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

MILITARY AGENCY FOR STANDARDIZATION (MAS)
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See Distribution List: STANAG AC/112(PHEWG)

STANAG 3681 SILCEP (EDITION 3) - CRITERIA FOR PRESSURE FUELLING/DEFUELLING OF AIRCRAFT

References:
a. MAS(AIR)475-PHE/3681 dated 5 February 1993 (Edition 2)
b. MAS(AIR)304-PHE/3681 dated 11 September 1996 (Edition 3) (1st Draft)
c. AC/112(PHEWG-INV)DS/1 dated 12 October 1998 (paragraphe 13(3))

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

2. References a. and b. 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

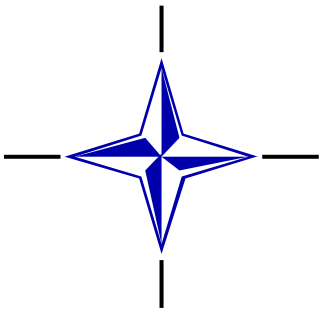
4. National staffs are requested to examine page iii of the STANAG and, if they have not already done so, advise the Chairman, NATO Pipeline Committee (AC/112) of their intention regarding its ratification and implementation.

A. GRØNHEIM
Major General, NOAF
Chairman MAS

Enclosure:
STANAG 3681 (Edition 3)

STANAG No. 3681
(Edition 3)

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)



MILITARY AGENCY FOR STANDARDIZATION
(MAS)

STANDARDIZATION AGREEMENT

(STANAG)

SUBJECT: CRITERIA FOR PRESSURE FUELLING/DEFUELLING OF AIRCRAFT

Promulgated on 6 November 1998

A. GRØNHEIM
Major General, NOAF
Chairman, MAS

RECORD OF AMENDMENTS

No.	Reference/date of amendment	Date entered	Signature
1			

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 the 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.

FEEDBACK

8. Any comments concerning this publication should be directed to NATO/MAS - Bvd Leopold III - 1110 Brussels - BE

STANAG 3681
(Edition 3)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT (STANAG)

CRITERIA FOR PRESSURE FUELLING/DEFUELLING OF AIRCRAFT

Related Documents:	STANAG 2947 SILCEP -	TECHNICAL CRITERIA FOR A CLOSED CIRCUIT REFUELLING SYSTEM
	STANAG 3105 ASSE -	PRESSURE REFUELLING CONNECTIONS AND DEFUELLING FOR AIRCRAFT
	STANAG 3149 SILCEP -	MINIMUM QUALITY SURVEILLANCE OF PETROLEUM PRODUCTS
	STANAG 3632 AE -	AIRCRAFT AND GROUND SUPPORT EQUIPMENT ELECTRICAL CONNECTIONS FOR STATIC GROUNDING
	STANAG 3682 SILCEP -	ELECTROSTATIC SAFETY CONNECTION PROCEDURES FOR AVIATION FUEL HANDLING AND LIQUID FUEL LOADING/ UNLOADING OPERATIONS DURING GROUND TRANSFER AND AIRCRAFT FUELLING/DEFUELLING
	STANAG 3784 SILCEP -	TECHNICAL GUIDANCE FOR THE DESIGN AND CONSTRUCTION OF AVIATION AND GROUND FUEL INSTALLATIONS ON NATO AIRFIELDS

AIM

1. The aim of this agreement is to standardize criteria for pressure fuelling and defuelling of aircraft.

AGREEMENT

2. Participating nations agree to the aircraft connection requirements and the conditions for aircraft pressure fuelling/defuelling in this STANAG.

DETAILS OF THE AGREEMENT

3. Aircraft Fuelling/Defuelling Connections. The pressure fuelling/defuelling connections should meet the following criteria:

a. Each aircraft to be pressure fuelled is to be provided with an adaptor which conforms with the dimensions specified in STANAG 3105 or STANAG 2947 for the Closed Circuit Refuelling (CCR) nozzle.

b. Pressure fuelling nozzles/connectors should be capable of connecting to the aircraft adaptor within the standard envelope dimensions specified in STANAG 3105 or the requirements of STANAG 2947.

c. It shall not be possible to remove pressure fuelling nozzles/connectors from the aircraft adaptor in the open or partially open condition.

d. Defuelling is to be accomplished through a pressure adaptor, which also conforms with the dimensions specified in STANAG 3105 or which can be connected to the CCR nozzle of STANAG 2947.

4. Pressure Fuelling Flow Rates. Rates of fuel flow into an aircraft vary with the amount of fuel on board and the internal piping resistance of the aircraft. In general, transport and tanker aircraft have the largest internal tanks and piping, multiple fuelling points and can accept fuel at a higher rate. Fighter type aircraft have smaller tanks and internal piping, normally fuel through only one connection at a time and therefore, can accept fuel at a lower rate. Rotary wing aircraft normally have more restrictive piping and smaller tanks and their fuelling rates are even lower. The primary purpose of an aircraft fuel dispensing system is to deliver clean, dry fuel, while controlling pressure to the aircraft within limits described herein, independent of varying flow rates. As a minimum, each fuelling point in permanently constructed fuel facilities and mobile equipment shall be capable of the following approximate flow rates: (assuming negligible back-pressure at the aircraft connector generated by the aircraft fuel system):

a. Land-Based Hydrant Systems:

(1) Fixed wing aircraft:

(a) Fighters - 1000 l/min or 220 Imp gal/min (small frame) (264 US gal/min).

(b) Transport/Tankers - 1000 l/min but normally (large frame) 2000 l/min or 440 Imp gal/min (530 US gal/min).

(2) Rotary wing aircraft - 500 l/min or 110 Imp gal/min (132 US gal/min).

b. Truck refuellers:

(1) Fixed wing aircraft - 1000 l/min or 220 Imp gal/min (264 US gal/min).

(2) Rotary wing aircraft - 250 l/min or 55 Imp gal/min (66 US gal/min).

5. Pressure Fuelling/Defuelling Controls. When pressure fuelling/defuelling aircraft from either fixed hydrant systems or refueller trucks, the following conditions should be met:

a. The steady-state dispensing pressure shall be limited to a maximum 3.79 bar (55 psi) at the fuelling nozzle/aircraft adaptor (immediately downstream of the nozzle), during the complete fuelling operation, including low-flow to no-flow conditions.

b. Fuel dispensing hardware should prevent momentary surges downstream of the fuelling nozzle from exceeding 8.27 bar (120 psi), which can occur when aircraft internal valves shut off rapidly. Normally pressure surges can be controlled with a surge control feature on the primary fuel control valve or with a surge control feature on a hose-end pressure controller.

c. To ensure proper closure of aircraft internal high level shut-off valves, a minimum of 1.72 bar (25 psi) must be available at the fuelling nozzle/connection during low-flow or no-flow conditions. (When the aircraft is full).

d. Hydrant Systems. Systems with a pumping capability which can exceed 3.79 bar (55 psi) at the fuelling nozzle/aircraft adaptor, must provide primary pressure control to ensure steady state nozzle pressures do not exceed 3.79 bar (55 psi). The pressure control can be located in the hydrant pit or on the mobile fuelling support equipment, such as the hydrant hose truck (HHT), hydrant hose cart (HHC) or detachable pantograph. An optional secondary and normally a back-up device, such as a hose-end pressure controller, may also be used to protect the aircraft from over pressurization. These devices are available with permanent pressure settings and attach just below the fuelling nozzle or can be furnished as a integral part of the nozzle. Both the primary fuelling control valve and the hose end pressure controller (if used) should also provide the surge pressure control discussed in 5.b.

e. Refueller trucks. As with fixed hydrant systems, provide pressure control to ensure steady state pressures at the fuelling nozzle/adaptor do not exceed 3.79 bar (55 psi). Pressure control is normally accomplished with a pump bypass valve or primary pressure control valve or a combination of the two valves. Downstream surge pressure control (which protects the aircraft from pressure spikes greater than 8.27 bar, (120 psi)) may be provided by either the primary pressure control valve or the hose-end control valve. Alternately, a hose-end pressure controller, which is normally a secondary or back-up device, may be provided as the primary pressure and surge control device.

f. Pressure fuelling/defuelling shall be performed with the nozzle locked in the full open position.

g. Pressure fuelling/defuelling systems (mobile and fixed) shall provide hand held deadman control for operational use and emergency shut off.

h. The minimum length (reach) of hose or hose/pantograph combination to be used for refueller truck pressure fuelling shall be 15 m (50 ft).

i. Mobile fuel support equipment such as HHTs, HHCs and portable pantographs which dispense fuel directly from a hydrant system into an aircraft are designed for close support as required and have no minimum hose or pantograph length requirements.

j. Fuel servicing equipment shall be clearly marked with the NATO code number of the fuel in accordance with STANAG 3149.

k. Electrostatic connections of aircraft during fuelling only operations should be in accordance with STANAG 3682. When ground support equipment is connected or other functions are performed simultaneously with fuelling, bonding and earthing should be in accordance with STANAG 3682.

6. Defuelling Conditions. When carrying out defuelling operations the following conditions should be met:

a. Earthing and bonding of aircraft and/or ground equipment during defuelling operations should be in accordance with STANAG 3682 or STANAG 3632 as applicable.

b. Trucks and mobile tanks used for defuelling of aircraft shall have automatic high-level shut-off devices or alarms to prevent overfilling.

c. When defuelling by truck, it is essential to minimize the hazards of static electricity. Hazards include mixing fuels having different volatility and different conductivity, static electricity generated by filtration equipment, the induction of air in the system, and the splashing that occurs during initial fill when the truck inlet is not submerged. Hazards can be minimized by adhering to the following restrictions:

(1) Flow rate is to be limited to 380 l/min or 83 Imp gal/min (100 US gal/min) when defuelling fixed wing aircraft not containing Static Dissipator Additive (SDA), such as F-34/44, or when the on board fuel type is unknown.

(2) Fixed wing aircraft known to contain **only** fuel with SDA additive are permitted to defuel at higher rates, up to 760 l/min or 166 Imp gal/min (200 US gal/min).

(3) Rotary wing aircraft defuel rate for all fuels are limited to 200 l/min or 44 Imp gal/min (53 US gal/min).

(4) Trucks designated as defueller, defueller/refueller or contaminated defuel shall be configured to route the defuel into a bottom (submerged) entry point. (Tank top openings are not to be used).

(5) Defuelling is not permitted into an empty truck. Truck tank must initially contain a minimum 10% capacity to prevent pump cavitation and to minimize turbulence.

(6) It is recommended that the fuel operator estimates the time required to defuel, based on the amount of fuel to be off-loaded. If the estimate is exceeded by more than 5 minutes or 10% (whichever is less), or if the defuel pump begins to cavitate, the defuel operation is to be discontinued. The defuel pump should not be started again without a one-minute relaxation interval.

d. Defuelling by a HHT/HHC or a dedicated defuel cart directly into a hydrant system is limited to 1140 l/min or 250 Imp gal/min (300 US gal/min). These higher flow rates depend on augmentation from on board aircraft defuel pumps and normally only apply to transport and tanker aircraft. Under these conditions, defuel product must be considered flyable fuel (not contaminated defuel). Once defuel product is in the hydrant system, it may go directly into another aircraft, therefore, the fuel must pass through filtration equipment **before** entering the hydrant system and is subject to the fuel quality requirements of STANAG 3149. If the defuel operation is conducted into dedicated return piping, it must pass through filtration equipment prior to operating storage.

e. Maximum allowable negative pressures vary widely from aircraft to aircraft, (0.1 bars-0.5 bars), (1.5 psi to 7 psi), as does the capability of defuel ground support equipment to develop negative suction pressures. In addition, most aircraft defuelling equipment surveyed do not have the capability to measure negative or suction pressures. Therefore, since aircraft are open-vented and vents are sized for maximum refuelling flow rates, the most positive way to prevent aircraft being subjected to excessive negative pressures is to ensure defuel rates are significantly **lower** than refuel rates. Therefore, maximum defuelling rates contained in 6.c.(1), (2), (3), and 6.d. above, shall apply.

f. Defuelling of aircraft that operate on F-37 fuel must be done in such a manner that inadvertent fuelling of uncleared aircraft and the disarming of filter water separators is prevented. Duefuelling proceudres must ensure that the co-mingling of F-37 into stocks of F-34/F-35/F-44 is avoided. When defuelled F-37 has to be transferred into bulk storage, the approval of the Service Authority must be obtained prior to the transfer. If approved, F-37 defuelled into bulk storage must be diluted at a minimum ratio of 1:100 with F-34, F-35 or F-44. All quality procedures identified in STANAG 3149, Annex B must be adhered to.

IMPLEMENTATION OF THE AGREEMENT

7. This STANAG is implemented when a nation's equipment/procedures comply with the requirements in this agreement.