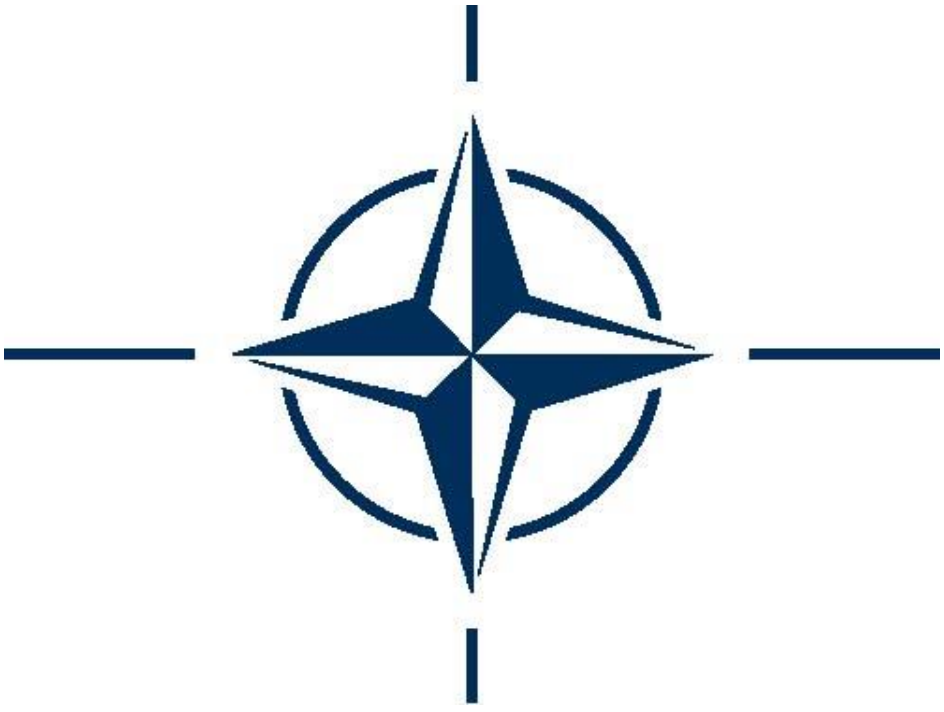
NATO STANDARD

AFLP-7063

METHODS OF DETECTION AND TREATMENT OF FUELS CONTAMINATED BY MICRO-ORGANISMS

Edition A Version 1
June 2015



NORTH ATLANTIC TREATY ORGANIZATION

ALLIED FUELS AND LUBRICANTS PUBLICATION

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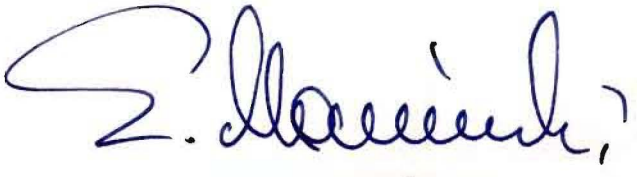
NATO LETTER OF PROMULGATION

19 June 2015

1. The enclosed Allied Fuels and Lubricants Publication AFLP-7063, Edition A , Version 1 METHODS OF DETECTION AND TREATMENT OF FUELS CONTAMINATED BY MICRO-ORGANISMS which has been approved by the nations in the AC/112, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 7063.

2. AFLP-7063 Edition A , Version 1 is effective upon receipt.

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



Edvardas MAŽEIKIS
Major General, LTUAF
Director, NATO Standardization Office

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RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS
Note: 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 Documents Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]

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SECTION 1 GENERAL

0101. From the moment they leave the fractionation column and throughout the operating chain, fuels derived from the medium petroleum fractions are contaminated by micro-organisms.

0102. Generally, the level of bio-contamination remains low and has no consequence on using of the products. However, these micro-organisms may also encounter favorable conditions to their development and proliferate until they reach a level of contamination beyond which the product becomes unfit for use without prior treatment.

0103. Fighting against these micro-organisms takes two forms :

(a) preventive form in order to limit the proliferation of micro-organisms;

(b) curative form in order to destroy the micro-organisms to make the product usable again.

0104. AFLP-7063 defines the means to use and determines the procedures to follow for :

(a) prevention ;

(b) detection and confirmation ;

(c) treatment and use of the treated products.

0105. The participating nations agree:

(a) not to distribute a suspect product ;

(b) to inform the user about the biocide additivation in a product. This additivation can be achieved occasionally (see Section 2) or curatively (see Section 4) when a bio-contamination has been confirmed (see Section 3).

(c) to use the detection tests and biocide additives detailed in Sections 3 and 4.

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SECTION 2 PREVENTION OF BIO-CONTAMINATION

PREVENTION

0201. The idea of removing all micro-organisms present in the fuel is unrealistic. However, it is possible to limit their proliferation by appropriate preventive measures.

NORMAL PREVENTIVE MEASURES

0202. Pure hydrocarbons do not constitute a favorable environment for micro-organisms. Elimination of the aqueous phase and keeping tanks clean limit their proliferation. Consequently, before any other solution is considered, and in accordance with the agreements set out in STANAG 3149, the following preventive measures must be systematically taken :

(a) regular draining of the aqueous phase at the bottom of the tank ;

(b) periodic cleaning of storage tanks.

(c) vehicles equipped with water separators should be inspected and drained regularly. If water is removed on a regular basis considerations should be given to drain the vehicle fuel tank of any water bottoms.

PREVENTION BY ADDITIVATION

0203. Preventive treatments by additivation are prohibited when biocide content is underdosed. Studies show that frequent use of biocide additive at a sublethal level may lead to the development of resistance mechanisms from micro-organisms which can degrade its efficiency.

0204. Even if there is no evidence of contamination an occasional treatment at lethal dose is authorized, for example for an aircraft coming back from a hot and wet climate country or before long storage.

0205. The principles of occasional treatment are summarized in the table below :

PRELIMINARY MEASURE	Draining of aqueous phase
TREATMENT	Incorporation of biocide at lethal dosage (see § 0405, 0406 and 0407)
HOMOGENIZATION	Mixing of the fuel

SECTION 3 DETECTION AND CONFIRMATION OF A BIO-CONTAMINATION

ABNORMAL LEVEL OF BIO-CONTAMINATION

0301. A fuel has an abnormal level of bio-contamination when its use can lead to malfunction or damage to materials or equipment.

SUSPECT PRODUCT

0302. A product is suspect as soon as one of the symptoms indicated in Section 3, paragraph 0304 below is observed.

PRODUCT TO BE TREATED

0303. A product is to be treated as soon as an abnormal level of bio-contamination has been confirmed.

INITIAL DETECTION OF ABNORMAL LEVEL OF BIO-CONTAMINATION

0304. Abnormal level of bio-contamination by micro-organisms can be initially detected by direct observation. An abnormal level of bio-contamination should be suspected when one of the following symptoms is observed :

(a) rotten egg smell ;

(b) gelatinous or fibrous masses in the tanks ;

(c) corrosion signs in the tanks ;

(d) dark stains on the filters ;

(e) abnormal filter pressure drop ;

(f) bleed water which is cloudy, emulsified and sometimes colored ;

(g) pH of drain water dropping below 6.

CONFIRMATION OF ABNORMAL LEVEL OF BIO-CONTAMINATION

0305. Whenever abnormal level of bio-contamination is suspected, it must be immediately measured by one of the detection tests used by NATO nations.

0306. Each detection test measures the level of bio-contamination by using a specific methodology (test sampling, incubation period , use of reagents, etc). The given result is specific for each test. The treatment limit corresponds, according to this scale, to a level, above which bio-contamination becomes abnormal.

0307. As the risk of spurious contamination of sampling is fairly high, each check is made on minimum two samples.

ELIMINATION OF THE DETECTION TESTS AFTER USE

0308. After use, the tests and reagents will be neutralized in accordance with the detection test instructions and with local legislation.

DETECTION TESTS

0309. Tests used by the Nations.

Nations	Name of the product	Incubation duration / incubator	Type of micro-organism detected and treatment limit			Remarks
			Bacteria	Yeasts	Fungi	
BEL	Easicult Combi (Orion Diag.)	96 h / Y	10^3/ml	10^2/ml	Slight	Product is unfit for use if ONE OF THE THREE levels of contamination is reached
BGR						
CAN	HY-LiTE Jet A1*		- Negligible (up to 1000 RLU/liter sample) - Moderate (1000 – 5000 RLU/liter sample) - Heavy (greater than 5000 RLU/litre sample)			*IATA recommended method for testing of total microbiological activity in fuel phase, water phase, or in mixed fuel/water interface. It measures the Adenosine-5'- triphosphate (ATP) content or the biological energy of all viable micro-organisms in the sample, which is reported as Relative Light Units (RLU). Any dissolved ATP (emitted from dead microbes or produced by biofilms on tank walls etc.) will also be detected. ASTM D02 technical committee has developed a new test method (ASTM D7463) for ATP content of micro-organisms in fuel, fuel/water mixtures and fuel associated water, which provides more details on precision and bias of this procedure. If biological activity is detected and further investigation is required then Sani-Check BF and Sani-Check YM can be employed to represent the abundance of bacteria and/or fungi (BF) in conjunction with yeasts and/or molds (YM).

Nations	Name of the product	Incubation duration / incubator	Type of micro-organism detected and treatment limit			Remarks
			Bacteria	Yeasts	Fungi	
CZE	EASICULT COMBI (Orion Diag.)		10^3/ml	10^2/ml	Slight	Product is unfit for use if **ONE OF THE THREE** levels of contamination is reached.
DEU	Cult-Dip combi (Merck)	72 h - 31°C	≥ 10000*	Slight to Moderate	Slight to Moderate	Product is unfit for use if **ONE OF THE THREE** levels of contamination is reached. * Determination of total bacterial count.
	TSA contact blister, Sab-Dex contact blister (VWR)	72 h - 31°C	Slight to Moderate	Slight to Moderate	Slight to Moderate	Product is unfit for use if **ONE OF THE THREE** levels of contamination is reached.
DNK	Liquicult (MCE)					
ESP						
EST						
FRA	S-1752 (MICROTEST P)	- 48 h / Bacteria - 96 h / Yeasts and Fungi - incubator required	Moderate	Moderate	≥ Slight	Product is unfit for use if **ONE OF THE THREE** levels of contamination is reached
	ATP metrics (Jet fuel only)		≤ 500 kRLU : No contamination 500 -1500 kRLU : Observation > 1500kRLU : Treatment needed			

Nations	Name of the product	Incubation duration / incubator	Type of micro-organism detected and treatment limit			Remarks
			Bacteria	Yeasts	Fungi	
GBR						
GRC						
HUN						
ITA						
LTU						
PRT	Cult-Dip combi (Merck)	- 48 h / Bacteria - 72 h /Yeasts and Fungi	10^3/ml	Slight to moderate	Slight to moderate	Product is unfit for use if one of the three levels of contamination is reached.
ROU						
SVK						
SVN						
TUR						
USA (Air Force only)	Merck HY-LiTE ASTM D7463	Not Applicable	- Negligible (up to 1000 RLU/liter sample) - Moderate (1000-5000 RLU/Liter sample) - Heavy (greater than 5000 RLU/liter sample)			Limits used in accordance with IATA guidance for aircraft. The decision to treat affected aircraft is done on a case by case basis and the final authority lies with the weapon system managers.
USA Naval Fuels Only	MicrobMonitor II					Used in accordance with Manufacturer's Guidelines

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SECTION 4 TREATMENT AND USE OF THE FUELS

TREATMENT OF A BIO-CONTAMINATION

0401. A bio-contamination level above the limits defined in Annex B, requires :

(a) to decontaminate product and equipment. The treatment involves the use of fuel biocide additive ;

(b) or to eliminate the fuel and to clean the equipment.

0402. The principles of curative treatment are summarized in the table below :

PRELIMINARY MEASURE	Draining of aqueous phase
TREATMENT	Incorporation of biocide at recommended dosage (see § 0405, 0406 and 0407)
HOMOGENIZATION	Mixing of the fuel
DECANTATION	Decantation at the recommended duration (see § 0405, 0406 and 0407)
MISCELLANEOUS	Possibly draining and filtration

BIOCIDE CHARACTERISTICS

0403. The characteristics of a biocide are as follows:

(a) the biocidal fuel additives have a broad spectrum of effectiveness against micro-organisms ;

(b) the biocidal fuel additives have no harmful effects, at the concentrations used, on land, air and navy engines, turbines, turbine engines and equipment ;

(c) the biocidal fuel additives can be used for curative treatment when used occasionally and as approved by the appropriate military authority. Treatments by additivation are prohibited when biocide content is underdosed : frequent use of biocide additive at a sublethal level may lead to the development of resistance mechanisms from micro-organisms which can degrade its efficiency.

USED ADDITIVES

0404. The tables below give the list of biocidal additives for land, air and navy fuels used by NATO nations. They give for each of them, the required dosage, decantation duration and maximal dosage acceptable for use.

0405. Biocidal additives for land fuels:

Nations	Name of the product	Dosage	Decantation time (hours)	Higher dosage acceptable for use	Remarks
BEL	S-1751	100 ppm vol	48	100 ppm vol	
BGR					
CAN					
CZE	KATHON FP1.5	100 ppm vol	48	100 ppm vol	
DEU	GrotaMar 82	1000 ppm	72	2500 ppm*	* shock dosage
DNK	BIOBOR JF	270 ppm	36	270 ppm	
ESP	BIOBOR JF BUSAN	150 ppm 5 ppm	100 100		
EST					
FRA	RS-1754	200 ppm vol	24	400 ppm vol	
GBR					
GRC					
HUN					
ITA					
LTU					
LUX					
LVA					
NLD	MAR-71	100 ppm vol	48	max 1000 ppm vol*	* shock dosage in case of very heavy contamination
NOR					
POL					
PRT					
ROU					
SVK					
SVN					
TUR					

Nations	Name of the product	Dosage	Decantation time (hours)	Higher dosage acceptable for use	Remarks
USA	MIL-S-53021	See Qualified Products List for dosage rates			This product is a fuel stabilizer package that contains a fuel biocide. Biocides used are Kathon FP 1.5 (S-1751) or Microgard 4000. Rely on visual clues to determine microbial contamination

0406. Biocidal additives for air fuels:

Nations	Name of the product	Dosage	Decantation time (hours)	Higher dosage acceptable for use	Remarks
BEL	S-1751	100 ppm vol	48	50 ppm vol	
BGR					
CAN	Biobor JF Kathon FP 1.5	270 ppm 100 ppm	36 hours 48 hours	270 ppm 100 ppm	Biocides are not recommended but if required, Biobor JF and Kathon FP 1.5 products can be considered
CZE	S-1751	100 ppm vol	48	100 ppm vol	
DEU	S-1751				Only used by civil operators on behalf of German airforce
DNK	BIOBOR JF	270 ppm	36	270 ppm	
ESP	BIOBOR JF	270 ppm	36	135 ppm	
EST					
FRA	S-1751	100 ppm vol	24	50 ppm vol	
GBR					
GRC					
HUN					
ITA	None				Air fuel treated with biocide can not be used on aircraft
LTU					
LUX					
LVA					

Nations	Name of the product	Dosage	Decantation time (hours)	Higher dosage acceptable for use	Remarks
NLD					
NOR					
POL					
ROU					
SVK					
SVN					
TUR					
USA (Air Force only)	Kathon FP 1.5 S-1751 DCSEA 754	100 ppm	48 hours	Not authorized	The US Air Force does not treat jet fuel bulk storage tanks with biocides. Aircraft are treated on a case by case basis with approval by the weapon system manager. Biocides are not approved for Army or Navy aviation use

0407. Biocidal additives for navy fuels :

Nations	Name of the product	Dosage	Decantation time (hours)	Higher dosage acceptable for use	Remarks
BEL	S-1751	100 ppm vol	48	100 ppm vol	
BGR					
CAN					
CZE					
DEU	GrotaMar 82	1000 ppm	72		
DNK	BIOBOR JF	270 ppm	36	270 ppm	
ESP	BIOBOR JF BUSAN	150 ppm 5 ppm	100 100		
EST					
FRA	RS-1754 RS-1753	200 ppm vol 1kg/50t	24 24	400 ppm vol 2kg/50t	For F-44 used in navy, see dosage of § 6 (biocidal additives for air fuels)
GBR					
GRC					
HUN					
ITA					
LTU					
LUX					

LVA					
NLD	NETBIOKEM SP 15	50 ppm vol	48	max 500 ppm vol*	* shock dosage in case of very heavy contamination
NOR	MAR 71	1000 ppm vol	48	max 300 ppm	*only once after cleaning if biocontamination was present
POL					
PRT	MAR 71	200 ppm vol	48	200 ppm vol	
ROU					
SVK					
SVN					
TUR					
USA	Biobor JF	110 ppm by volume		110 ppm by volume	Confirmation of biocontamination and usage approval required prior to treatment

USE OF THE TREATED PRODUCTS

0408. The treated products may be used after a curative treatment. However, their biocidal additive concentration must be below acceptable dosage for use. This concentration may be obtained by mixing treated product with product conforming to the appropriate specification. Treated jet fuel must meet the requirements of the specification. Consideration should be given to downgrading jet fuel to land vehicle use rather than discarding the fuel.

0409. When this product is distributed, the user has to be informed of the treatment.

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