NATO STANDARD

ATP-3.3.4.7

AIR-TO-AIR REFUELLING SIGNAL LIGHTS IN HOSE AND DROGUE SYSTEMS

Edition B, Version 1

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RATIFICATION DRAFT

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED TECHNICAL PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

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NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

[Date]

1. The enclosed Allied Technical Publication ATP-3.3.4.7 Edition B, Version 1, AIR-TO-AIR REFUELLING SIGNAL LIGHTS IN HOSE AND DROGUE SYSTEMS which has been approved by the nations in the MCASB, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 7215.

2. ATP-3.3.4.7, Edition B, Version 1, is effective upon receipt and supersedes ATP-3.3.4.7, 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
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 Document Database for the complete list of existing reservations.	

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RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
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AAP-6	NATO GLOSSARY OF TERMS AND DEFINITIONS
STANAG 3447	AERIAL REFUELLING EQUIPMENT DIMENSIONAL AND FUNCTIONAL CHARACTERISTICS
SAE AS25050A -	COLORS, AERONAUTICAL LIGHTS AND LIGHTING EQUIPMENT

1.2. AIM

The aim of this agreement is to:

a. To standardize the signal lights displayed to a receiver aircraft during probe and drogue air-to air-refuelling operations.

b. To display suitable signal lights to receiver aircraft being operated by crews who are operating either with or without the use of night vision imaging systems (NVIS).

1.3. AGREEMENT

1. Participating nations agree to use the Signal Lights display, meanings and principles established in this NATO STANDARD and its ANNEXES as a reference.

2. This NATO STANDARD is implemented when a nation has issued instructions that all future equipment developed or services contracted will be in accordance with the requirements detailed in this agreement. Any nation procuring tanker aircraft, which existed prior to promulgation of this agreement, shall identify any and all exceptions to the requirements detailed herein for said aircraft. Any nation which modifies an aircraft platform with aerial refuelling equipment, which existed prior to the promulgation of this agreement, shall identify any and all exceptions to the requirements detailed herein for said aircraft. Nations are recommended to update their Signal Lights in current tanker fleets in order to assure interoperability. Individual nations may introduce compliance dates on a progressive basis.

1.4. GENERAL

1.4.1 Applicability.

This NATO STANDARD is applicable to all podded store and integral systems; it shall not apply to Boom Drogue Adapter systems. The different types of systems currently used by the NATO nations are described in STANAG 3971 (ATP 3.3.4.2 (ATP-56(D)))[1].

1.4.2 Scope.

This NATO STANDARD shall apply to signal lights associated with refuelling equipments of individual nations and shall not cover signal lights used for either formation control or rendezvous.

1.4.3 Use of Terminology.

Throughout this NATO STANDARD, unless otherwise defined, terms written with the first letter being capitalised shall have the meaning given to them in STANAG 3971 (ATP-3.3.4.2(ATP-56(D))).

1.5. IMPLEMENTATION OF THE NATO STANDARD

This NATO STANDARD is considered to be implemented when a nation has issued the necessary orders/instructions to the forces concerned by putting the signal lights, displays, meanings and principles detailed in this agreement in any new drogue air-to-air refuelling system that they procure or introduce into the field in the future.

[1] For example, such systems may include integral systems, WARPS, MPRS and IARS.

CHAPTER 2. SIGNALLING PRESENTED TO RECEIVER AIRCRAFT BEING OPERATED WITHOUT THE USE OF NVIS

2.1. TYPE, NUMBER AND DISPOSITION OF LIGHTS

2.1.1 Colours.

Signals shall be displayed to a receiver crew by the use of coloured lights; the colours used shall be RED[2], AMBER[3] and GREEN[4].

2.1.2 Intensity.

The RED, AMBER and GREEN lights are to appear to be of equal intensity when in the ON state when at full intensity (see paragraph 2.1. 5.) as viewed by the receiver crew. All lights are to continue to be harmonised in intensity when dimmed (see paragraph 2.1.6).

2.1.3 Number.

Two sets of lights shall be fitted each containing a RED, AMBER and GREEN light. A signal shall comprise 2 light sets of the appropriate colour illuminated simultaneously to:

a. Provide system redundancy in case of the failure of a single light.

b. Reduce the risk of disorientation.

c. Increase the probability of the receiver crew being able to see at least one full set of lights when required to deviate from the centreline.

2.1.4 Positioning.

The two sets of lights shall be positioned symmetrically such that there is one set either side of the refuelling hose.

2.1.5 Light Status.

1. Each coloured light shall have one of 3 modes as appropriate to the signalling requirements as follows:

[2] RED shall mean Aviation Red as defined in STANAG 3224 Edition.
[3] AMBER shall mean Aviation Yellow as defined in Mil-C-25250.
[4] GREEN shall mean Aviation Green as defined in STANAG 3224.

a. **ON**. The lights shall be of constant intensity appropriate to their dimmed or undimmed setting.

b. **Flashing**[5],[6]. When lights are flashing, each light pair shall be either ON or OFF at the same time. Two rates of flashing shall be used for the signal lights as described in this paragraph. The lights shall therefore flash at a rate according to their colour as follows:

(1) **FLASHING RED**: Flashing shall be from OFF to ON to OFF. A fast flash rate shall be used; however, the rate shall be such that the same rate is usable for the equivalent flashing signal during NVIS operations as described in Part 2 below. The rate shall be such that the light is perceived as FLASHING and not ON.

(2) **FLASHING AMBER**: Flashing shall be from OFF to ON to OFF. AMBER lights shall flash at the same rate as described in paragraph 5(b)(1).

(3) **FLASHING GREEN**: Flashing shall be from OFF to ON to OFF at a rate that is less than that of the FLASHING RED light. However, the rate shall be such that the light is perceived as FLASHING and not OFF.

c. **OFF**. No emission of light from the position of the light source shall be apparent to the receiver crew.

2.1.6 Dimming[7].

All coloured lights shall be capable of being dimmed simultaneously by a member of the tanker crew.

a. **RED Signals.**

(1) For signals involving the use of FLASHING RED lights, the lights shall ignore the dimmed setting and use full brilliance.

(2) For signals involving the use of RED ON lights, the lights shall respect the dimmed setting.

b. **AMBER and GREEN Signals**. For signals involving the use of AMBER or GREEN, whether FLASHING or ON, the lights shall respect the dimmed setting.

[5] Further amplification as to Flash rates may be included in future editions of this STANAG.
[6] See Mil Standard 1472
[7] Further definition of “Dimming” capability may be contained in subsequent editions of this STANAG

2.1.7 Breakaway.

To reduce tanker crew workload, after the FLASHING RED signal has been displayed for 10-15 seconds, the signal shall revert to the RED ON signal, respecting any previous dimming setting, until the tanker crew resumes normal operations.

2.1.8 Disconnect.

After receiver disconnection, if the system is not ready for further refuelling, a RED ON signal shall be automatically provided, without undue delay, to avoid the receiver attempting to make a subsequent contact before the equipment is read.

2.2. SIGNAL INDICATIONS AND MEANINGS

2.2.1 Single Colour Usage.

Each message signalled to a receiver aircraft is to use only one colour of light. No two different colours of light should be lit, at any one time. It shall not be permissible for a single message to be indicated by alternating between any two-coloured lights.

2.2.2 Priority of Signals.

a. **FLASHING RED**. The display of the FLASHING RED signal is to cancel all other signals.

b. **RED**. The selection of, or automatic display of, the RED ON signals is to cancel any AMBER or GREEN signals.

c. **AMBER**. The automatic display of any AMBER signals is to cancel any GREEN signals.

2.2.3 Receiver Actions.

The desired receiver action to a given signal may vary according to such receiver's current position as either in or out of contact with the hose. Full details of receiver desired actions for each signal are at Annex A.

a. **FLASHING Signals.**

(1) **RED or AMBER**. A receiver crew shall move aft in response to either a FLASHING RED or a FLASHING AMBER signal.

(2) **GREEN**. A receiver crew may remain in the refuelling range appropriate to the circumstances in response to a FLASHING GREEN signal.

b. **Mandatory Instructions**. FLASHING RED, RED ON and FLASHING AMBER signals shall indicate mandatory instructions to the receiver crew.

2.2.4 Fuel Transfer Associated with Signals.

When any of the following signals are displayed, the fuel flow shall be stopped or shall be stopping:

a. FLASHING RED.

b. RED ON.

c. FLASHING AMBER.

d. AMBER ON.

CHAPTER 3. SIGNALLING PRESENTED TO RECEIVER AIRCRAFT BEING OPERATED WITH THE USE OF NVIS

3.1. APPLICABILITY.

In cases where it is not possible to differentiate between coloured lights with NVIS, the requirements of this Chapter 3 shall apply.

3.2. TYPE, NUMBER AND DISPOSITION OF LIGHTS.

3.2.1 Coloured Lights vs. Night Vision Lights.

The system of coloured lights shall be off and NVIS compatible lights shall be available instead.

3.2.2 Number vs Colour.

The coloured signal lights used Chapter 2 of this NATO STANDARD shall be replaced by a corresponding number of NVIS compatible lights as follows:

a. RED: 3-Lights illuminated.

b. AMBER: 2-Lights illuminated.

c. GREEN: 1-Light illuminated.

3.2.3 Positioning.

The two sets of lights are to be positioned symmetrically such that there is one set either side of the refuelling hose, each set mirroring the other about the vertical axis.

3.2.4 Distance Between Lights.

a. **Minimum Separation**. The minimum distance between any 2 individual lights within a set of 3 signal lights, and between the 2 sets of lights depends on the viewer's visual acuity and the viewing distance. These minimum distances shall allow clear identification of individual lights during refuelling operations.

b. **Maximum Separation**. When the receiver crew is observing the tanker from either the astern position or while in contact, all 3 lights within a set of signal lights shall be visible to the receiver crew, such that the NVIS field of view does not obstruct any part of the set of 3 signal lights with a small movement of the receiver crew's head.

3.2.5 Non-signal Lights.

Signal lights shall be positioned such that no confusion may arise as to which lights form part of a set of signal lights and which lights are being used for other purposes; any close light may change the meaning of signal lights.

3.2.6 Light Status.

Each light(s) shall have one of 3 modes as appropriate to the signalling requirements as follows:

a. **ON**. The light(s) shall be of constant intensity appropriate to its dimmed or undimmed setting.

b. **Flashing**. Two rates of flashing shall be used for the light signals as described in this paragraph. The 3-Light and 2-Light signals shall flash to gain the immediate attention of the receiver crew; the 1-Light signal shall flash to provide advisory information. When multiple lights are FLASHING (3-Lights or 2-Lights cases) it shall be simultaneously. The lights shall therefore flash at a rate according to their number as follows:

(1) **FLASHING 3-Light**: Flashing shall be from OFF to ON to OFF. A fast flash rate should be used; however, the rate should be such that the rate is usable during NVIS operations.

(2) **FLASHING 2-Light**: Flashing shall be from OFF to ON to OFF. 2-Light signals shall flash at the same rate as described in paragraph 17(b)b(1).

(3) **FLASHING 1-Light**: Flashing shall be from OFF to ON to OFF at a rate that is less than that of the FLASHING 3-Light signal and FLASHING 2-Light signal. However, the rate must not be so slow as to be misinterpreted by the receiver crew as a pod failure resulting in all lights being OFF.

c. **OFF**. No emission of light from the position of the light source shall be apparent to the receiver crew.

3.2.7 Dimming.

All lights shall be capable of being dimmed simultaneously by a member of the tanker crew.

a. **3-Lights Signals**.

(1) For signals involving the use of FLASHING 3-Lights , the 3-Lights signal shall ignore any dimmed setting and use full brilliance.

(2) For signals involving the use of 3-Lights ON, the lights shall respect the dimmed setting.

b. **2-Lights and 1-Light Signals**.

(1) For signals involving the use of either 2-Lights or 1-Light, whether FLASHING or ON, the lights shall respect the dimmed setting.

3.2.8 Breakaway.

To reduce tanker crew workload, after the FLASHING 3-Lights signal has been displayed for 10-15 seconds, the signal shall revert to 3-Lights ON, respecting any previous dimming setting, until the tanker crew resumes normal operations.

3.2.9 Disconnect.

After receiver disconnection, if the system is not instantly ready for further refuelling a 3-Light ON signal shall be automatically provided, without undue delay, to avoid the receiver attempting to make a subsequent contact before the equipment is ready.

3.3. SIGNAL INDICATIONS AND MEANINGS

3.3.1 Single Number Usage.

Each message signalled to a receiver aircraft shall use only one number of light(s). For example, it shall not be permissible for a single message to be indicated by alternating between two different signals eg by alternating between having 1 and then 2 lights illuminated.

3.3.2 Priority of Signals.

a. **FLASHING 3-Lights**. The display of the FLASHING 3-Lights signal shall cancel all other signals.

b. **3-Lights ON**. The selection of, or automatic display of, 3-Lights ON signal shall cancel any 2-Lights or 1-Light signals.

c. **2-Lights**. The automatic display of any 2-Lights signals shall cancel any 1-Light signals.

3.3.3 Receiver Actions.

The desired receiver action to a given signal may vary according to such receiver's current position as either in or out of contact with the hose. Full details of receiver actions for each signal are at Annex B.

a. **FLASHING Signals.**

(1) A receiver crew shall move aft in response to either a FLASHING 3-Lights signal or FLASHING 2-Lights signal.

(2) A receiver crew may remain in the refuelling range appropriate to the circumstances in response to a FLASHING 1-Light signal.

b. **Mandatory Signals**.

(3) FLASHING 3-Lights, 3-Lights ON and FLASHING 2-Lights signals indicate mandatory instructions to the receiver crew.

3.3.4 Light Failures.

Where 2 sets of signal lights are fitted for a refuelling hose, and a single light fails in one set, then there is the possibility that a receiver crew could misinterpret the total number of lights lit. To minimise this risk, the light elements within each array shall be equally spaced. The separation between any sets of lights shall be greater than the spacing between any 2 lights in a single set of lights. Where the total number of lights view by a receiver crew is an odd number **and** the spacing between the lights is irregular, then the receiver crew should suspect a system failure, conduct a DISCONNECT and contact the tanker crew for clarification.

3.3.5 Fuel Transfer Associated with Signals.

When any of the following signals are displayed, the fuel flow shall be stopped or shall be stopping:

a. 3-Lights FLASHING.

b. 3-Lights ON.

c. 2-Lights FLASHING.

d. 2-Lights ON.

A - SIGNALS AND MEANINGS – AIRCRAFT BEING OPERATED WITHOUT THE USE OF NVIS

RECEIVER POSITION		NON - NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**RED**	**AMBER**	**GREEN**
Breakaway Mandatory instruction: Carry out procedure described in ATP 3.3.4.2 (ATP-56(D)) for Breakaway After the FLASHING RED signal has been displayed for 10-15 seconds, the signal should revert to RED ON until the tanker crew resumes normal operations.	**Breakaway** Mandatory instruction: Carry out procedure described in ATP 3.3.4.2 (ATP-56(D)) for Breakaway After the FLASHING RED signal has been displayed for 10-15 seconds, the signal should revert to RED ON until the tanker crew resumes normal operations.	FLASH	OFF	OFF
Maintain Astern Tanker not yet ready to refuel receiver. Receiver should remain in Astern	**Disconnect** Mandatory instruction: Non-emergency Disconnect. Receiver shall carry out a normal Disconnect and either: Radio Procedures. Remain in Astern Position Radio Silent. Move to Reform position.	ON	OFF	OFF

RECEIVER POSITION		NON - NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**RED**	**AMBER**	**GREEN**
Not Applicable	**Too Close – Move Aft** Mandatory instruction: Move aft. Receiver is forward of the refuelling range and too close to the tanker. Fuel flow stops.	OFF	FLASH	OFF
Clear Contact Tanker ready for receiver to make Contact. Receiver should make Contact with hose.	**Move forward into refuelling range** Hose is aft of refuelling range. Receiver should continue to push hose in to enter refuelling range. Fuel flow stops.	OFF	ON	OFF

RECEIVER POSITION		NON - NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**RED**	**AMBER**	**GREEN**
Not Applicable	**Clear to disconnect as required** Receiver is in refuel range but fuel flow is less than 50[8] US gal per min Radio Procedures. Await instruction from tanker crew. Radio Silent. Maintain position or disconnect when ready. Receiver crew should determine reason for low fuel flow as either: a. Tanks are full. b. Receiver switch selections incorrect. c. Soft Contact. d. Dry Contact.	OFF	OFF	FLASH
Not Applicable	Receiver is in refuel range and fuel flow is more than 50[9] US gal per min. Receiver should: Radio Procedures. Await instruction to Disconnect. Radio Silent. Maintain position or Disconnect.	OFF	OFF	ON

[8] Fuel flow rates can be set differently, especially for helos. The aircraft with very low fuel on load rates of less than 50 gal per min may observe a Flashing Green Light through the whole refuelling period"
[9] Fuel flow rates can be set differently, especially for helos. The aircraft with very low fuel on load rates of less than 50 gal per min may observe a Flashing Green Light through the whole refuelling period"

RECEIVER POSITION		NON - NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**RED**	**AMBER**	**GREEN**
Breakaway Mandatory instruction: Carry out procedure described in AJP-3.3.4.2 (ATP-56(D)) for Breakaway	**Breakaway** Mandatory instruction: Carry out procedure described in AJP-3.3.4.2 (ATP-56(D)) for Breakaway	OFF	OFF	OFF

B - SIGNALS AND MEANINGS – AIRCRAFT BEING OPERATED WITH THE USE OF NVIS

RECEIVER POSITION		NUMERICAL BASED NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**3-Lights**	**2-Lights**	**1-Light**
Breakaway Mandatory instruction: Carry out procedure described in ATP 3.3.4.2 (ATP-56(D)) for Breakaway After the FLASHING 3-Light signal has been displayed for 10-15 seconds, the signal should revert to 3-Lights ON until the tanker crew resumes normal operations.	**Breakaway** Mandatory instruction: Carry out procedure described in ATP 3.3.4.2 (ATP-56(D)) for Breakaway After the FLASHING 3-Light signal has been displayed for 10-15 seconds, the signal should revert to 3-Lights ON until the tanker crew resumes normal operations.	FLASH	FLASH	FLASH
Maintain Astern Tanker not yet ready to refuel receiver. Receiver should remain in Astern	**Disconnect** Mandatory instruction: Non-emergency Disconnect. Receiver shall carry out a normal Disconnect and either: Radio Procedures. Remain in Astern Position Radio Silent. Move to Reform position.	ON	ON	ON

RECEIVER POSITION		NUMERICAL BASED NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**3-Lights**	**2-Lights**	**1-Light**
Not Applicable	**Too Close – Move Aft** Mandatory instruction: Move aft. Receiver is forward of the refuelling range and too close to the tanker. Fuel flow stops.	OFF	FLASH	FLASH
Clear Contact Tanker ready for receiver to make Contact. Receiver should make Contact with hose.	**Move forward into refuelling range** Hose is aft of refuelling range. Receiver should continue to push hose in to enter refuelling range. Fuel flow stops.	OFF	ON	ON

RECEIVER POSITION		NUMERICAL BASED NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**3-Lights**	**2-Lights**	**1-Light**
Not Applicable	**Clear to disconnect as required** Receiver is in refuel range but fuel flow is less than 50[10] US gal per min Radio Procedures. Await instruction from tanker crew. Radio Silent. Maintain position or disconnect when ready. Receiver crew should determine reason for low fuel flow as either: a. Tanks are full. b. Receiver switch selections incorrect. c. Soft Contact. d. Dry Contact.	OFF	OFF	FLASH
Not Applicable	Receiver is in refuel range and fuel flow is more than 50[11] US gal per min. Receiver should: Radio Procedures. Await instruction to Disconnect. Radio Silent. Maintain position or Disconnect.	OFF	OFF	ON

[10] Fuel flow rates can be set differently, especially for helos. The aircraft with very low fuel on load rates of less than 50 gal per min may observe a Flashing Green Light through the whole refuelling period"
[11] Fuel flow rates can be set differently, especially for helos. The aircraft with very low fuel on load rates of less than 50 gal per min may observe a Flashing Green Light through the whole refuelling period"

RECEIVER POSITION		NUMERICAL BASED NVIS OPS		
NOT IN CONTACT	**IN CONTACT**	**3-Lights**	**2-Lights**	**1-Light**
Breakaway Mandatory instruction: Carry out procedure described in ATP-3.3.4.2 (ATP-56(D)) for Breakaway	**Breakaway** Mandatory instruction: Carry out procedure described in ATP-3.3.4.2 (ATP-56(D)) for Breakaway	OFF	OFF	OFF

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