NATO STANDARD

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GUIDE SPECIFICATION FOR GREASES

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NORTH ATLANTIC TREATY ORGANIZATION

ALLIED FUELS AND LUBRICANTS PUBLICATION

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

14 November 2022

1. The enclosed Allied Fuels and Lubricants Publication AFLP-7101, Edition A, Version 2, GUIDE SPECIFICATION FOR GREASES, which has been approved by the nations in the PETROLEUM COMMITTEE, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 7101.

2. AFLP-7101, Edition A, Version 2, is effective upon receipt and supersedes AFLP-7101, Edition A, Version 1, which shall be destroyed in accordance with the local procedure for the destruction of documents.

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4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Major General, GRC (A)
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
DEU	Compared with the previous edition the following essential content is missing: „With the agreement of the Aviation F&L WP other national tests may be accepted to ascertain the performance of the grease in rolling bearings." This content is for national implementation important, because of the paragraph 11 listed method ASTM D 3336 is in Europe not widespread. Germany is usually apply standard method DIN 51821-1 mit DIN 51821-2.
DNK	For NATO code G-403 the implementing specification used by the Danish Defence (the US spec, MIL-PRF-10924) has no requirement for Rust Preventive Properties, Water Washout Characteristics, or Apparent Viscosity, and the Oil Separation test temperature is 100 °C. For NATO code G-460 the Roll Stability requirement is not imposed in the implementing specification used by the Danish Defence
FRA	France does not issue G-1352 and G-403 products. The maximum limit required for Grease G-460 penetration worked 60 times is 310 mm/10 instead of 295 mm/10.
GBR	Air: G-421 Def Stan 91-105 operating temperature -40 deg C max. G-421 Def Stan 91-105 does not require Apparent viscosity Shear Rate at 100s (Def Stan 91-105 AVSR is measured at 25s). Army: G-403 Def Stan 91-27 has no water washout requirement. Navy: G-460 Def Stan 91-34 has no Roll Stability requirement.
POL	The Polish Armed Forces reserve the right not to use G-403 and G414 grease.
PRT	PRT NAVY does not use G-408; G-412; G-414 and G-421 products.
SVK	Greases NATO Code Number G-403, G-408, G-412, G-421, G-450 and G-460 are not used in the Armed Forces of the Slovak Republic.
TUR	TAF does not use G-421 and G-414 products of this STANAG.
USA	Presently, the USA DoD has not transitioned to the use of NATO Codes, G-414, G-421, and G-460 greases specified in this STANAG. For NATO Code G-403, the US guiding specification has no requirement for Rust Preventive Properties, Water Washout Characteristics, or Apparent Viscosity, and the Oil Separation test temperature is 100° C.

The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

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TABLE OF CONTENTS

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SECTION 1: GENERAL

0101. The aim of this agreement is to provide a document which establishes the minimum quality at the time of initial procurement of greases for use in service operations by NATO Forces. It specifies a limited number of multipurpose greases, which are intended for multi-service applications, i.e. Land and Sea. Careful selection of these greases to meet specific applications would allow nations and forces to rationalize their grease inventories.

0102. This Guide Specification represents the minimum quality standards acceptable under the appropriate NATO Code Numbers. Under previous agreements, a single national specification has been selected for each grease to provide the quality standard which other nations' specifications are expected to meet in order to achieve interchangeability. Since product development is constantly in progress and national specifications are frequently revised to take advantage of this, 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. Therefore, a nation that has made technical changes to a specification listed in table 1 (page 1-2), is to send it to the AC/112 Staff Officer for distribution to the WP delegates at least one month prior to discussion at the annual ARMY/ NAVY FLWP meeting.

0103. Nation's specifications shall comply with the minimum requirements before being acceptable as standardized products under the appropriate NATO Code Number. The test methods shown in AFLP-7101 are for reference only. The greases shall comply with the specified limiting values. The specified limiting values must not be changed. This precludes any allowance for the test method precision and adding or substracting digits.

0104. In order to promote product development, any nation's specifications may include additional tests or improved quality requirements to those listed in AFLP-7101.

0105. STANAG 1135, Annex C, lists under individual product descriptions, national specifications which have been agreed as interchangeable.

0106. The quality standards contained in this document are to be used by Member Nations (MNs) in the preparation and maintenance of their individual procurement specifications and standards. A MN's individual procurement document may be more stringent depending upon its equipment. This STANAG is not designed to be used in the direct procurement of products.

0107. For the aviation greases nations will rely on SAE grease specifications.

NO	NATO CODE	PRODUCT DESCRIPTION (AS LISTED IN STANAG 1135)	GUIDE SPECIFICATION (NOTE 1)
(a)	(b)	(c)	(d)
1	G-403	Grease, automotive and artillery	See section 3
2	G-408	Grease, graphite soft	VV-G-671 E (Grade 1)
3	G-412	Grease, graphite medium	VV-G-671
4	G-414	Grease, general use (-30°C to 130°C)	See section 4
5	G-421	Grease, general use (-30°C to 140°C)	See section 2
6	G-460	Grease, sea water resistant	See section 5
7	G-450	Grease, naval general purpose ball and roller bearing	MIL-PRF-24139

Table - 1

Note 1 – Consult STANAG 1135 for the applicable version (unless otherwise indicated herein).

SECTION 2: NATO GUIDE SPECIFICATION FOR GREASE, GENERAL USE, G-421

	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
1 1.1	Composition Scope			The grease shall consist of PAO and/or synthetic/semi-synthetic and/or mineral liquid lubricant plus lithium complex soap thickener and additives as necessary. The grease shall be used for applications over the temperature range minus 30 °C to plus 140 °C.	
2	Dropping Point	°C	ISO 6299	Min 220	
3	Penetration, Worked	mm/10	ISO 2137	265 to 295	NLGI 2
4	Effect on Copper: • condition of grease • copper strip corrosion	 Rating	ASTM D4048	 No green colour or change in texture Max 1	Test temperature (100 ± 1) °C Test period 24 hrs ± 15 min

5	Rust preventive properties	Rating	ISO 11007	Max 1	Using distilled water
	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
6	Water Washout characteristics	% m/m	ISO 11009	Max 5	Test temperature (38 ± 2) °C
7	Extreme Pressure properties: • Load-wear index (Mean Hertz load) • Weld load	 kg kg	ASTM D2596	 Min 50 Min 250	Running time 10 s
8	Anti-wear properties: - mean wear scar diameter	mm	ASTM D2266	Max 0.70	Test temperature (75 ± 2) °C load 40 kg, test period 60 min
9	Low Temperature Torque (10 % distilled water): - Starting torque - Running torque	 mNm mNm	Def Stan 05-50 (Part 62)	 Max 250 Max 150	Test temperature minus (30 ± 1) °C Running time 60 min
10	Working stability in the presence of water. Difference in penetration from grease worked in absence of water: - 10 % distilled water	mm/10	Def Stan 05-50 (Part 63)	Minus 10 to Plus 50	Change in penetration after 10^5 double strokes
11	Elevated temperature performance: Running time	Hours	ASTM D3336	Min 900	Test temperature (140 ± 2) °C
	Oil separation	% m/m	IP 121	Max 6	Test temperature 40°C

12			DIN 51817		Test period 168 hrs
	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
13	Evaporation loss	% m/m	ASTM D972	Max 8	Test temperature 140°C Test period 22 hrs
14	Oxidation stability: • After 100 hours • After 500 hours	 kPa kPa	ASTM D942	 Max 50 Max 150	Test temperature 99°C

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SECTION 3: NATO GUIDE SPECIFICATION FOR GREASE, AUTOMOTIVE AND ARTILLERY, G-403

	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
1 1.1	Composition Scope			The grease shall consist of a mineral/synthetic oil plus soap thickener and additives as necessary. The grease shall be used for applications over the temperature range minus 54 °C to plus 105 °C.	
2	Dropping Point	°C	ISO 6299	Min 130	
3	Penetration, Worked	mm/10	ISO 2137	265 to 295	NLGI 2
4	Effect on Copper	Rating	ASTM D4048	Max 1b	Test temperature (100 ± 1) °C Test period 24 hrs ± 30 min
5	Rust preventive properties	Rating	ISO 11007	Max 1	Using distilled water
6	Water Washout characteristics	% m/m	ISO 11009	Max 10	Test temperature (38 ± 2) °C

	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
7	Extreme Pressure Properties: • Load-wear index (Mean Hertz load) • Weld load	 kg kg	ASTM D2596	 Min 35 Min 250	Running time 10 s
8	Anti-wear Properties: Mean wear scar diameter	 mm	ASTM D2266	 Max 0.70	Test temperature (75 ± 1) °C, load 40 kg, test period 60 min
9	Roll Stability: • change in penetration (after 24 hrs) • change in penetration (after 100 hrs)	 mm/10 mm/10	ASTM D1831 (modified)	 -25 to +60 -25 to +60	Sample size (150 ± 2.0) g Rolling speed (10 ± 1) rpm Test temperature (66 ± 1) °C Rolling period (100 ± 0.25) hrs
10	Apparant Viscosity: • shear rate 25 s^{-1} • shear rate 100 s^{-1}	 Pa.s Pa.s	ASTM D1092	 1 150 to 2 000 Max 1 000	Test temperature minus (54 ± 1) °C
11	Working stability in the presence of Water. Change in penetration from grease worked in absence of water: - 10 % distilled water	 mm/10	Def Stan 05-50 (Part 63)	 -25 to + 60	Change in penetration after 10^5 double strokes

	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
12	Oil separation	% m/m	ASTM D6184	Max 8	Test temperature 180°C Test period 30 hrs
13	Evaporation loss	% m/m	ASTM E1131	Max 10	Analysis to be performed by thermogravimetry

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SECTION 4: NATO GUIDE SPECIFICATION FOR GREASE, GENERAL USE, G-414

	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
1 1.1	Composition Scope			The grease shall consist of mineral oil lubricant or synthetic oil, or a mixture of both, plus soap thickener and additives as necessary. The grease shall be used for applications over the temperature range minus 30 °C to plus 130 °C.	
2	Dropping Point	°C	ISO 6299	Min 130	
3	Penetration, Worked	mm/10	ISO 2137	250 to 290	NLGI 2
4	Effect on Copper	Rating	ASTM D 4048	Max 2b	Test temperature (100 ± 1) °C Test period 24 hrs ± 15 min

	REQUIREMENT	UNITS	TEST METHODS	LIMITS	NOTES
5	Rust preventive properties	Rating	ISO 11007	Max 1	Using distilled water
6	Water Washout Characteristics	% m/m	ISO 11009	Max 10	Test temperature (38 ± 2) °C
7	Extreme Pressure Properties: • Load-wear index (Mean Hertz load) • Weld load	 kg kg	ASTM D2596	 Min 30 Min 157	Running time 10 s
8	Anti-wear Properties: Mean wear scar diameter	 mm	ASTM D2266	 Max 0.70	Test temperature (75 ± 1) °C, load 40 kg, test period 60 min
9	Roll Stability: • change in penetration after 24 hrs • change in penetration after 100 hrs	 mm/10 mm/10	ASTM D1831 (modified)	 -25 to +45 -25 to +45	Sample size (150 ± 1.0) g Rolling speed (10 ± 1) rpm Test temperature (66 ± 1) °C Rolling period (100 ± 0.25) hrs
10	Apparent Viscosity: • shear rate 25 s^{-1} • Shear rate 100 s^{-1}	 Pa.s Pa.s	ASTM D1092	 Max 1 750 Max 850	Test temperature minus (25 ± 1) °C

	REQUIREMENT	UNITS	TEST METHODS	LIMITS	NOTES
11	Working stability in the presence of water. Change in penetration from grease Worked in absence of water: 10 % distilled water	 mm/10	Def Stan 05-50 (Part 63)	 -10 to +45	Change in penetration after 10^5 double strokes
12	Elevated Temperature Performance: Running time	 hours	ASTM D3336 (modified) (1)	 Min 300	Test bearing grease charge 0.3 g
13	Oil separation: • After 24 hours • After 48 hours	% m/m	ASTM D1742	 Max 4 Max 6	Test temperature 25°C
14	Evaporation loss	% m/m	ASTM D972	Max 2	Test temperature 121°C, Test period 22 hrs
15	Torque at low temperature: • At start • After 10 minutes	 daN.cm daN.cm	ASTM D1478	 Max 10 Max 2	
16	Oxidation stability: • After 100 hours • After 400 hours	Pressure drop kPa kPa	ASTM D942	 Max 35 Max 100	Test temperature 99°C

NOTE:
(1): The test shall be carried out in quadruplate. The spinner in the oven shall not be fitted to the test spindle for this test. The continuous test cycle shall be 21.5 hours running (heat on) and 2.5 hours stationary (heat off). By the end of the stationary period, the test bearing should have cooled to between 15 and 40°C.

SECTION 5: NATO GUIDE SPECIFICATION FOR GREASE, SEA WATER RESISTING, G-460

	REQUIREMENT	UNITS	TEST METHOD	LIMITS	NOTES
1	Composition			The grease shall consist of mineral or synthetic oil or a mixture of both with a kinematic viscosity of 100 mm^2s^{-1} minimum at 40 °C, plus soap thickener and additives as necessary. The thickener must be compatible with calcium soap greases.	The viscosity referred to at (e) relates to that of base oil and not to oil that has been separated from the grease.
1.1	Scope			The grease shall be used for applications over the temperature range minus 20 °C to plus 60 °C.	
2	Dropping Point	°C	ISO 6299	Min 130	

	REQUIREMENT	UNITS	TEST METHODS	LIMITS	NOTES
3	Penetration, Worked	mm/10	ISO 2137	265-295	NLGI 2
4	Rust preventive properties	Rating	ISO 11007	Max 1	3% m/m NaCl solution in place of distilled water
5	Effect on Copper: • Condition of grease • Copper strip corrosion	Rating	ASTM D 4048	The grease shall not decompose or show evidence of green or dark brown discoloration. Max 2	Test temperature (100 ± 1) °C Test period 24 hrs ± 15 min
6	Water Washout characteristics	% m/m	ISO 11009	Max 5	Test temperature (38 ± 2) °C
7	Low Temperature Penetration	mm/10	ISO 13737	Min 120	Test temperature minus (20± 2) °C
8	Oil separation	% m/m	DIN 51817	Max. 3	Test temperature 40°C Test period 168 hrs
9	Roll stability	mm/10	ASTM D1831	± 50	

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