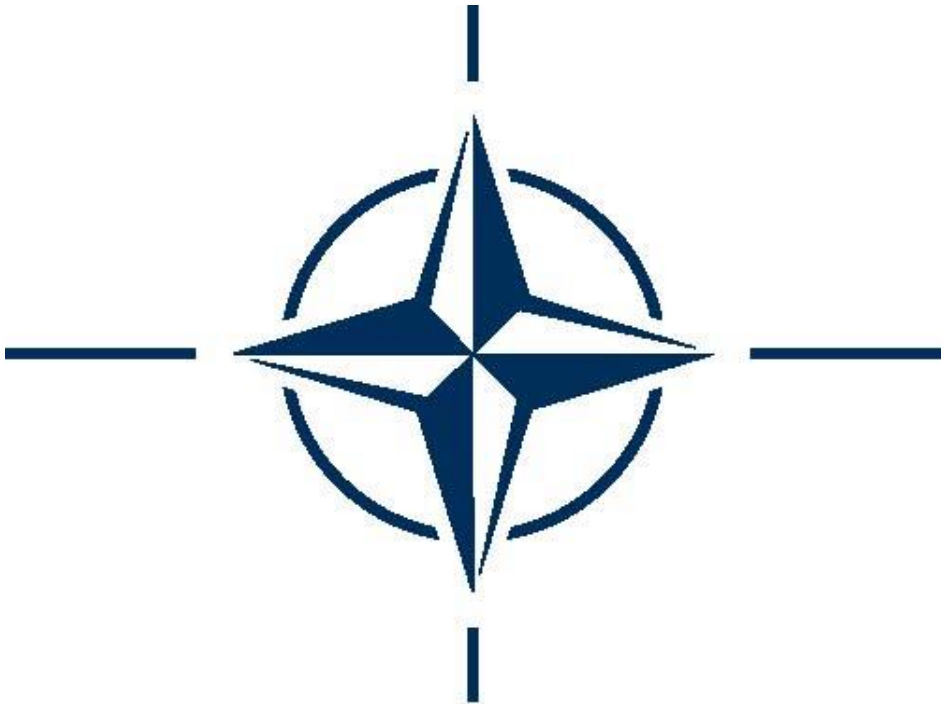
# STANDARDS RELATED DOCUMENT 7090

# GUIDE SPECIFICATION FOR NATO GROUND FUELS – GUIDELINES FOR PROCUREMENT OF F-54

**Edition A**
**February 2016**



**NORTH ATLANTIC TREATY ORGANIZATION**

**ALLIED FUELS AND LUBRICANTS PUBLICATION**

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**NATO STANDARDIZATION OFFICE (NSO)**

**NATO LETTER OF PROMULGATION**

2 February 2016

1. The enclosed Standards Related Document SRD-7090, GUIDE SPECIFICATION FOR NATO GROUND FUELS – GUIDELINES FOR PROCUREMENT OF F-54, which has been approved in conjunction with AFLP-7090 by the nations in the AC/112, is promulgated herewith.

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Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

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## SECTION 1: GENERAL

0101. STANAG 1135, Annex C - interchangeability chart of NATO standardized fuels, lubricants and associated products - lists under individual product descriptions of national specifications which have been agreed as interchangeable.

0102. Under previous agreements, a single national specification has been selected for each land systems product to provide the quality standard which other nations' specifications are expected to meet in order to achieve interchangeability. However, product development is constantly in progress, and national specifications are frequently revised to take advantage of this. Thus a nation whose specification is used as a guide may find it difficult to make such changes without altering the product quality standard in a manner unacceptable to other nations.

0103. NATO guide specifications have therefore been prepared to define the minimum quality requirements of the most important products. Further specifications may be prepared as considered necessary.

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## SECTION 2: DETAIL OF THE AGREEMENT

0201. The STANAG 7090/AFLP-7090 provides the guidelines for the homeland / peacetime procurement of F-54. The specification will be fulfilled by national/international specifications like EN 590 or ASTM D975. Nations to provide detailed information in STANAG 1135 Annex C.

0202. This Standard Related Document (SRD) is a technical guidance document for the procurement of F-54 in out of area operations and includes a risk assessment when deviating from the specification.

0203. The Lead Nation (LN) or responsible procurement agency for F-54 during operations will use STANAG 7090/AFLP-7090 as the reference specification for F-54 procurement in out of area operations.

0204. If there is no possibility to comply with the STANAG 7090/AFLP-7090 requirements, the supplier(s) will propose his (their) product with the minimum and maximum characteristics he (they) can guarantee for delivery.

0205. The Technical Fuel Expert (TFE) of the LN will evaluate the proposals of the suppliers and rank/select the fuel based upon:

- The closest quality to the required STANAG 7090/AFLP-7090 specification.
- The lowest impact on engine, handling activities and functioning of NATO Military equipment/operations (see section3 – Effects and impact level of “off” specification characteristics). A description is made for the short and long term consequences, the severity of the impact and the possibilities for improvement.
- The fuel quality as agreed with the selected supplier will form the basis for future supply and quality control procedures as defined in STANAG 3149.

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## SECTION 3: EFFECTS AND IMPACTS OF "OFF SPEC" CHARACTERISTICS OF F-54

**Table 1: Effects and impacts of "off spec" characteristics as a guidance to NATO Commands / technical Fuel Expert to advise in procurement issues for F-54.**

| Specification requirement | | Possible effects on vehicles due to non-conformity of the fuel **Effects are not systematic and depend on engine technology** | | Impact Severity (meaning see below table 1) | Possibility to correct | Remarks |
|---|---|---|---|---|---|---|
| | | Short term effect | Long term effect | | | |
| Appearance | Clear, bright, and free from solid matter and undissolved water at ambient temperatures | Blockage of filters and/or injectors | | xx | Yes, filtration | Suitable filtration systems. Refer to STANAG 3149 |
| Density at 15°C | 820-845 kg/m$^3$ | Low density: engine power loss, increased fuel consumption<br>High density: environmental concern, smoke | | x | No | |

| Specification requirement | | Possible effects on vehicles due to non-conformity of the fuel **Effects are not systematic and depend on engine technology** | | Impact Severity (meaning see below table 1) | Possibility to correct | Remarks |
|---|---|---|---|---|---|---|
| | | Short term effect | Long term effect | | | |
| Distillation temperature | | | | | | |
| % v/v recovered at 250°C | ≤ 65 | | More oil dilution by fuel | x | No | Reduce oil drain interval |
| % v/v recovered at 350°C | 85 min | No | No | - | - | |
| 95% v/v recovered at | 360°C | No | More oil dilution by fuel | x | No | Reduce oil drain interval |
| Flash point | 52°C min | Handling safety concern | | xx | No | Take appropriate safety precautions if < 38°C. |
| | | Engine operability | | -/x | No | |
| Cloud point (applies to wintergrade, class 0) | -10°C max | fuel storage concern (setting of wax) | | xx | Yes, blend with F-34, use of additive[1] | Must be adapted to local average (night) temperature. If necessary use an additive or blend with F-34 or use SFP |
| CFPP (applies to wintergrade, class 0) | -20°C max | Cold start difficulties Filter plugging | | xxx | Yes, blend with F-34, use of additive[1] | Must be adapted to local average (night) temperature. If necessary use an additive or blend with F-34 or use SFP |

| Specification requirement | | Possible effects on vehicles due to non-conformity of the fuel **Effects are not systematic and depend on engine technology** | | Impact Severity (meaning see below table 1) | Possibility to correct | Remarks |
|---|---|---|---|---|---|---|
| | | Short term effect | Long term effect | | | |
| Kinematic viscosity @ 40°C | 1.20-4.50 $mm^2/s$ | Low viscosity (< 1.20 $mm^2/s$) : injection pump and injector size, engine power loss<br>High viscosity (> 4.50 $mm^2/s$) : injector fouling, environmental concern, smoke | | xxx<br>x | No | high viscosity : less influence in hot weather |
| Sulphur content | 15 mg/kg max | >50 ppm: Concern only with exhaust gas treatment device<br>No short term effect | | xxx | No | Adjust/modify emission control devices, possibility of adjustment of engine management system |
| | | | > 2000 ppm: risk of corrosion by sulphuric acid formation | x | No | Reduce oil drain interval by 50% |
| Copper strip corrosion (3h at 50°C) | Class 3 max | No | Engine corrosion | xx | No | |

| Specification requirement | | Possible effects on vehicles due to non-conformity of the fuel **Effects are not systematic and depend on engine technology** | | Impact Severity (meaning see below table 1) | Possibility to correct | Remarks |
|---|---|---|---|---|---|---|
| | | Short term effect | Long term effect | | | |
| Carbon residue (10% distillation residue) | 0.35% m/m max | No | Carbon deposit formation | x | No | |
| Ash content | 0.01% m/m max | No | Injector fouling | x | No | |
| Oxidation stability (EN ISO 12205) | 25 g/m$^3$ max | No | Injector fouling F-54 degradation in case of long term storage. Engine corrosion due to acid formation | xx | Yes, use of anti-oxidant | When long term storage, the use of an anti-oxidant can be considered (type Butyl Hydroxy Toluene, BHT) |
| Oxidation stability (EN ISO 15751 – Rancimat) | 20 hr min | No | Injector fouling F-54 degradation in case of long term storage. Engine corrosion due to acid formation | xx | Yes, use of anti-oxidant | When long term storage, the use of an anti-oxidant can be considered (type Butyl Hydroxy Toluene, BHT) |

| Specification requirement | | Possible effects on vehicles due to non-conformity of the fuel **Effects are not systematic and depend on engine technology** | | Impact Severity (meaning see below table 1) | Possibility to correct | Remarks |
|---|---|---|---|---|---|---|
| | | Short term effect | Long term effect | | | |
| Water content | 200 mg/kg max | Filter plugging / microbiological contamination Injection pump and injector seize | | xx | Yes, bulk filtration | Apply strict draining procedures during fuel storage. Monitor fuel quality according to STANAG 3149. |
| Total contamination | 24 mg/kg max | Filter plugging | | xx | Yes, bulk filtration | Make sure PHE has suitable filtering systems (STANAG 3149). |
| Polycyclic aromatic hydrocarbons | 8.0% m/m max | No | Injector fouling, smoke | x | No | |
| Cetane number | 49 min | Cold start difficulties Low engine speed instability Noise | | x | Yes, use of cetane improver | Option to use the S-1750 additive. Consult TFE for the right dosage. |
| Cetane index | 46 min | | | | | |
| Lubricity, corrected wear scar Diameter at 60°C | 520 µm max | Injection pump and injector seize | Wear of fuel pumps, engine wear | xxx | Yes, use of lubricity improver | Option to use the S-1750 additive. Consult the TFE for the right dosage. |

| Specification requirement | | Possible effects on vehicles due to non-conformity of the fuel **Effects are not systematic and depend on engine technology** | | Impact Severity (meaning see below table 1) | Possibility to correct | Remarks |
|---|---|---|---|---|---|---|
| | | Short term effect | Long term effect | | | |
| FAME content | Not allowed | | If present then risk of biocontamination during fuel storage | xxx | No | Use of biocide in case of biocontamination. Good housekeeping procedures; refer to STANAG 3149 and 7063. Additization for lowering the CP/CFPP in cases where FAME is detected, is recommended. This ensures that additives be effective if fuel is exposed to a low temperature situation. |

-: no impact

-/x: no to low impact

x: low impact

xx: medium impact

xxx: severe impact

1: Caution should be brought to the fact that when additives are used, these are more effective when added at the time of manufacture. Trying to fix a fuel problem in cloud point or CFPP after it happens increases the risk the additives will not be effective, particularly if fuel has a biodiesel content.

**Table 2: Summary of member nations concerning diesel fuel quality during operations**

| Characteristics | Mean value | Extreme value | Median value | EN 590 specification limits |
|---|---|---|---|---|
| Water content (mg/kg) | 118 | 590 | 110 | 200 max |
| Total contamination (mg/kg) | 13 | 86 | 7 | 24 max |
| Sulphur content (mg/kg) | 2509 | 8760 | 1833 | 10 max |
| Lubricity, corrected wear scar diameter at 60°C (µm) | 377 | 577 | 378 | 460 max |
| Density at 15°C ($kg/m^3$) | 846.4 | 880.8 | 846.2 | 845 max |
| T at 95% vol recovered (°C) | 360.1 | 407.7 | 359 | 360 max |
| Cetane number | 51.8 | 44 | 51.4 | 51 |
| Viscosity @ 40°C ($mm^2/s$) | 3.3 | 5.9 | 3.3 | 4.5 max |

Remark: France is collecting the data.

# SRD-7090
# Edition A