NATO STANDARD

AATMP-07

AIRFIELD LIGHTING

Edition A Version 1
JUNE 2018

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED AIR TRAFFIC MANAGEMENT PUBLICATION
Published by the
NATO STANDARDIZATION OFFICE (NSO)

© NATO/OTAN

INTENTIONALLY BLANK

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

14 June 2018

1. The enclosed Allied Air Traffic Management Publication AATMP-07, Edition A, Version 1, AIRFIELD LIGHTING, which has been approved by the nations in the AIR TRAFFIC MANAGEMENT – COMMUNICATIONS, NAVIGATION AND SURVEILLENCE ADVISORY GROUP, is promulgated herewith. The agreement of nations to use this publication is recorded in STANAG 3316.

2. AATMP-07, Edition A, Version 1, is effective upon receipt.

3. No part of this publication may be reproduced, stored in a retrieval system, used commercially, adapted, or transmitted in any form or by any means, electronic, mechanical, photo-copying, recording or otherwise, without the prior permission of the publisher. With the exception of commercial sales, this does not apply to member or partner nations, or NATO commands and bodies.

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

Zoltán GULYÁS
Brigadier General, HUNAF
Director, NATO Standardization Office

INTENTIONALLY BLANK

RESERVED FOR NATIONAL LETTER OF PROMULGATION

INTENTIONALLY BLANK

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.	

INTENTIONALLY BLANK

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
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.	

INTENTIONALLY BLANK

Table of Contents

INTENTIONALLY BLANK

CHAPTER 1.
Introduction

1.1 Related Documents

1.1.1	STANAG 3346 AS	Marking and Lighting of Airfield Obstructions.
1.1.2	AATCP-1	NATO Supplement to ICAO Doc 8168-OPS/611 Volume II for the Preparation of Instrument Approach and Departure Procedures.
1.1.3	AAP - 6	NATO Glossary of Terms and Definitions (English and French).
1.1.4	AEP - 12	Light Fittings for Airfield Visual Aids (Runway In-Pavement Lights).
1.1.5	ICAO Annex 14	Volume I, Aerodrome Design and Operations.

1.2 Purpose

AATMP-07 establishes standards for the airfield lighting including:

a. Approach Lighting

b. Runway Lighting

c. Taxiway Lighting

d. Apron Floodlighting

e. Miscellaneous Lighting

f. NVG operations

1.3 Scope

The requirements for airfield lighting shall be in compliance with the Standards and Recommended Practices (SARPs) of the International Civil Aviation Organization (ICAO) Annex 14, (Volume I, Aerodrome Design and Operations), Sixth Edition - July 2013, except as otherwise indicated.

1.4 Terms and Definitions

For the purpose of this AATMP, the following definitions apply (other terms are defined in ICAO Annex 14):

a. Beam Spread

The angle between the two directions in a specified plane through the axis of the beam in which the intensity is 33% of the maximum.

b. Obstacle Lights

Aeronautical ground lights provided to indicate obstacles, which are considered to be an obstruction to aircraft on the ground in the manoeuvring area or in flight.

1.5. Safety Considerations

Safety considerations for implementing STANAG 3316 (AATMP-07) are contained in Annex A.

CHAPTER 2.
Runway Operating Criteria

2.1 Table 1

FACILITY	NON INSTRUMENT	NON PRECISION	PRECISION CAT I >200FT DH RVR >550M	PRECISION CAT II DH <200FT >100FT RVR > 350M	LOW VIS. TAKE-OFF RVR < 550M	REF PARA.
Simple Approach Lighting	X	X	-	-	-	3.1
Precision Approach CAT I lighting	O	O	X	-	-	3.2
Precision Approach CAT II/III lighting	-	-	-	X	-	3.3
Sequenced Flashing lights	-	-	O	-	-	3.4
Approach slope indicator	X	X	X	O	-	3.5
Circling Guidance lights	O	O	O	-	-	3.6
Runway lead-in lights	O	O	O	-	-	3.7
Runway threshold identification lights	O	O	O	-	-	3.8
Runway edge lights	X	X	X	X	X	4.1
Runway edge (circling guidance) lights	O	O	O	-	-	4.1
Runway threshold lights and threshold wing bar lights	X	X	X	X	-	4.2
Runway end lights	X	X	X	X	X	4.3
Runway centre line lights	-	-	O	X	#	4.4
Touchdown zone	-	-	-	X	-	4.5
Rapid exit taxiway indicator lights	-	-	-	O	_	4.6
Stopway lighting lights	X	X	X	X	X	4.7
Taxiway lighting	X	X	X	X	X	5.1
Stopbars *	-	-	-	X	X	5.2
Intermediate holding position lights	-	-	-	X	X	5.3
Runway guard lights	-	-	*	X	X	5.4
Road holding position lights	-	-	-	X	X	5.5
Apron floodlighting lights	O	O	O	O	O	6.1
IRDM	O	X	X	X	X	7.1
Arrestor cable markers**	X	X	X	X	X	7.2
Illuminated guidance sign	*	X	X	X	X	7.3
Aerodrome Beacon	O	O	O	O	O	7.4
Aerodrome Identification Beacon	O	O	O	O	O	7.5
Electrical supply	X	X	X	X	X	8.1
Lighting Control and Monitoring System	X	X	X	X	X	8.2
Obstacle lighting (STANAG 3346)	X	X	X	X	X	-

Key.

O = Optional, circumstances may vary.
X = Mandatory, minimum requirements.
– = Not required.
* = Mandatory requirements vary, refer to text.
# = RVR <550m – optional depending on local conditions; RVR <400m – mandatory.
Note: Where a Non-Instrument runway is used for daylight operations only, AGL items are optional.
** = Arrestor Cable Markers are a mandatory requirement where an arrestor barrier wire/tape is installed.

INTENTIONALLY BLANK

CHAPTER 3
Approach Lighting

3.1 Simple Approach Lighting

As ICAO Annex 14, Vol 1 paragraphs 5.3.4.1 to 5.3.4.9. Where operationally required, the approach system may be supplemented by three sequenced flashing lights located on the extended runway centre line at a distance of 420m, 360m and 300m from the threshold respectively. The three sequenced flashing lights are to operate independently of the others in the approach lighting system. See also paragraph 3.4.

3.2 Precision Approach Category I Lighting System

As ICAO Annex 14, Vol 1 paragraphs 5.3.4.1 and 5.3.4.10 to 5.3.4.21. Where an arrestor wire (or tape) is installed and the Approach lights are located within the hook engagement area (150m before the barrier) it will be necessary to provide inset light units (fully flush) to avoid hook engagement problems. Where the Approach lights are installed within the runway swept area it will be necessary to provide inset light units (semi-flush). The method of determining the runway swept area is shown in Annex C, Figure C-1.

3.3 Precision Approach Category II/II Lighting System

As ICAO Annex 14, Vol 1 paragraphs 5.3.4.1 and 5.3.4.22 to 5.3.4.39.

3.4 Sequenced Flashing Lights

Irrespective of the type of lighting pattern beyond 300m from the threshold, the approach system may be supplemented by sequenced flashing lights located on the extended runway centre line at each approach light unit location, without obscuring any approach light, commencing at 300m from the threshold. The system shall be provided in accordance with ICAO Annex 14, Vol 1 paragraph 5.3.4.35. The minimum intensity of the light units shall be effectively 10,000 candelas. The beam spread at this intensity shall not be less than 20° horizontally and 10° vertically. The alignment settings shall be consistent with those of the approach lighting system.

3.5 Approach Slope Indicator

A Precision Approach Path Indicator (PAPI) shall be provided in accordance with ICAO Annex 14, Vol 1 paragraphs 5.3.5.23 to 5.3.5.45. Additionally, the characteristics of the light units shall be in accordance with Annex B, Figure B-1.

3.6 Circling Guidance Lights

As ICAO Annex 14, Vol 1 Section 5.3.6.

3.7 Runway Lead-In Lighting Systems

As ICAO Annex 14, Vol 1 Section 5.3.7.

3.8 Runway Threshold Identification Lights

As ICAO Annex 14, Vol 1 Section 5.3.8. Additionally, the minimum intensity of the light units shall effectively be 10,000 candelas. The beam spread at this intensity shall not be less than 20° horizontally and 10° vertically. The light units shall be toed-out at an angle of 10±1° and at an elevation of 7°.

CHAPTER 4.
Runway Lighting

4.1 Runway Edge Lighting

As ICAO, Annex 14, Vol 1Section 5.3.9. Additionally:

4.1.1 Where circling guidance is provided by runway edge lights, the light units shall be spaced at intervals not exceeding 100m and shall show in all angles of azimuth, to provide guidance to a pilot landing or taking off in either direction. The light units shall have a minimum intensity of 1,000 candelas up to 8° and a minimum of 50 candelas between 8° and 15° above the horizontal.

4.1.2 Where an arrestor wire (or tape) is installed, it will be necessary to provide inset light units (semi-flush) within the runway swept area. The method of determining the runway swept area is shown in Annex C, Figure C-1.

4.1.3 Where IRDMs are provided, the requirement to provide a section of the lights 600m or one-third of the runway length, whichever is the less, at the remote end of the runway from the end at which the take-off run is started that may show yellow is to be considered as permissive.

4.2 Runway Threshold and Threshold Wing Bars

As ICAO Annex 14, Vol 1 Section 5.3.10. Additionally:

4.2.1 The photometric characteristics of the light units installed on an instrument or non-precision approach runway shall be comparable with those of the runway edge lighting system.

4.2.2 Where an arrestor wire (or tape) is installed and the threshold lights are located within the hook engagement area (150m before the barrier) it will be necessary to provide inset light units (fully flush) to avoid hook engagement problems. Where the threshold lights (including Threshold Wing Bars) are installed within the runway swept area it will be necessary to provide inset light units (semi-flush). The method of determining the runway swept area is shown in Annex C, Figure C-1.

4.3 Runway End Lights

As ICAO Annex 14, Vol 1 Section 5.3.11. Additionally:

4.3.1 The photometric characteristics of the light units installed on an instrument or non-precision approach runway shall be comparable with those of the runway edge lighting system.

4.3.2 Where an arrestor barrier system is installed and runway centre line lighting is not provided, a fixed light unit showing green shall be installed in the centre line position of the runway end lights and directed towards the runway to act as an aiming point for the pilot. The photometric characteristics of the light units shall be similar to those of the runway end lighting system.

4.3.3 Where an arrestor wire (or tape) is installed and the runway end bar lights are located within the hook engagement area (150m before the barrier) it will be necessary to provide inset light units (fully flush) to avoid hook engagement problems. Where the runway end lights are installed within the runway swept area it will be necessary to provide inset light units (semi-flush). The method of determining the runway swept area is shown in Annex C, Figure C -1.

4.4 Runway Centre Line Lights

As ICAO Annex 14, Vol 1 Section 5.3.12. Additionally, where an arrestor wire (or tape) is installed, it will be necessary to provide inset light units (fully flush) within the hook engagement area (150m before the barrier) to avoid hook engagement problems.

4.5 Runway Touchdown Zone Lights

As ICAO Annex 14 Vol 1, Section 5.3.13. The longitudinal spacing between pairs of barrettes shall be 60m. Additionally, where an arrestor wire (or tape) is installed, it will be necessary to provide inset light units (fully flush) within the hook engagement area (150m before the barrier) to avoid hook engagement problems.

4.6 Rapid Exit Taxiway Indicator Lights

As ICAO Annex 14 Vol 1, Section 5.3.15. Additionally, where an arrestor wire (or tape) is installed, it will be necessary to provide inset lights units (fully flush) within the hook engagement area (150m before the barrier) to avoid hook arrangement problems.

4.7 Stopway Lights

As ICAO Annex 14 Vol 1, Section 5.3.16. Additionally, not less than two uni-directional red lights shall be provided across the end of the stopway, directed towards the runway and placed symmetrically about the centre line. Where an arrestor wire (or tape) is installed and the stopway lights are located within the hook engagement area (150m before the barrier) it will be necessary to provide inset light units (fully flush) to avoid hook engagement problems. Where the stopway lights are installed within the runway swept area it will be necessary to provide inset light units (semi-flush). The method of determining the runway swept area is shown in Annex C, Figure C -1.

CHAPTER 5.
Taxiway Lighting

5.1 Taxiway Lighting (incl. Turn pad Lighting)

As ICAO Annex 14, Vol 1 Sections 5.3.17 to 5.3.19. Additionally:

5.1.1 The spacing for taxiway edge lighting shall be in accordance with Table 2. Further guidance is provided at Annex D, Fig D-1.

5.1.2 Elevated taxiway edge lights should not be used where they will be subjected to damage from jet blast, the operation of arresting systems or where they would interfere with aircraft operations. (Elevated light units may be replaced by inset lights (semi or fully flush) to maintain aircraft luminous guidance.)

Recommended spacing for taxiway edge lighting	
Taxiway	Spacing
Straights and curves down to 350m radius	60m (max.)
Curves with radius between 350m and 100m	R/7
Curves with radius between 100m and 28m	Close to but not greater than 14.5m
Curves with radius below 28m	R/2, minimum of 4 lights incl. tangent positions for 90 degree curves

(Where 'R' is the radius of the inner curved line joining the inside light positions)

Table 2

5.2 Stop Bars

As ICAO Annex 14 Vol 1, Section 5.3.20.

5.3 Intermediate Hold Position Lights

As ICAO Annex 14 Vol 1, Section 5.3.21.

5.4 Runway Guard Lights

As ICAO Annex 14 Vol 1, Section 5.3.23.

5.5 Road-Holding Position Lights

As ICAO Annex 14 Vol 1, Section 5.3.28.

INTENTIONALLY BLANK

CHAPTER 6.
Apron Floodlighting

6.1 Apron Floodlighting

As ICAO Annex 14 Vol 1, Section 5.3.24. Additionally:

6.1.1 The siting of floodlighting pylons and towers is restricted according to their height and distance from the runway and shall be in compliance with the specified Obstacle Limitation Surfaces. The pylons and towers must not interfere with a pilot's view of the landing light pattern, nor with his or the Air Traffic Controllers view of aircraft taking off, taxiing or landing.

6.1.2 Consideration must also be given to the position and height of the pylons and/or towers to ensure that radio or radar navigation aids are not detrimentally affected.

INTENTIONALLY BLANK

CHAPTER 7.
Miscellaneous Lighting

7.1 Illuminated Runway Distance Markers (IRDM)

7.1.1 Vertical runway distance markers shall be placed on both sides of a runway on a line parallel to and normally equidistant from the centreline of the runway. The markers are to indicate the distance for both directions of operation.

7.1.2 The markers shall indicate the runway distance remaining in thousands of feet (the last three digits being omitted). Where the length of the runway (Declared TORA) is other than a multiple of 300m (1,000 ft), half the odd length shall be used at each end of the runway, for determining the actual position of the markers.

7.1.3 The distance from the edge of the usable runway shall not be less than 15m (50 ft) nor greater than 23m (75 ft). Markers, which would normally be at a runway or taxiway intersection, may be omitted. However, they may be sited not more than 30m (100 ft) further along the line if this makes it possible to avoid omitting them altogether. The corresponding markers shall remain opposite to each other.

7.1.4 The photometric characteristics of the IRDMs are shown in Annex E, Fig E-1.

7.2 Illuminated Arrestor Cable Markers (IACM)

7.2.1 The position of all runway arrestor barrier cables shall be indicated in the direction of use by vertical illuminated arrestor barrier markers.

7.2.2 Markers shall be placed on both sides of the runway adjacent to the cable and normally equidistant from the centre line of the runway. The distance from the edge of the usable runway shall not be less than 15m (50 ft) nor greater than 23m (75 ft).

7.2.3 The markers shall be light and frangible and show a yellow disc 1.0m (3.25 ft) diameter, on a black border not less than 100mm wide.

7.2.4 The photometric characteristics of the IACMs are shown in Annex E, Fig E-1.

7.3 Illuminated Guidance Signs (IGS)

As ICAO Annex 14 Vol 1, Section 5.4. Additionally, where armament safe heading marker boards are required, they shall be considered mandatory and will be inscribed in the form shown in Annex E, Fig E2. The Boards should be located 15m (50ft) from the taxiway or parking area edge in accordance with

the requirements for IGS, but their precise locations will be determined operationally.

7.4 Aerodrome Beacon

As ICAO Annex 14, Vol 1, paragraphs 5.3.3.1 to 5.3.3.7. Additionally, where used the coloured flashes emitted by beacons at military land aerodromes shall be red.

7.5 Aeronautical Identification Beacon

As ICAO Annex 14, Vol 1, paragraphs 5.3.3.1 to 5.3.3.2 and 5.3.3.8 to 5.3.3.14. Additionally, where used the coloured flashes emitted by beacons at military land aerodromes shall be red.

CHAPTER 8.
Overall Consideration

8.1 Electrical Supply

As ICAO Annex 14, Vol 1 Sections 8.1 and 8.2. Additionally, all approach, runway, threshold, end and IRDM lighting circuits should be interleaved and so designed that the failure of one circuit will not result in a misleading visual pattern. (Each PAPI wing bar shall be connected to a separate circuit).

8.2 Lighting Control System

As ICAO Annex 14 Vol 1, paragraphs 5.3.1.9 to 5.3.1.12 and Sections 8.3 and 9.8. Additionally:

8.2.1 The lighting systems detailed below shall be provided with the specified minimum number of adjustable pre-set progressive stages of brilliancy to ensure that the systems, when installed, can be operated at compatible intensities and meet the prevailing conditions.

a. Minimum of 5 stages of brilliancy: Approach lighting, approach slope indicator, threshold lighting, runway edge lighting, runway threshold and end lighting, runway centre line lighting, and touchdown lighting.

b. Minimum of 2 stages of brilliancy. Taxiway lighting and other appropriate facilities.

Note. Where required, the control system shall be provided with a facility, which enables the blackout of all airfield lighting to be selected.

8.3 Colour of Lights, Signs and Panels

As ICAO Annex 14, Vol 1, Appendix 1.

8.4 Design and Installation of Light Units

As ICAO Annex 14, Vol 1 paragraphs 5.3.1.1 – 5.3.1.8 and Section 9.9. Additionally, the design of inset light units shall take into account factors described in AEP-12.

8.5 Frangibility of Elevated Lights

As ICAO Annex 14 Vol 1, paragraph 5.3.1.4. to 5.3.1.7.

Note. Guidance on frangibility requirements is given in the ICAO Aerodrome Design Manual Part 6 – Frangibility (Document 9157).

8.6 Maintenance of Visual Aids

As ICAO Annex 14, Vol 1 Section 10.5.

CHAPTER 9.
Control of Lighting at Airfields During NVG Operations

9.1 General

The lighting that can adversely affect the use of NVG includes the airfield lighting that is controlled by ATC and is specified in this document. However, other lighting on and adjacent to the airfield including lighting not provided for aviation purposes must be considered. It will not necessarily be under the control of military authorities and may be legally required to fulfil general safety requirements.

Different requirements will apply for the various operational types listed below:

a. Fixed wing operations with NVG (F/W NVG)

b. Helicopter operations with NVG (Helo NVG)

c. Simultaneous fixed wing + helicopter operations with NVG (F/W.Helo NVG)

d. Simultaneous operation with and without NVG (Sim NVG)

9.1.1 NVG operations may require the retention of some visual aids, suitably modified to be compatible with the use of NVG or the provision of aids specifically for that mode of operation.

9.1.2 The NVG Control Plan Checklist at Annex F describes how each type of light source can be controlled. The choice of lighting to be controlled is the responsibility of the operational command.

9.2 NVG Operations Lighting Control Plan

An airfield NVG Operations Lighting Control Plan shall be approved before NVG operations take place. As far as practicable the Plan shall include such measures of lighting control as are necessary to ensure that the performance of NVG is not significantly affected by any light on or adjacent to the airfield.

9.3 Training

Where NVG operations are to take place all personnel involved shall receive training that includes the light control measures and operational procedures to be used when NVG operations are taking place**.**

9.4 Equipment

Only personnel whose presence is essential for safety and efficiency reasons shall be on the manoeuvring area during NVG operations.

9.5 Availability

It shall be defined in the Operations Lighting Control Plan which runway approach directions are designed to support NVG operations. The plan shall also indicate which of the types of operations shown in paragraph 9.1 are supported.

9.6 ATC Issues

All ATC procedures for final approach, ground roll, taxi and departure shall be reviewed and amended as necessary to take account of the changes to the visual cues available to pilots when NVG operations are taking place.

9.7 Implementation Time

The time need to activate and fully implement the Lighting Control Plan shall be determined by operational assessment. The time interval between reversion from NVG to normal operations for all services should be as short as practicable.

9.8 Flight Check

The effectiveness of the Operational Lighting Control Plan shall be checked by means of a flight check.

ANNEX A. Safety Considerations

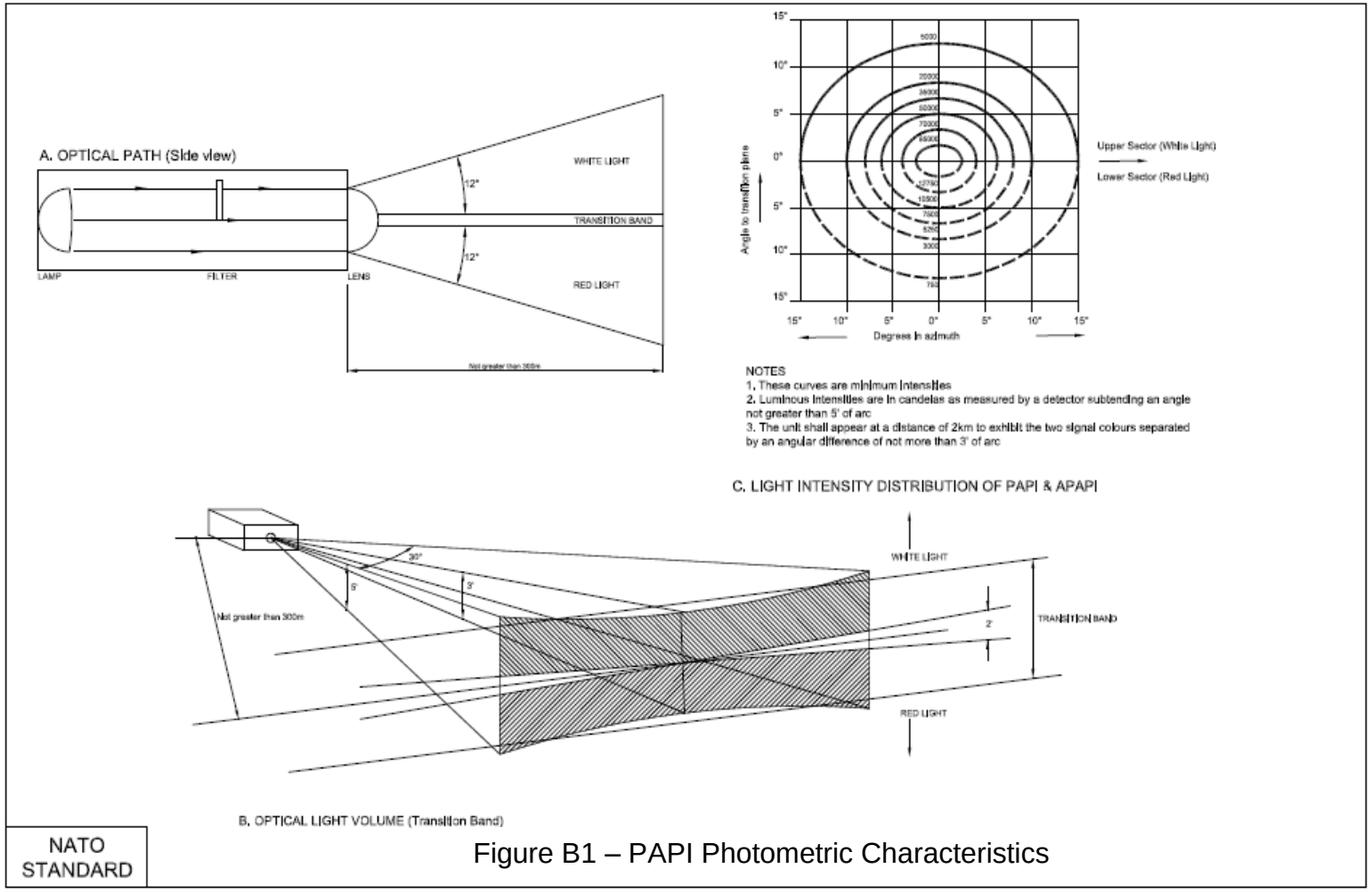
STANAG 3316 – Airfield Lighting

Custodian POC. Andy Dunn (UK) DIOSEE-EngElecAH@mod.uk

Safety Considerations	Consequences	Possible Mitigations
Incorrect provision and/or installation of airfield lighting systems.	Misleading visual aids leading to pilot confusion and/or increased workload and possibility of an incident or accident.	Ensure the use of appropriate standards, competent system designers and installers, and the airfield lighting systems are fully commissioned prior to use.
Incorrect/poor maintenance of airfield lighting systems.	Unserviceable or misleading visual aids leading to pilot confusion and/or increased workload and possibility of an incident or accident.	Ensure the use of appropriate equipment and timely maintenance activities by competent maintenance technicians and the retention of accurate and complete maintenance records.
Light units and/or signs may become dislodged due to loose fixings, jet blast or propeller wash.	Damage to the equipment, reduced system serviceability, non-compliance to STANAG, and/or Foreign Object Debris (FOD) may impede airfield operations and give rise to an incident or accident.	Ensure light units and/or signs are securely fixed and undertake regular inspection and testing.
PAPI or APAPI units may become misaligned due to airfield operations or ground movement	Incorrect glide slope indication may be provided to aircraft on approach leading to an incident or accident	Regularly verify the accuracy of the PAPI or APAPI angular settings using an alignment tool, comparison with electronic navigation aids, flight checks, or other suitable methods. Periodicity defined in local orders.
Light units and signs may become unserviceable through misalignment or obscured by environmental conditions such as dust, dirt, snow, and frost.	The visibility of the light unit and signs may be diminished or extinguished reducing their effectiveness leading to increased pilot workload and possibility of an incident or accident	1) Employ a suitable system of planned preventative maintenance, including regular inspections and tests to ensure defined serviceability criteria is achieved. 2) Notify aircrew when serviceability criteria are not achieved.
Harsh environmental conditions such as wind blown sand, snow, or frost may degrade long term performance of system components.	Equipment reliability may be compromised rendering equipment unserviceable	Carefully monitor equipment performance to ensure routine maintenance is sufficient to ensure reliable system operation

Safety Considerations	Consequences	Possible Mitigations
Airfield operatives working in close proximity to airfield lighting systems.	Poorly maintained electrical systems can give rise to hazards, including dangerous voltages that may cause harm to airfield operatives.	Employ a suitable system of planned preventative maintenance, including regular inspection and testing, to ensure the electrical circuits remain in a safe condition.
Airfield lighting maintenance personnel	Potential injury, including death, to airfield lighting maintenance personnel while undertaking maintenance tasks.	1) Ensure equipment is maintained in a safe condition and airfield lighting maintenance personnel are competent and follow a suitable and sufficient safe system of work. 2) Ensure airfield lighting maintenance personnel are aware and briefed of local specific hazards that may give rise to danger.

ANNEX B. PAPI Photometric Characteristics

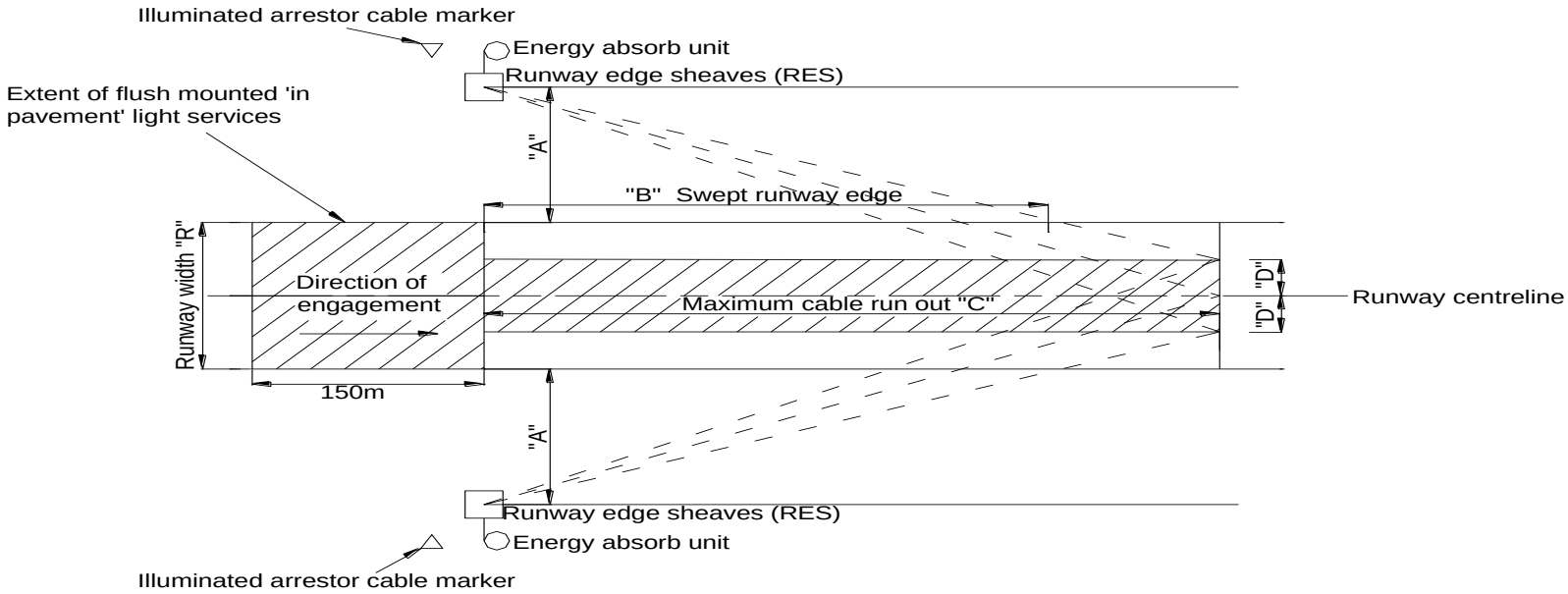


NATO STANDARD

Figure B1 – PAPI Photometric Characteristics

INTENTIONALLY BLANK

ANNEX C. Determination of Runway Area Swept by Arrestor Cable



Notes
This engagement detail is to be applied to the AGL layout of the runway being fitted with RHAG to determine the number of fittings affected and the extent of any hazard to other elevated lighting services.

Pendant engagement may be in either runway direction and on either side of the runway centreline.

The swept lengh "B" is given by:-

$$B = \frac{AxC}{\frac{R+A-D}{2}}$$

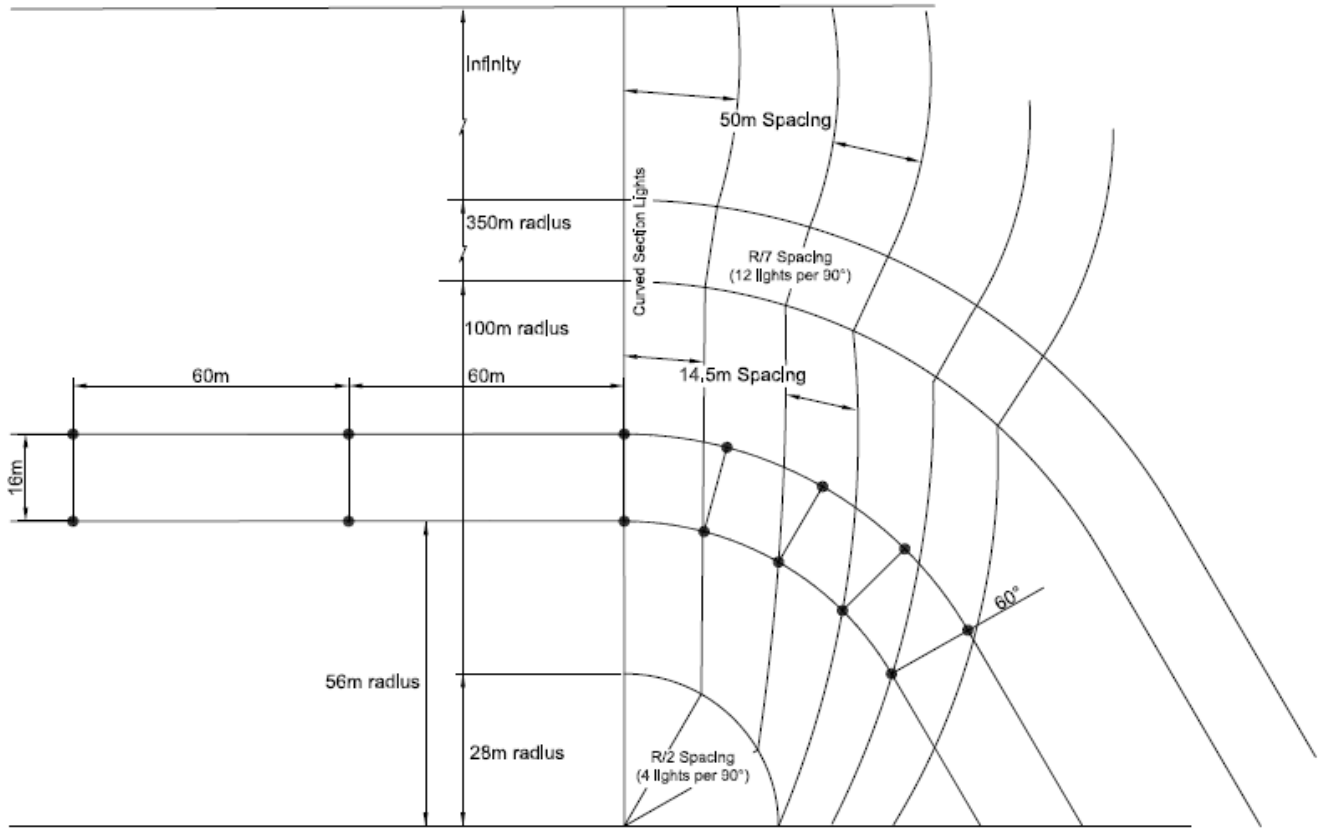
Where A=Dispalcement of RES from runway edge
C=Cable runout normally 400m
R=Runway width
D=Distance from runway centreline to point of engagement on pendant wire - maximum expected is 12m

NATO STANDARD

Figure C1 – Determination of Runway Area Swept by Arrestor Cable

INTENTIONALLY BLANK

ANNEX D. Typical Taxiway Edge Lighting Spacing of Lights on Curves



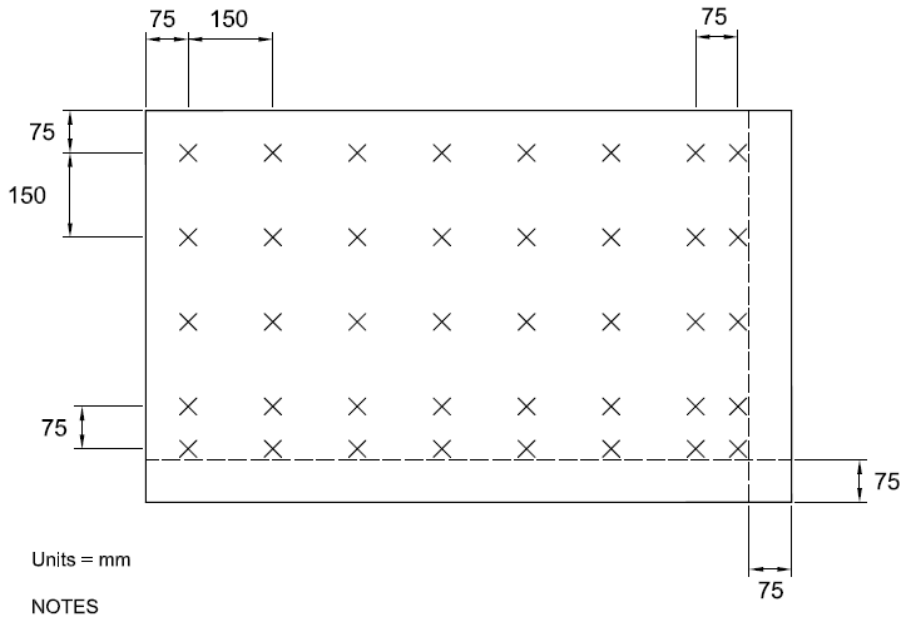
NOTES
1. Worked example of a 60° curved section, inner radius 56m of a 16m wide taxiway track.
2. Spacings are maximum. Spacings could be reduced to give equal spacing between tangent points.
3. Edge lights preferably in pavement surface

NATO STANDARD

Figure D1 – Typical Taxiway Edge Lighting Spacing of Lights on Curves

INTENTIONALLY BLANK

ANNEX E. Illuminated Guidance Signs

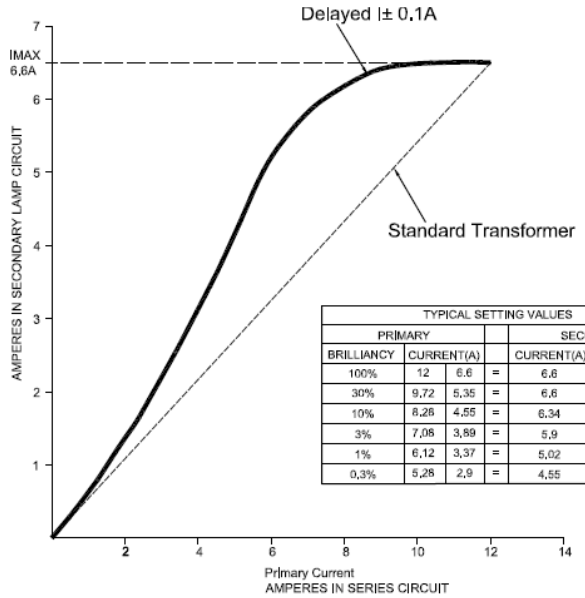


Units = mm

NOTES

1. The average luminance is obtained by taking measurements on a blank sign face at the grid points shown and the arithmetic mean of all the measured values
2. The average luminance shall be at least :
   Yellow 50cd/m
   White 100cd/m
3. The ratio between the maximum and the minimum luminance value over the whole sign face shall not exceed 5:1
4. For IRDM, the height of the figures shall be 1m. The stroke of each figure shall be approximately 130mm wide and the border not less than 100mm wide.

A- IRDM & IACM Marker Boards



TYPICAL SETTING VALUES					
PRIMARY				SECONDARY	
BRILLIANCY	CURRENT(A)			CURRENT(A)	BRILLIANCY
100%	12	6,6	=	6,6	100%
30%	9,72	5,35	=	6,6	100%
10%	8,26	4,55	=	6,34	80%
3%	7,08	3,89	=	5,9	50%
1%	6,12	3,37	=	5,02	20%
0,3%	5,28	2,9	=	4,55	10%

B- CURRENT CONTROL FOR IRDM

NATO STANDARD

Figure E1 – IRDM and IACM

INTENTIONALLY BLANK

NOTES
1. The board shall have a white inscription on a red background.
2. The heading shown is the Safe Magnetic Heading and tolerance determined for the individual parking area and aircraft.

NATO STANDARD

Figure E2 – Armament Safe Heading Marker Board

INTENTIONALLY BLANK

ANNEX F. NVG Control Plan Checklist

FACILITY	RECOMMENDED NVG LIGHTING STATE	COMMENTS
Approach lighting	VLP/Off	For 40(D) BF/NT, for 40(B) Off
High Intensity Runway Edge Lighting	VLP	For 40(D) BF/NT, for 40(B) Off
Threshold Lighting	VLP	For 40(D) BF/NT, for 40(B) Off
Runway End Lighting	VLP	For 40(D) BF/NT, for 40(B) Off
Low Intensity Runway Edge Lighting	VLP	For 40(D) BF/NT, for 40(B) Off
Sequence Flashing Lights	Off	
Runway Identification Lights	Off	
Visual Glideslope Indicator System	Off	
Military Cat II Lighting	Off	If used for MOS training use VLP
Runway Centreline Lighting	Off	For 40(D) BF/NT
Taxiway Lighting	VLP	For 40(D) BF/NT, for 40(B) Off
Illuminated Runway Distance Markers	Off	BF may be operational option
Arrestor Cable Markers	Off	For 40(D) NT
Illuminated Taxiway Guidance Signs	Off	Pilot may be able to read text with NVG
Obstacle Lighting	On	Leave on if essential./NT
Runway taxiway traffic lights	Off	NT or use modified procedures to control vehicles. Add hold signs at all runway/taxiway intersections. Consider use of selectable barriers at runway/roadway intersections.
Floodlighting	Off	Floodlighting of apron areas may be essential operationally BF/Control beam spread.
Building windows and doors	Shutters/curtains. Lock doors facing operational areas	For large buildings (hangars) NVG compatible lighting is an option.

FACILITY	RECOMMENDED NVG LIGHTING STATE	COMMENTS
ATC visual control room		Not normally a problem.
ATC caravan		Use techniques similar to those used in cockpit to make NVG compatible when required.
Off-airfield lighting (under approach and take-off climb surface out to 4km		Assess effects. Where practicable make arrangements for control.
IR NATO T	On	On for 40(B) only.
IR identification beacon	On	On for 40(B) only.

Notes

(1) The following abbreviations are used:-

OFF Lighting selected off.

VLP Very Low Power setting, typically 5-10% rated power.

BF Blue Filter added to fitting.

NT Light unit not emitting infra-red, (non-tungsten) e.g. electro-luminescent or LED.

(2) This Annex presents information on each type of light system that may exist at an airfield. The selection of lights to be controlled during NVG operations is an operational decision. For fixed wing operations the most basic Plan may only retain obstacle lighting. For helicopter operations the Plan may include the NATO T and an identification beacon.

ANNEX G. Technical Means for NVG Control

1 NVG are designed to operate with low levels of light. Sources that emit high levels of infra-red radiation can reduce the contrast of the image seen by the pilot. In more extreme cases the infra-red glare can completely disable the NVG.

2 The output from lights can be made compatible with NVG in a number of ways; by the reduction of the amount of infra-red radiation emitted, by selective filtering of the light, by careful control of the light beam coverage and in the extreme case by the extinguishing of the light.

3 Most airfield lighting uses tungsten filament lamps. In all cases a large percentage of the energy is emitted in the red and infra-red parts of the spectrum where NVG are most sensitive.

4 As the voltage on the filament is reduced the total energy emitted is reduced, but the proportion of the energy in the infra-red is increased. When the voltage is reduced below approximately 20% of the rated voltage (10% power) very little visible energy is emitted. However, sufficient infra-red energy is present to produce an image in the NVG that can have ranges in excess of 5km without adversely affecting NVG performance. Thus an NVG setting on the light control system where no visible light is seen can provide an adequate lighting pattern for NVG operations.

5 One alternative method, that enables levels of white lighting to be emitted that are sufficient for simultaneous operations using normal eye sight or NVG involves the use of blue filters attached to the light source. These carefully selected filters, by removing the red and near infra-red transmission still produce a light that subjectively is seen as white light. However, because the wavelengths that affect the NVG are heavily suppressed the problems of goggle overload can be adequately dealt with. This approach is particularly useful for apron floodlighting and other maintenance areas such as HAS and hangers, where lighting needs to be available whenever operations are taking place. A practical problem that can exist with this technique is caused by the high levels of heat retention in the light fitting due to the filter.

6 Devices that produce light by the excitation of phosphors, such as electro-luminescent systems and light emitting diodes can in some cases be used to provide equipment that can be used simultaneously by pilots with or without NVG.

7 In some circumstances, NVG compatibility can be achieved by careful design of the light fitting. For example, floodlighting and street lighting can be designed so that no significant light is projected above the horizontal. This

type of light is available because of general concern about environmental light pollution caused by light spillage into unnecessary areas.

ANNEX H. Visual Aids for NVG

1 The use of NVG generally reduces the amount of visual aids that are necessary to support night operations.

2 For fixed wing operations runway edge lighting is recommended (see Annex G), together with taxiway lighting.

Helicopter operations should be supported by a NATO ‘T’ pattern defined by infra-red marker lights. An infra-red airfield identification beacon

AATMP-07(A)(1)