STANAG No. 2415
(Edition 2)

**NORTH ATLANTIC TREATY ORGANIZATION**
**(NATO)**

**MILITARY AGENCY FOR STANDARDIZATION**
**(MAS)**

# STANDARDIZATION AGREEMENT
**(STANAG)**

SUBJECT: PROCEDURES FOR OPERATION OF MECHANICAL GROUND EQUIPMENT TO MINIMIZE DIESEL FUEL PROBLEMS AT LOW AMBIENT TEMPERATURES

Promulgated on 5 July 1996

G.B. FERRARI
Major-General, ITAF
Chairman, MAS



Information Handling Services, 2000

## RECORD OF AMENDMENTS

| No. | Reference/date of amendment | Date entered | Signature |
|---|---|---|---|
| 1 | MAS/420-LCEP/2415 5-11-97 | 10-4-00 | R. Bouchon |

## EXPLANATORY NOTES

### AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Chairman MAS under the authority vested in him by the NATO Military Committee.

2. No departure may be made from the agreement without consultation with the tasking authority. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

### DEFINITIONS

4. Ratification is "In NATO Standardization, the fulfilment by which a member nation formally accepts, with or without reservation, the content of a Standardization Agreement" (AAP-6).

5. Implementation is "In NATO Standardization, the fulfilment by a member nation of its obligations as specified in a Standardization Agreement" (AAP-6).

6. Reservation is "In NATO Standardization, the stated qualification by a member nation that describes that part of a Standardization Agreement that it will not implement or will implement only with limitations" (AAP-6).

### RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page iii gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page iv (and subsequent) gives details of reservations and proprietary rights that have been stated.



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## RATIFICATION AND IMPLEMENTATION DETAILS
## STADE DE RATIFICATION ET DE MISE EN APPLICATION

| NATION | NATIONAL RATIFICATION REFERENCE DE LA RATIFICATION NATIONALE | NATIONAL IMPLEMENTING DOCUMENT NATIONAL DE MISE EN APPLICATION | IMPLEMENTATION/MISE EN APPLICATION | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | FORECAST DATE PREVUE | | | ACTUAL DATE REELLE | | |
| | | | NAVY MER | ARMY TERRE | AIR | NAVY MER | ARMY TERRE | AIR |
| BE | VS3/MAS-96-02937 (JSO-G/Pol) of/du 22/4/06 | STANAG | | | | 4.96 | 4.96 | 4.96 |
| CA | 2441-2415 (DPMCE 5) of/du 8.4.96 | STANAG | | | | | 4.96 | |
| DA | MA204.68-S 2415/MAM 3-05005 of/du 12.3.96 | STANAG | | | | | 10.96 | |
| FR* | 001995/DEF/DCSEA/ SDE.1/189/00/STG 2415 of/du 28.3.96 | STANAG | | | | 4.96 | 4.96 | 4.96 |
| GE | BMVg-FüSIV2 - AZ 03-51-40 of/du 20.1.97 | STANAG | | | | 11.96 | 11.96 | 11.96 |
| GR | F 060/UNCLAS/193656 of/du 12.8.96 | STANAG | | | | 7.96 | 10.96 | 7.96 |
| IT | | | | | | | | |
| LU | NOT PARTICIPATING/NE PARTICIPE PAS | | | | | | | |
| NL* | RNLAF/NW 96023933 of/du 29.3.96 | STANAG | | | | 7.96 | 7.96 | 7.96 |
| NO | | | | | | | | |
| PO | CHOD PO RRN 111/96/DA of/du 3.5.96 | STANAG | | | | | 7.96 | 7.96 |
| SP | NOROPE 026/2415/021D of/du 14.2.96 | STANAG | | | | 9.96 | 9.96 | 9.96 |
| TU | Gn.P.P:2307-108-96/And.D. (MAS.S/2415) of/du 15.2.96 | STANAG | | | | 10.96 | 10.96 | 10.96 |
| UK | | | | | | | | |
| US | WL/POSF of/du 24.1.96 | MIL-HDBK-114A AMC-R 70-17 Field Manual FM7-207 | | | | | 7.96 | |

See overleaf reservations(*)/comments (+)
Voir au verso réserves (*)/commentaires (+)



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## RESERVATIONS

FR: This STANAG will not be implemented where French Forces implement the Single Fuel Concept.

Paragraph 7: French Forces use only F-34/F-35 aircraft turbine kerosene fuel for ground equipment.

Paragraph 13: Addition of S-1751 biocide additive prevents microbiological growth.

NL: Paragraph 10: RNLNA cannot meet standards of standard filter separators which are not referenced.

## RESERVES

FR: Ce STANAG ne sera pas mis en application partout où les Armées français mettront en oeuvre le Concept du Carburant Unique.

Paragraphe 7: Les Armées français n'utilisent que le carburéacteur F-34/F-35 pour les matériels terrestres.

Paragraphe 13: L'ajout d'additif biocide, S-1751, empêche la prolifération microbilogique.

NL: Paragraphe 10: La Marine néerlandaise ne peut répondre aux normes concernant des filtres-séparateurs standard dont aucune référence n'est donnée.



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# NORTH ATLANTIC TREATY ORGANIZATION
# ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD

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MAS(AIR)241-IF&L/2415
5 July 1996

To : See Distribution Llst Air B

Subject : STANAG 2415 IF&L (EDITION 2) - PROCEDURES FOR OPERATION OF MECHANICAL GROUND EQUIPMENT TO MINIMIZE DIESEL FUEL PROBLEMS AT LOW AMBIENT TEMPERATURES

References :
a. MAS(ARMY)425-F&L/2415 dated 15 November 1990 (Edition 1)
b. MAS(AIR)484-IF&L/2415 dated 12 December 1995 (Edition 2)(Ratification Draft 1)

Enclosure : STANAG 2415 (Edition 2)

1. The enclosed NATO Standardization Agreement which has been ratified by nations as reflected in page iii is promulgated herewith.

2. The references listed above are to be destroyed in accordance with local document destruction procedures.

3. AAP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine page iii of the STANAG and if they have not already done so, to advise the Air Board, MAS, through their national delegation as appropriate of their intention regarding its ratification and implementation.

G.B. FERRARI
Major-General, ITAF
Chairman, MAS

33-FB
AIR241



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Agreed English/French Texts

STANAG 2415
(Edition 2)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT
STANAG

# PROCEDURES FOR OPERATION OF MECHANICAL GROUND EQUIPMENT TO MINIMIZE DIESEL FUEL PROBLEMS AT LOW AMBIENT TEMPERATURES

Annex : A. Cloud Point versus Cloud Point Index

| | | |
|---|---|---|
| Related documents: | STANAG 2895 PCS - | Extreme Climatic Conditions and Derived Conditions for Use in Defining Design/Test Criteria for NATO Forces Materiel |
| | STANAG 7090 (Edition 1) - | Guide Specification for NATO Ground Fuels |
| | AFLP-1 - | NATO Civil/Military Ground Fuels Interchangeability Catalogue |

## AIM

1. The aim of this agreement is to describe recommended procedures to minimize operational problems at low ambient temperatures when using diesel fuel.

## AGREEMENT

2. Participating nations agree to the procedures set forth in this agreement.

## TERMS AND DEFINITIONS

3. The following terms and definitions are used for the purpose of this STANAG.

(a) Mechanical Ground Equipment. Mechanical ground equipment includes all combat tactical tracked and wheeled equipment, combat engineering equipment, mobile power generation equipment and other soldier support materiel designed to consume diesel fuel.

(b) Low Ambient Temperature. A low ambient temperature would include those ambient air temperatures defined in ClimaticCategories C0 (Mild Cold), C1 (Intermediate Cold), and C2 (Cold) as specified under STANAG 2895. The ambient air temperature (°C) ranges for Categories

AMENDMENT 1



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C0, C1 and C2 are -6 to -19, -21 to -32 and -37 to -46 respectively.

(c) Satisfactory Operability. Satisfactory operability or acceptable performance of mechanical ground equipment is the ability to perform their intended function regardless of the prevailing low temperature.

## GENERAL

4. Low temperatures can effect fuel properties to the extent that engine driven vehicles and equipment can fail to complete their missions. The principal cause of failure is due to inadequate flow of fuel resulting from either the formation of ice due to water contamination or wax crystals. Ice can clog fuel lines, fuel filters and fuel pumps. Wax crystals build on fuel filter surfaces, fuel pump intake screens or within fuel lines causing fuel starvation.

5. Ice formation can be prevented by the exclusion of free water from fuel (e.g. use of filter separators), adherence to good housekeeping practices, the application of heat to the fuel system, or by the use of Fuel System Icing Inhibitors (FSII).

6. Wax crystallization can be prevented by proper fuel selection or by adjustment of the Cloud Point or the Cold Filter Plugging Point (CFPP) of available fuel for that of the prevailing or anticipated ambient air temperature. Nations have access to civil fuels which are seasonally blended (i.e. summer versus winter fuels) and these fuels may be used where appropriate.

7. Wax crystallization can occur at any temperature below the Cloud Point of the fuel as it generally represents the lower operational limits for equipment utilizing the fuel. Aircraft turbine kerosene base fuels (F-34, F-35 and F-44) have virtually no wax crystallization in the temperature range defined in paragraph 3(b). and will present no problem when used in areas where low ambient temperature prevail. Military diesel fuel (F-54) has a Cloud Point limit of -13°C maximum which in most instances provides satisfactory low temperature operability. A winterized version of F-54, designated as F-65, had been standardized which consists of a 1:1 mixture of F-54 with F-34, F-35, F-44, or other kerosenes.

## DETAILS OF THE AGREEMENT

8. Vehicle fuel tanks should be kept full by frequent "topping off" to prevent water condensation within the tank ullage area.

9. Efforts should be made to minimize the possibility of water entry during refuelling. Vehicles and equipment should not be refuelled from freshly-filled refuelling vehicles or fuel supply tanks (i.e. sufficient time is needed for the entrained and/or separated water to settle). Fuel supply



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tanks that have been recently steam cleaned should also be avoided if possible. Fuel inlets and vents should be kept free of accumulated snow and dirt.

10. Standard filter separators should be used wherever possible during fuel transferring and refuelling operations as coalescers and remove much of the free water present in fuel. However, diesel fuels unlike aviation fuels, tend to hold water in suspension due to the presence of naturally-occurring surface active agents (surfactants), making water separation by coalescence less effective. Further, many commercial diesel fuels contain surfactant-type additives such as anti-settling wax agents and dispersants which can cause filter separators to not perform satisfactorily or even become inoperative. In general, effectiveness of filter-separators can be increased by frequent changing of the filter-coalescer elements and by derating the rated capacity (i.e., slowing down the flow rate) by as much as fifty percent.

11. Fuel storage tanks and filter separators should be drained of bottom water more often during winter operations. Daily draining of bottom sumps is recommended.

12. On board fuel-water separators should be drained daily of accumulated water during winter operations. To prevent ice formation of the separated water, drain water separator sumps immediately after the engine has been shut off. Fuel filters should be changed as directed in the appropriate technical publication.

13. FSIIs, interchangeable under S-1745, may be added to diesel fuels to prevent ice formation occurring in fuel lines or filters; FSII concentration should not exceed 0.15 volume percent. FSII also acts as a biostat that can reduce micro-biological growth in fuel systems, a frequent contributor to fuel stoppage in cold weather. When used, FSII can be added to diesel fuels in elevated fuel storage tanks, service station underground tanks, tank trucks or cars, drum storage, or refuelling vehicles (see paragraph 17). Handlers of FSII will take the appropriate personal safety precautions as prescribed by their respective nations.

14. Procurement procedures for diesel fuels should consider consumption rates (i.e., turnover intervals) as it is essential that the specified Cloud Point or CFPP values in the case of civil fuels, be equal to or lower than the temperature anticipated during the coldest time within that period of use. Every effort should be made to deplete summer fuel stocks prior to the onset of winter. When the Cloud Point or CFPP value is known to be above the anticipated prevailing low ambient temperatures provision must be made to "winterize" the fuel.

15. Fuel blending to reduce wax content must be performed before the onset of any anticipated low temperatures. Complete mixing of the two fuels is essential. With reference to STANAG 2845, Annex P, appropriate blending fuels are kerosene type fuels with Freezing Points of -47°C maximum as follows:



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a. F-34 Turbine Fuel, Aviation, Kerosene Type.

b. F-35 Turbine Fuel, Aviation, Kerosene Type.

c. F-44 Turbine Fuel, Aviation, High Flash Type.

d. F-58 Kerosene.

Gasoline or naphtha type fuels should never be used for blending as they can substantially reduce the fuel flash point resulting in an increased fire hazard.

16. The blending ratio can be determined by comparing the Cloud Point values of the base fuel with the blending fuel. The following industry-developed formula is generally applicable for most fuels.

$$K = 100 \times (B-A)/(B-C)$$

a. Definitions within this formula are as follows:

(1) K Kerosene blending fuel needed (percent).

(2) B Cloud Point Index of diesel fuel to be treated.

(3) A Cloud Point Index of blend (desired value).

(4) C Cloud Point Index of kerosene blending fuel.

b. The formula uses a Cloud Point Index value which is based on the Cloud Point of the fuels. Converting Cloud Point values to Cloud Point Index values is accomplished by use of Annex A which provides tabulation of Cloud Point versus Cloud Point Index.

c. Although the formula is usable with a wide variety of diesel fuels, there may be some combinations in which this formula does not apply.

17. Ideally, blending should be performed in either fuel storage tanks, fixed fuel dispensing tanks or refuelling vehicles. It is usually not practical to blend in the consuming vehicle's fuel tank. After addition, the mixture should be recirculated for at least ten minutes. After recirculation, the mixture should be sampled to ensure a uniform blend. If not uniformly blended, mixture should be recirculated until a uniform blend is achieved.

IMPLEMENTATION OF THE AGREEMENT

18. This STANAG is implemented when nations have issued instructions to their forces adopting the procedures contained herein.



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ANNEX A TO
STANAG 2415
(Edition 2)

## CLOUD POINT VERSUS CLOUD POINT INDEX

| CLOUD POINT °C | CLOUD POINT INDEX | CLOUD POINT °C | CLOUD POINT INDEX |
|---|---|---|---|
| +5 | 268.6 | -22 | 35.1 |
| +4 | 249.1 | -23 | 32.6 |
| +3 | 231.0 | -24 | 30.2 |
| +2 | 214.2 | -25 | 28.0 |
| +1 | 198.7 | -26 | 26.0 |
| 0 | 184.3 | -27 | 24.1 |
| -1 | 170.9 | -28 | 22.3 |
| -2 | 158.5 | -29 | 20.7 |
| -3 | 147.0 | -30 | 19.2 |
| -4 | 136.3 | -31 | 17.8 |
| -5 | 126.4 | -32 | 16.5 |
| -6 | 117.2 | -33 | 15.3 |
| -7 | 108.7 | -34 | 14.2 |
| -8 | 100.8 | -35 | 13.2 |
| -9 | 93.5 | -36 | 12.2 |
| -10 | 86.7 | -37 | 11.3 |
| -11 | 80.4 | -38 | 10.5 |
| -12 | 74.6 | -39 | 9.7 |
| -13 | 69.2 | -40 | 9.0 |
| -14 | 64.1 | -41 | 8.4 |
| -15 | 59.5 | -42 | 7.8 |
| -16 | 55.2 | -43 | 7.2 |
| -17 | 51.2 | -44 | 6.7 |
| -18 | 47.5 | -45 | 6.2 |
| -19 | 44.0 | -46 | 5.8 |
| -20 | 40.8 | -47 | 5.3 |
| -21 | 37.8 | -48 | 4.9 |



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1 DEC 1997

5 November 1997 MAS/420-ILCEP/2415

See Distribution List: STANAG AC/112(ARMY FLWP)

**STANAG 2415 ILCEP (EDITION 2)(AMENDMENT 1) - PROCEDURES FOR OPERATION OF MECHANICAL GROUND EQUIPMENT TO MINIMIZE DIESEL FUEL PROBLEMS AT LOW AMBIENT TEMPERATURES**

Reference:
MAS(AIR)241-IF&L/2415 dated 5 July 1996 (Edition 2)

1. The subject STANAG was promulgated by the document at reference. Addressees are requested to destroy the existing pages 1/2 and iii/iv of the STANAG and substitute the revised ones attached.

2. AAP-4 should be amended to reflect the latest status of the STANAG.

A. GRØNHEIM
Major General, NOAF
Chairman MAS

Enclosure:
Revised pages 1/2 and iii/iv

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