 391 – Petroleum products – Determination of aromatic hydrocarbon types in middle distillates – High performance liquid chromatography method with refractive index detection
IP 430 – Petroleum products – Determination of alkyl nitrate in diesel fuels – Spectrometric method
IP 438 – Petroleum products – Determination of water – Coulometric Karl Fischer titration method
IP 440 – Liquid Petroleum products – Determination of contamination in middle distillates

*CEC – Coordination European Council
Draft SI 107 part 1 (2014)


IP 450  Diesel fuel – Assessment of lubricity using the high-frequency reciprocating rig – (HFRR) – Test method

IP 455  Determination of the manganese content of gasoline - Atomic absorption spectrometry (AAS) method


IP 498  Determination of ignition delay and derived cetane number (DCN) of middle distillate fuels by combustion in a constant volume chamber

IP 567  Determination of derived cetane number (DCN) of middle distillate fuels – Fixed range injection period, constant volume combustion chamber method

IP 579  Liquid petroleum products – Determination of fatty acid methyl ester (FAME) content in middle distillates - Infrared spectrometry Method

IP Part 21  Guidelines for the control of hazards arising from static electricity – Part 21: Model code of safe practice in the petroleum industry
3. **Sampling**

   In the first line of the section, after the words: “EN ISO 3170 or EN ISO 3171”, the following shall be added:

   Or as described in American Standards ASTM D4057 or ASTM D4177.

4. **Pump marking**

   At the end of the section, the following shall be added:

   According to the provisions of this section that the marking of the pumps shall comply with the requirements of National Standards in every country or with its mandatory Standards, the National Standards are as specified below:

   - The pumps shall be marked with the Hebrew word for “Diesel Fuel”
   - The marking shall be noticeable and pronounced and the height of its letter fonts shall be as specified below:
     - In a Mechanical Pump – at least 50 mm;
     - In an Electronic Pump – at least 27 mm.

5. **Requirements and test methods**

5.2. **Additives**

5.2.1 **General**

   In the last line, the words “the use of additives is allowed” is no longer applicable and instead the following shall be applicable:

   The following additives shall be present in diesel fuel supplied to consumers - detergents and foam prevention substances, as specified in Appendix A below. The presence of such additives in diesel fuel tested during the time period from its delivery from the refinery or unloading from the ship until it is loaded on the tankers is not obligatory.

5.2.2. **Methylcyclopentadienyl Manganese Tricarbonyl (MMT)**

   The following shall be added at the end of the section:

   If no MMT was added, then the Manufacturer shall declare this.

   Only in the absence of the above-mentioned Manufacturer’s Declaration, this property shall be checked.

5.3. **Fatty Acid Methyl Ester (FAME)**

   - The first paragraph of the section, beginning with the words “Diesel Fuel” and ending with the words “do not apply” is no longer applicable and instead the following shall be applicable:

     The diesel fuel may contain up to 7% (volume percentage) of Fatty Acid Methyl Esters (FAME) that comply with Israeli Standard SI 5731, except for the Cold filter plugging point (CFPP), and provided that the diesel fuel which contains Fatty Acid Methyl Esters (FAME) complies with this Standard (Israeli Standard SI 107 Part 1).
In the end of the section, the following shall be added:

If no Fatty Acid Methyl Esters (FAME) were added, the manufacturer shall declare it.

Only in the absence of the aforesaid Manufacturer’s Declaration, this property shall be checked.

5.5. Generally applicable requirements and related test methods

5.5.1. The first sentence beginning with the words “When tested” and ending with the words “in Table 1” is no longer applicable, and the following shall be applicable instead:

When tested by means of one of the methods specified in Table 1 below, in accordance with the property being tested.

In case of disagreements, the testing method specified in the column “The Prevailing Testing Method” shall prevail.

5.5.2. - In the first line, the words “Table 1” are no longer applicable and the following shall be applicable instead:

“Table 1”.

- In the second line, after the words: “EN ISO 13759”, the following shall be added:

“Or IP 430 or ASTM D4046”. In case of disagreements, the results as per the International Standard EN ISO 13750 or the British document IP 430 shall prevail.

5.5.3. Table 1

Generally applicable requirements and test methods for automotive diesel fuel

The table is no longer applicable and table 1 shall be applicable instead, as specified below:

<table>
<thead>
<tr>
<th>The Property being Tested</th>
<th>Units</th>
<th>Limits</th>
<th>Additional Testing Methods</th>
<th>The Prevailing Testing Method</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimal</td>
<td>Maximal</td>
<td>(a)</td>
</tr>
<tr>
<td>Cetane(d) Number</td>
<td>-</td>
<td>51.0</td>
<td>-</td>
<td>EN ISO 5165</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 15195</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 15195</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 15195</td>
</tr>
<tr>
<td>Cetane Index</td>
<td>-</td>
<td>46.0</td>
<td>-</td>
<td>EN ISO 4264</td>
</tr>
<tr>
<td>Density at 15°C</td>
<td>Kg/m(^3)</td>
<td>820.0</td>
<td>845.0</td>
<td>EN ISO 3675</td>
</tr>
<tr>
<td>Polycyclic Aromatic Hydrocarbons(e)</td>
<td>Mass %</td>
<td>-</td>
<td>8.0</td>
<td>EN 12916</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>The Property being Tested</th>
<th>Units</th>
<th>Limits</th>
<th>The Prevailing Testing Method(a)(b)(c)</th>
<th>Additional Testing Methods(a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimal</td>
<td>Maximal</td>
<td></td>
</tr>
<tr>
<td>Sulfur Content(f)</td>
<td>Mg/Kg</td>
<td>-</td>
<td>10.0</td>
<td>EN ISO 20846</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN ISO 20884</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM D2622</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM D5453</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP 447</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP 490</td>
</tr>
<tr>
<td>Manganese Content(g)</td>
<td>Mg/L</td>
<td>-</td>
<td>2.0</td>
<td>prEN 16576</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP 455</td>
</tr>
<tr>
<td>Flash Point</td>
<td>°C</td>
<td>Above 55.0</td>
<td>-</td>
<td>EN ISO 2279</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM D 93</td>
</tr>
<tr>
<td>Carbon Residue(h)</td>
<td>Mass %</td>
<td>-</td>
<td>0.30</td>
<td>EN ISO 10370</td>
</tr>
<tr>
<td>(In an evaporation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>residue of 10%)</td>
<td></td>
<td></td>
<td></td>
<td>IP 398</td>
</tr>
<tr>
<td>Ash Content</td>
<td>Mass %</td>
<td>-</td>
<td>0.010</td>
<td>EN ISO 6245</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM D482</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP 4</td>
</tr>
<tr>
<td>Water content</td>
<td>Mg/Kg</td>
<td>-</td>
<td>200</td>
<td>EN ISO 12937</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP 438</td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>Mg/Kg</td>
<td>-</td>
<td>24</td>
<td>EN 12662</td>
</tr>
<tr>
<td>Content</td>
<td></td>
<td></td>
<td></td>
<td>IP 440</td>
</tr>
<tr>
<td>Copper Band Corrosion</td>
<td></td>
<td></td>
<td></td>
<td>According to ranking</td>
</tr>
<tr>
<td>(3 hours, at 50 °C)</td>
<td></td>
<td></td>
<td></td>
<td>Class 1</td>
</tr>
<tr>
<td>Content of Fatty Acid</td>
<td>Volume %</td>
<td>-</td>
<td>7.0</td>
<td>EN 14078</td>
</tr>
<tr>
<td>Methyl Esters (FAME)</td>
<td></td>
<td></td>
<td></td>
<td>IP 579</td>
</tr>
<tr>
<td>Oxidation Stability(i)</td>
<td>g/m³/3</td>
<td>20</td>
<td>25</td>
<td>EN ISO 12205</td>
</tr>
<tr>
<td></td>
<td>hours</td>
<td></td>
<td></td>
<td>ASTM D2274</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IP 388</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 15751</td>
</tr>
<tr>
<td>Lubrication Capacity,</td>
<td>µm</td>
<td>-</td>
<td>460</td>
<td>EN ISO 12156-1</td>
</tr>
<tr>
<td>wear scar corrected</td>
<td></td>
<td></td>
<td></td>
<td>IP 450</td>
</tr>
<tr>
<td>diameter (WSD 1,4) at 60  °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillation(n)</td>
<td>Volume %</td>
<td>-</td>
<td>&lt;65</td>
<td>EN ISO 3405</td>
</tr>
<tr>
<td>Restoration at 250 °C</td>
<td></td>
<td></td>
<td></td>
<td>ASTM D86</td>
</tr>
<tr>
<td>Restoration at 350 °C</td>
<td>Volume %</td>
<td>85</td>
<td>360</td>
<td>EN 116</td>
</tr>
<tr>
<td>(v/v) 95% restored at</td>
<td>°C</td>
<td></td>
<td></td>
<td>IP 309</td>
</tr>
<tr>
<td>Viscosity at 40 °C</td>
<td>mm³/sec</td>
<td>2.000</td>
<td>4.500</td>
<td>EN 3104</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ASTM D445</td>
</tr>
<tr>
<td>Distillation(n)</td>
<td>Volume %</td>
<td>-</td>
<td>&lt;65</td>
<td>EN ISO 3405</td>
</tr>
<tr>
<td>Cold Filter Plugging</td>
<td></td>
<td></td>
<td></td>
<td>ASTM D86</td>
</tr>
<tr>
<td>Point (CFPP)(o)</td>
<td>See Table 2</td>
<td></td>
<td></td>
<td>EN 116</td>
</tr>
<tr>
<td>Additives: Detergents</td>
<td></td>
<td></td>
<td></td>
<td>IP 309</td>
</tr>
<tr>
<td>and Foam Prevention</td>
<td>See Appendix A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Substances</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.6. Climate dependent requirements and related test methods

5.6.1. - In the fourth line, the words “and Table 3 (arctic or severe winter climates)” is no longer applicable.

- In the fifth line, the words: “and Table 3” is no longer applicable.

5.6.2. - According to the provisions of this section, whereby every country shall determine the requirements as per their climatic conditions, Table 2 is no longer applicable, and Table 2, which was adapted to the [climatic] conditions in Israel, shall be applicable instead, as specified below:
Table 2 – Requirements and Climatic Measuring Methods – Mild Climate
(Adapted to the [climatic] conditions in Israel)

<table>
<thead>
<tr>
<th>The Property being Tested</th>
<th>Requirements</th>
<th>Additional Testing Methods (a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold Filter Plugging Point CFPP(b) (Degrees Celsius), Max.</td>
<td>Winter (November 15th – March 31st)</td>
<td>Summer (April 1st – November 14th)</td>
</tr>
<tr>
<td></td>
<td>-5°</td>
<td>+5° (c)</td>
</tr>
</tbody>
</table>

Table Notes:
(a) Both Testing Methods in this column are identical.
(b) CFPP – Cold Filter Plugging Point.
(c) In spite of the aforesaid, the following requirements shall apply to the diesel fuel only at the exit from the refineries and at the import terminals:
- In the time period between Nov. 1st and Nov. 14th, the Cold Filter Plugging Point shall be max. (-5) Degrees Celsius;
- During the other seasons of the year, the requirements shall be as specified in the Table.

- Table 3
Climate-related requirements and test methods – Arctic or severe winter climates
The table, including its title, is no longer applicable.

5.7. Precision and dispute

5.7.1. In the third line, after the words “EN ISO 4259”, the following shall be added:
“or ASTM D3244”

5.7.2. After the words: “EN ISO 3675”, the following shall be added:
“or ASTM D1298 or IP 160”

5.7.3. After the words: “EN ISO 20846 or EN ISO 20884”, the following shall be added:
“Or ASTM D2622 or ASTM D5453 or IP 447 or IP 490”

5.7.4. – In the second line, the words “and Table 3” is no longer applicable.
– In the fourth line, after the words: “EN ISO 4259”, the following shall be added:
“or ASTM D3244”.

5.7.5. After the words: “EN ISO 3405”, the following shall be added:
“or ASTM D86, or IP 123”.

5.7.6. After the words: “EN 116”, the following shall be added:
“or IP 309”.

- After Annex A, “Appendix A” shall be added as specified below:
Appendix A – Additives: Detergents and Foam Prevention Substances
(Normative)

In addition to the requirements of section 5.2 – Additives, the additives: detergents and foam prevention substances shall meet the requirements specified below:

A-1. The additives shall contain only the following elements: Carbon, Hydrogen, Oxygen, Nitrogen and Sulfur, and shall not contain metals or/and Halogens. In foam prevention substances, the addition of a Silicon concentration as per the manufacturer’s recommendation is permitted.

A-2. The manufacturer of the additives shall present a written declaration stating that the additives do not harm vehicle systems.

A-3. Diesel fuel for diesel engines shall contain the manufacturer’s recommended concentration. The manufacturer of the additives shall present a testing certificate confirming that the additives meet the requirements specified below:

A-3.1. In a cleanliness test performed on diesel fuel injectors for indirect injection diesel engines as per the specifications of European Standard CEC-F-23-01, the airflow-related loss shall not exceed 50%.

A-3.2. In a cleanliness test performed on diesel fuel injectors for direct injection diesel engines as per the specifications of European Standard CEC-F-98-08, the engine power-related loss shall not exceed 2%. The test shall be carried out while using the DF79 reference fuel, with the addition of a Zinc concentration of 1 ppm.

A-3.3. During a test performed as per the NF M 07-075 French Standard, the volume of the foam shall not exceed 100 ml, and the foam disappearance time shall not exceed 15 seconds.

A-4. Diesel fuel for diesel engines containing the manufacturer’s recommended concentration of additives shall meet all the requirements of this Standard.