

CHLITE System configuration

INTRODUCTION AND SYSTEM OVERVIEW



Revision

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1. About this Product information

Thank you for purchasing this product!

This manual mainly follows CAP 437.

CAP 437 is standards for offshore helicopter landing areas, has become an accepted world-wide source of reference. The changes in the 8th edition incorporate final results of valuable experience gained from the CAA-funded research project conducted with the support of the UK offshore industry and the UK Health and Safety Executive (HSE) into improved helideck lighting systems.

Part 1 to 4 are generic in nature, describing the overall system and installation methods for each CHLITE system type A, B and C. Part 5 is system specific and will give the user sufficient information to enable operation and maintenance of the equipment in a safe and functionally correct manner in all phases after installation.



WARNING

Installation, maintenance, overhaul and repair may only be carried out by appropriate authorized, qualified and trained personnel!

Please follow this manual for installation, maintenance and assurance of a long life of this product. Changes made to the product which do not confirm to the approvals of this equipment, is a safety violation. The manufacturer is under no circumstances responsible for personal injuries, death or any other damage caused by such activities. For your health and safety, always use safety gear suited for the task. Be certain to follow codes, regulations and/or specific procedures that are related to the installation operation and maintenance.

Repair that effects the explosion protection may only be carried out by Stahl Tranberg AS, or a qualified electrician in compliance with respective national regulation. For replacement and repair of the CHLITE only Stahl Tranberg AS spare parts shall be used.

1.1 Terms, definitions, abbreviations, icons and references

1.1.1 Terms and definitions

D-circle

A circle, usually hypothetical unless the helideck itself is circular, the diameter of which is the D-value of the largest helicopter the helideck is intended to serve.

D-value

The largest overall dimension of the helicopter when both rotors are turning. This dimension will normally be measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor tip path plane (or the most rearward extension of the fuselage in the case of Fenestron or Notar tails)

'H'

Heliport identification marking lighting

Helideck

Dedicated helicopter landing area located on a fixed or floating offshore facility.

Helideck circle

Normally a hypothetical circle, (unless the helideck itself is circular), circumscribing the landing area of the helideck with a diameter equal to the deck's DH-value.

Helideck size marking

A whole number inscribed in the perimeter line at three positions with an angle spacing of 90°, marking the D-value for the largest helicopter the helideck is dimensioned for, rounded to the nearest whole number.

Landing Area

A generic term referring to the load-bearing area primarily intended for the landing and take-off of aircraft. The area, sometimes referred to as the Final Approach and Take-Off area (FATO), is bounded by the perimeter line and perimeter lighting.

Lighting Element

A lighting element is a light source within a segment or sub-section and may be individual (e.g. a Light Emitting Diode (LED) or continuous (e.g. Fiber optic cable, electroluminescent panel). An individual lighting element may consist of a single light source or multiple light sources arranged in a group or cluster.

Segment

A segment is a section of the TD/PM Circle lighting. For the purposes of this specification, the dimensions of a segment are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses.

Shall

Verbal form used to indicate requirements strictly to be followed in order to conform to standard regulations and from which no deviation is permitted, unless accepted by all involved parties.

Sub-Section

A sub-section is an individual section of the 'H' lighting. For the purposes of this specification, the dimensions of a sub-section are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses.

Touchdown circle (TD circle)

The yellow inner circle marking the pilots' aiming point for a safe touchdown of the undercarriage within the landing area. Correct touchdown allows for safe access, cargo handling and other required services on the helideck.

TD/PM Circle

Touchdown/Positioning Marking Circle. Described as the Aiming Circle in earlier editions of CAP437, the TD/PM Circle is the aiming point for a normal touchdown (landing) so located that when the pilot's seat is over the marking, the whole of the undercarriage will be within the landing area and all parts of the helicopter will be clear of any obstacles by a safe margin. NOTE: It should be noted that only correct positioning over the TD/PM Circle will ensure proper clearance with respect to physical obstacles and provision of ground effect and provision of adequate passenger access/egress.

1.1.2 Abbreviations

Helideck	Helicopter deck
LED	Light Emitting Diode
TD	Touchdown Circle
PM	Positioning Marking
CAA	Civil Aviation Authority
HCA	Helideck Certification Agency
ICAO	International Civil Aviation Organization
EASA	European Aviation Safety Agency
NM	Nautical Mile(s)
BSL	Bestemmelser for sivil luftfart (Regulation for Civil Aviation)
ISO	International Organization for Standardization
HSE	Health and Safety Executive (UK)

1.1.3 Icons used in this manual



Warning sign! Indicates to be aware of this section/part of the manual before continuing.



Stop sign! Indicates stop and read/understand this section/part of the manual before continuing.



Do's and Don'ts! Indicates best practice (do's) and what not to do (don'ts).

1.1.4 References

Latest issue of the references shall be used unless otherwise agreed.

The installation, operation and maintenance shall be in conformity with the standard norms listed below.

1. CAP 437 (Edition Eight, Dec 2016) - Standards for Offshore Helicopter Landing Areas
2. NORSOK Standard C-004 (Edition 2, May 2013) - Helicopter deck on offshore installations
3. NORSOK S-001 Technical Safety
4. NORSOK S-002 Working Environment – Inspection and maintenance access
5. EN 60079-0:2012 – Ex Equipment
6. 94/56/EC – EU Aviation Safety – civil accidents and incidents
7. EASA – European Aviation Safety Agency Regulations
8. ICAO – Annex 14 (Stands on page.4 CHLITE part 1, therefore included)
9. BSL – Bestemmelser for Sivil Luftfart (Regulation for Civil Aviation - Norway)
10. EN 50014:1997 – Electrical apparatus for potentially explosive atmospheres - General requirements
11. FEU – Regulation on electrical equipment
12. NEK IEC 60079-17 - Explosive atmospheres - Part 17: Electrical installations inspection and maintenance
13. Company specification – Project specification
14. NEK 420:2007 – Electrical Installations in hazardous areas with gas and dust
15. IEEE 515-2011 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Industrial Applications.

If more information is needed please see other regulations within your country and region.

- National safety regulations
- National installation regulations
- National accident prevention regulations
- Generally recognized technical regulations
- Safety guidelines in these installation instructions
- Appendix A “Mounting Methods” in Part 2, 3 and 4 - Additional instructions for the mounting method

2. Introduction

2.1 Background

This manual is based on the “Standards for Offshore Helicopter Landing Areas”, CAP 437. The provision set forth in this manual shall be complied with all phases of planning, construction and operation of the helideck. It shall be read in conjunction with the regulation in force.

CAP 437 “Standards for Offshore Helicopter Landing Areas”, have become an accepted world-wide source of reference into improved helideck lighting systems. The CAA in the UK believes that it represents a significant safety enhancement over traditional floodlighting and takes every opportunity to actively encourage the industry to deploy the new lighting scheme in preference to floodlighting.

In ICAO Annex 14 Volume II has an acceptable alternative to the TD/PM Circle and ‘H’ marking lighting. It should be noted that references in CAP 437 are made to the UK legislative and advisory bodies. However, the standard is written so that it may provide minimum standards applicable for the safe operation of helicopters to offshore helidecks throughout the world.



Our CHLITE system has been tested thoroughly by a third party (DNV-GL) to ensure that the *system itself and the mounting methods* comply with CAP 437. The testing simulated the loads applied during a helicopter landing and included both lateral and vertical load/pressure to the light modules.

The CAP 437 states that “Helideck perimeter line marking and lighting serves to identify the limits of the Landing Area (see Terms and definitions) for day and night operations respectively. The CAA considers that as a minimum these issues should be examined during periodic surveys to confirm that there has been no alteration or deterioration in the condition of the helicopter landing area.”

Appendix A in CAP 437 defines a 'checklist' which provides in specific and detailed terms the minimum criteria which need to be assessed when determining the acceptability of a helicopter landing area on an offshore installation or vessel.

Appendix C in CAP 437 defines specification for Helideck Lighting Scheme Compromising: Perimeter Lights, Lit Touchdown/Positioning Marking and Lit Heliport Identification Marking. Please see below for some overall operational requirements. If more information is needed, please see Appendices extracted from CAP 437.

2.2 Overall Operational Requirements

NOTE:

References are only parts stated in Appendix C in CAP 437.

Please see Appendices (extracted from CAP 437) for missing sections.



WARNING

Installation, maintenance, overhaul and repair may only be carried out by appropriate authorized, qualified and trained personnel!

- “The whole lighting scheme should be visible over a range of 360° in azimuth. Although on some offshore installations the helideck may be obscured by topsides structure in some approach directions, the lighting configuration on the helideck need not take this into account.”
- “The visibility of the lighting scheme should be compatible with the normal range of helicopter vertical approach paths from a range of two nautical miles (NM).”
- “The purpose of the lighting scheme is to aid the helicopter pilot perform the necessary visual tasks during approach and landing.”
- “The design of the perimeter lights, TD/PM Circle and 'H' should be such that the luminance of the perimeter lights is equal to or greater than that of the TD/PM Circle segments, and the luminance of the TD/PM Circle segments is equal to or greater than that of the 'H'.”
- “The design of the TD/PM Circle and 'H' should include a facility to increase their intensity to twice the minimum figures given in this specification to permit a once-off (tamper proof) adjustment at installation; the maximum figures should not be exceeded. The purpose of this facility is to ensure adequate performance at installations with high levels of background lighting without risking glare at less well lit installations. The TD/PM Circle and 'H' should be adjusted together using a single control to ensure that the balance of the overall lighting system is maintained in both the 'standard' and 'bright' settings.”

2.2.1 The Touchdown/Positioning Marking Circle Requirement

- “The lit TD/PM Circle should be superimposed on the yellow painted marking. It should comprise one or more concentric circles of at least 16 discrete lighting segments, of 40 mm minimum width. A single circle should be positioned at the mean radius of the painted circle. Multiple circles should be symmetrically disposed about the mean radius of the painted circle. The lighting segments should be of such a length as to provide coverage of between 50% and 75% of the circumference and be equidistantly placed with the gaps between them not less than 0.5 m. The mechanical housing should be colored yellow – see CAP 437, Chapter 4, paragraph 2.11.”
- “The TD/PM Circle is considered serviceable provided that at least 90% of the segments are serviceable. A TD/PM Circle segment is considered serviceable provided that at least 90% of the lighting elements are serviceable.”

2.2.2 The Heliport Identification Marking Requirement

“The lit Heliport Identification Marking ('H') should be superimposed on the 4 m x 3 m white painted 'H' (limb width 0.75 m).”

“An outline lit 'H' should comprise sub-sections of between 80 mm and 100 mm wide around the outer edge of the painted 'H' (see Figure 1).

There are no restrictions on the length of the sub-sections, but the gaps between them should not be greater than 10 cm.”

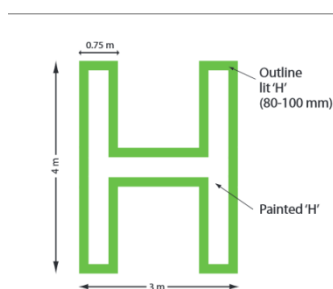


Figure 1 - Heliport Identification Marking "H"

“The 'H' is considered serviceable provided that at least 90% of the sub-sections are serviceable. An 'H' sub-section is considered serviceable provided that at least 90% of the lighting elements are serviceable.”

2.2.3 Other Considerations

“All lighting components and fitments should meet safety regulations relevant to a helideck environment such as explosion proofing (Zone 1 or 2 as appropriate) and flammability (by a notified body in accordance with the ATEX directive).”

“All lighting components and fitments should, as a minimum, meet IEC International Protection (IP) standard IP66, i.e. dust tight and resistant to powerful water jetting.”

“All lighting components should be tested by an independent test house. The optical department of this test house should be accredited according to ISO/IEC 17025.”

3. System overview

The 2013 review of CAP437 requires now a mandatory illuminated installation for the TD/PM circle marking and the “H” heliport identification markings of helidecks in offshore installations. In the following, a reference picture of the illuminated system is shown. Please see figure 1 below.



Figure 2 - Helideck Lighting System

3.1 System Configuration

For reproducing the overall figure of the “Circle” and “H” according to CAP437 requirements, systems of lighting lines and cable routings are required. Depending on the size and the type of helideck different configurations are available. The following description highlights the different system configuration and sizes for the CHLITE System.

Variable part of the system will be the Circle and the cable routing system. The H has a constant size. The number of elements for the circle is depending on the helidecks D-value. According to CAP437, the lighting segment length as to provide coverage of between 50% and 75% of the circumference and be placed equidistantly with gaps on the mean diameter of the circle. The following table shows the system size for different D-values.

D-value [m]	Mean diameter of the painted circle [m]	Number of light elements
12m – 13,5m	7m – 7,75m	16
13,5m – 17,2m	7,75m – 9,6m	20
17,2m – 20,8m	9,6m – 11,4m	24
20,8m – 24,8m	11,4m – 13,4m	28

Table 1 – Number of circle lighting elements vs. D-value

For each system type the number and the size of lighting fixtures used for the H are constant. Their positioning layout, the gaps between segments of the “TD/PM Circle”, and coverage depends upon the D-Value of the helideck, but always in compliance with the CAP437 requirements. The CHLITE-T-28 is suitable for helidecks with a D-Value of up to 24,8 meters. It is possible to “fit” higher D-Value due to the modular solution by simply adding some segments to provide the suitable coverage / gaps.

4. Cable routing

The system provides different opportunities for the cable routing (Figure 3-5 show solutions for the cable routing).

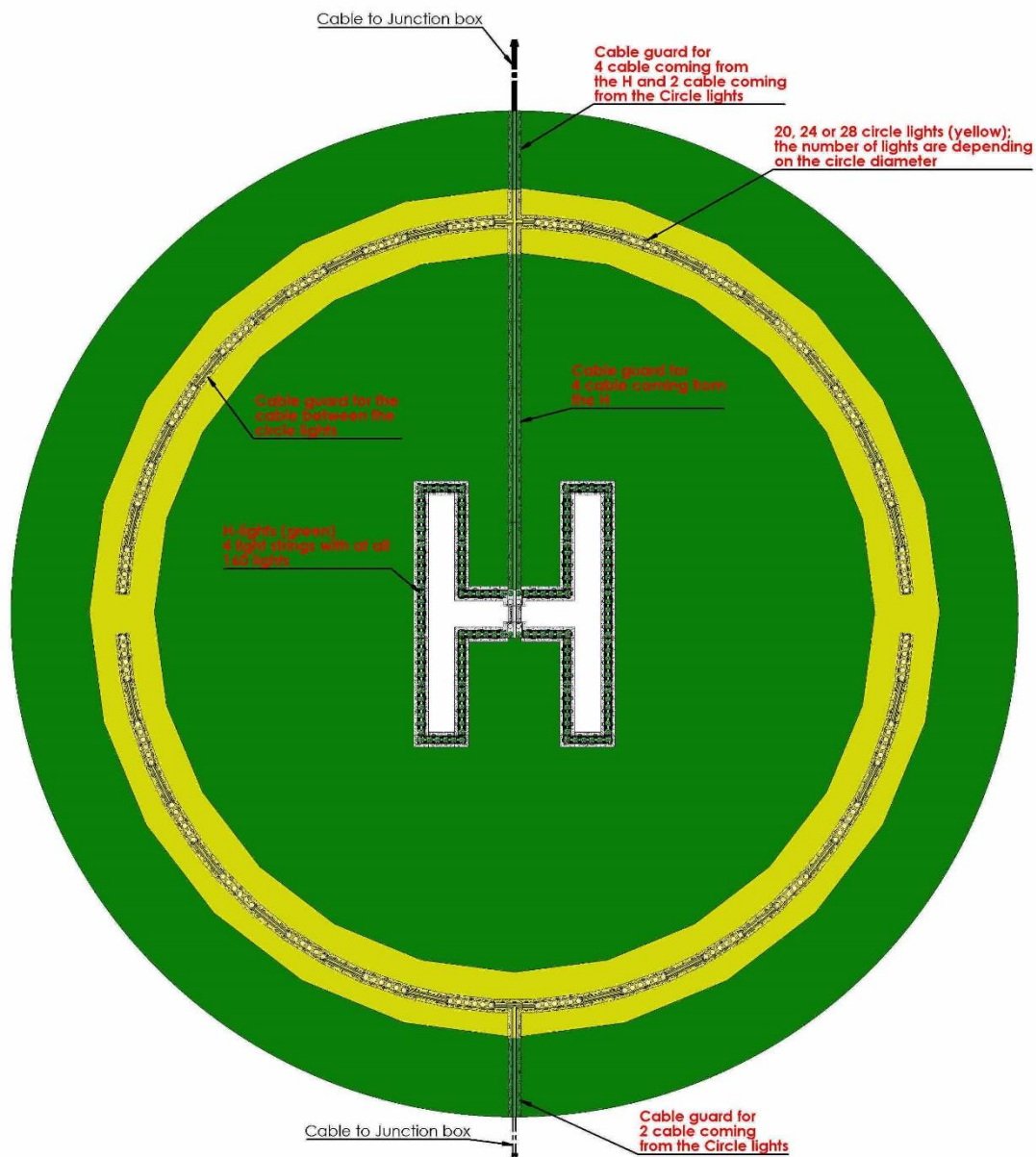


Figure 3 - ABOVE deck cable routing – System A.

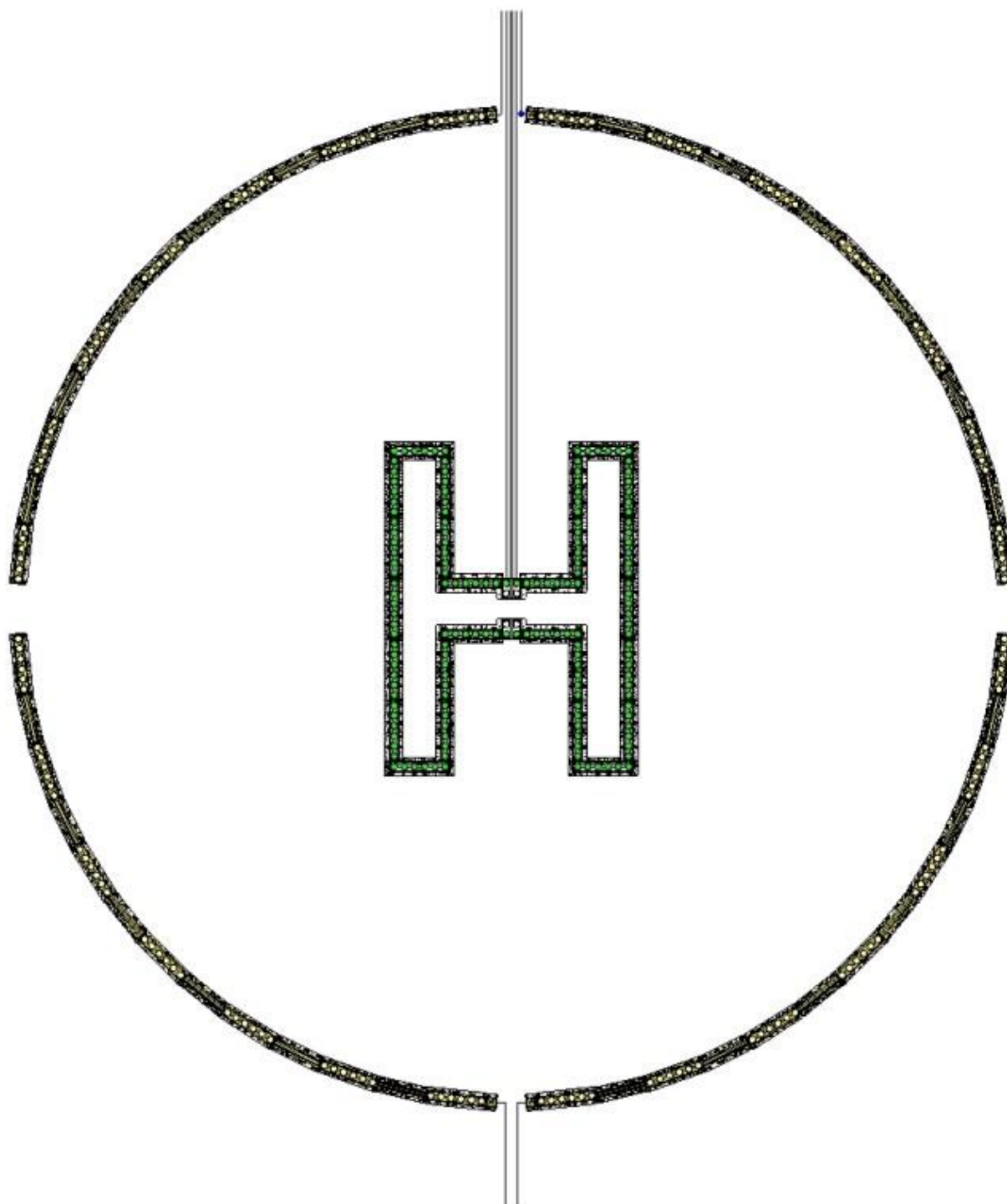


Figure 5 - ABOVE deck cable routing – System C.

5. Mounting/Installation Methods

Mounting methods are described under each system Installation Manual (Part 2, 3 and 4). The mounting methods differ depending on the deck materials, covering steel decks, aluminum decks, and wooden decks. Please look at Part 2, 3 and 4 for more information if needed.

- Part 2a: Installation Manual CHLITE-A
- Part 2b: Installation Manual CHLITE-B
- Part 2c: Installation Manual CHLITE-C



Note: To be able to define the correct mounting methods a survey of the helideck structure must be performed in advanced!

6. Control System

Different control solutions are available. STAHL TRANBERG can provide solutions for the safe area and for Zone 1 or Zone 2. CHLITE system is ready for use with STAHL TRANBERG's Commander System.

6.1 System connection

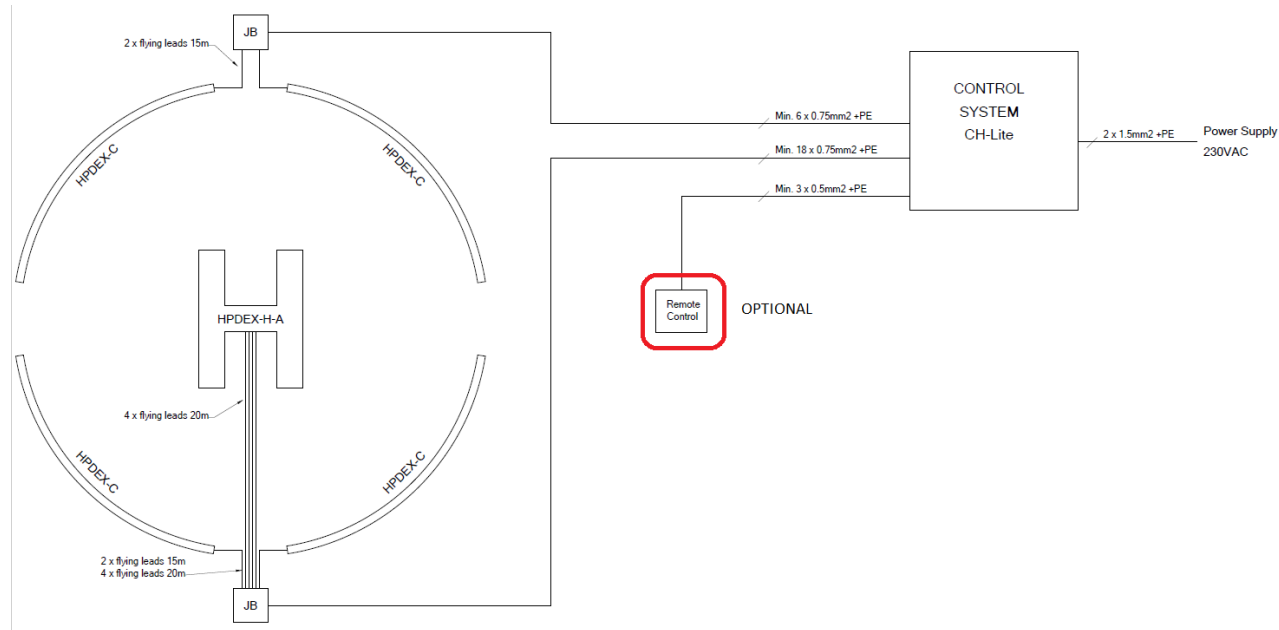


Diagram 1 – Principle diagram of the control system connection.

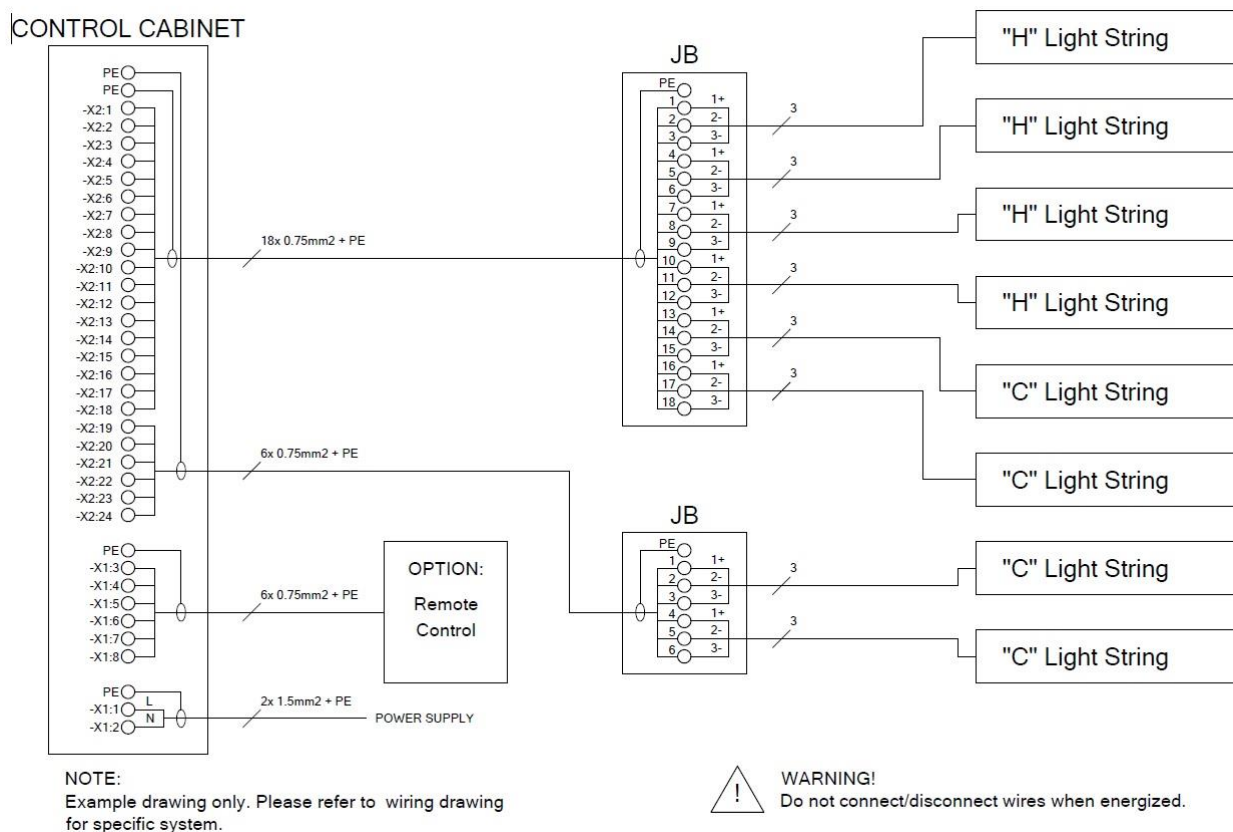


Diagram 2 – Principle wiring diagram

Note: Remote Control is an optional item. If you have questions regarding this option please contact STAHL TRANBERG for additional information.

7. Part List/Part numbers

Part lists are described under each System Installation Manual.

- Part 2a: Installation Manual CHLITE-A
- Part 2b: Installation Manual CHLITE B
- Part 2c: Installation Manual CHLITE C

8. APPENDICES

APPENDIX A

CAP 437

Standards for Offshore Helicopter Landing Areas

Appendix A Checklist

The following 'checklist' is based on extracts from JAR-OPS 3 Section 2 Subpart D, AMC No. 2 to OPS 3.220, which provides in specific and detailed terms the minimum criteria which need to be assessed when determining the acceptability of a helicopter landing area on an offshore installation or vessel. The CAA considers that as a minimum these issues should be examined during periodic surveys to confirm that there has been no alteration or deterioration in the condition of the helicopter landing area.

a) The physical characteristics of the helideck:

- i) Dimensions as measured;
- ii) Declared D-value;
- iii) Deck shape; and
- iv) Scale drawings of deck arrangement.

b) The preservation of obstacle-protected surfaces is the most basic safeguard for all flights. These surfaces are:

- i) The minimum 210° Obstacle Free Sector (OFS) surface;
- ii) The 150° Limited Obstacle Sector (LOS) surface; and
- iii) The minimum 180° falling 5:1 gradient surface with respect to significant obstacles.

If one or more of these surfaces is infringed due, for example, to the proximity of an adjacent installation or vessel, an assessment should be made to determine any possible negative effect which may lead to operating restrictions.

c) Marking and lighting:

- i) Adequate helideck perimeter lighting;
- ii) Adequate helideck touchdown marking lighting ('H' and TD/PM Circle lighting) and/or floodlighting;
- iii) Status lights (for day and night operations);
- iv) Helideck markings;
- v) Dominant obstacle paint schemes and lighting; and
- vi) General installation lighting levels including floodlighting.

Where inadequate helideck lighting exists the Helideck Limitation List (HLL) should be annotated 'daylight only operations'.

d) Deck surface:

- i) Surface friction;
- ii) Helideck net (as applicable);
- iii) Drainage system;
- iv) Deck edge perimeter safety netting;
- v) Tie-down points; and
- vi) Cleaning of all contaminants (to maintain satisfactory recognition of helideck markings and preservation of the helideck friction surface).

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e) Environment:

- i) Foreign object damage;
- ii) Air quality degradation due to exhaust emissions, hot and cold vented gas emissions and physical turbulence generators;
- iii) Bird control;
- iv) Any adjacent helideck/installation environmental effects may need to be included in any air quality assessment; and
- v) Flares.

f) Rescue and Fire Fighting:

- i) Primary and complementary media types, quantities, capacity and systems;
- ii) Personal Protective Equipment (PPE); and
- iii) Crash box.

g) Communications and navigation:

- i) Aeronautical radio(s);
- ii) Radio/telephone (R/T) call sign to match helideck name and side identification which should be simple and unique;
- iii) Non-Directional Beacon (NDB) or equivalent (as appropriate); and
- iv) Radio log.

h) Fuelling facilities:

- i) In accordance with relevant national guidance and regulations.

i) Additional operational and handling equipment:

- i) Windsock;
- ii) Meteorological information (recorded by an automated means);
- iii) Helideck Motion System recording and reporting (where applicable);
- iv) Passenger briefing system;
- v) Chocks;
- vi) Tie-downs; and
- vii) Weighing scales for passengers, baggage and freight.

j) Personnel:

- i) Trained helicopter staff (e.g. Helicopter Landing Officer, Helideck Assistant and fire-fighters).

k) Other:

- i) As appropriate.

NOTE: AMC No. 2 to OPS 3.220 also provides detailed guidance on the format and content of the HLL and the Helideck template (the HIP) which are required to be provided as part of the helideck approvals process.

APPENDIX C

CAP 437

Standards for Offshore Helicopter Landing Areas

Appendix C Specification for Helideck Lighting Scheme Comprising: Perimeter Lights, Lit Touchdown/Positioning Marking and Lit Heliport Identification Marking

1 Overall Operational Requirement

- 1.1 The whole lighting scheme should be visible over a range of 360° in azimuth. Although on some offshore installations the helideck may be obscured by topsides structure in some approach directions, the lighting configuration on the helideck need not take this into account.
- 1.2 The visibility of the lighting scheme should be compatible with the normal range of helicopter vertical approach paths from a range of two nautical miles (NM).
- 1.3 The purpose of the lighting scheme is to aid the helicopter pilot perform the necessary visual tasks during approach and landing as stated in Table 1.

Table 1 Visual Tasks During Approach and Landing

Phase of Approach	Visual Task	Visual Cues/Aids	Desired Range (NM)	
			5000 m met. vis.	1400 m met. vis.
Helideck Location and Identification	Search within platform structure.	Shape of helideck; colour of helideck; luminance of helideck perimeter lighting.	1.5 (2.8 km)	0.75 (1.4 km)
Final Approach	Detect helicopter position in three axes. Detect rate of change of position.	Apparent size/shape and change of size/shape of helideck. Orientation and change of orientation of known features/markings/lights.	1.0 (1.8 km)	0.5 (900 m)
Hover and Landing	Detect helicopter attitude, position and rate of change of position in three axes (six degrees of freedom).	Known features/markings/lights. Helideck texture.	0.03 (50 m)	0.03 (50 m)

- 1.4 The minimum intensities of the lighting scheme should be adequate to ensure that, for a minimum Meteorological Visibility (Met. Vis.) of 1400 m and an illuminance threshold of $10^{-6.1}$ lux, each feature of the system is visible and usable at night from ranges in accordance with paragraphs 1.5, 1.6 and 1.7.
- 1.5 The perimeter lights are to be visible at night from a minimum range of 0.75 NM.
- 1.6 The TD/PM Circle on the helideck is to be visible at night from a minimum range of 0.5 NM.
- 1.7 The Heliport Identification Marking ('H') is to be visible at night from a minimum range of 0.25 NM.
- 1.8 The minimum ranges at which the TD/PM Circle and 'H' are visible and usable (see paragraphs 1.6 and 1.7) should still be achieved even where a correctly fitted landing net covers the lighting.
- 1.9 The design of the perimeter lights, TD/PM Circle and 'H' should be such that the luminance of the perimeter lights is equal to or greater than that of the TD/PM Circle segments, and the luminance of the TD/PM Circle segments is equal to or greater than that of the 'H'.
- 1.10 The design of the TD/PM Circle and 'H' should include a facility to increase their intensity to twice the minimum figures given in this specification to permit a once-off (tamper proof) adjustment at installation; the maximum figures should not be exceeded. The purpose of this facility is to ensure adequate performance at installations with high levels of background lighting without risking glare at less well-lit installations. The TD/PM Circle and 'H' should be adjusted together using a single control to ensure that the balance of the overall lighting system is maintained in both the 'standard' and 'bright' settings.

2 Definitions

- 2.1 The following definitions should apply:

- 2.1.1 **Lighting Element**

A lighting element is a light source within a segment or sub-section and may be individual (e.g. a Light Emitting Diode (LED)) or continuous (e.g. fibre optic cable, electroluminescent panel). An individual lighting element may consist of a single light source or multiple light sources arranged in a group or cluster.

- 2.1.2 **Segment**

A segment is a section of the TD/PM Circle lighting. For the purposes of this specification, the dimensions of a segment are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses.

- 2.1.3 **Sub-Section**

A sub-section is an individual section of the 'H' lighting. For the purposes of this specification, the dimensions of a sub-section are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses.

3 The Perimeter Light Requirement

3.1 Configuration

Perimeter lights, spaced at intervals of not more than 3 m, should be fitted around the perimeter of the landing area of the helideck.

3.2 Mechanical Constraints

For any helideck where the D-value is greater than 16.00 m, the perimeter lights when installed should not exceed a height of 25 cm above the surface of the helideck. Where a helideck has a D-value of 16.00 m or less, the perimeter lights when installed should not exceed a height of 5 cm above the surface of the helideck.

3.3 Light Intensity

The minimum light intensity profile is given in Table 2 below:

Table 2 Minimum Light Intensity Profile for Perimeter Lights

Elevation	Azimuth	Intensity (min)
0° to 10°	-180° to +180°	30 cd
>10° to 20°	-180° to +180°	15 cd
>20° to 90°	-180° to +180°	3 cd

No perimeter light should have a luminous intensity of greater than 60 cd at any angle of elevation. Note that the design of the perimeter lights should be such that the luminance of the perimeter lights is equal to or greater than that of the TD/PM Circle segments.

3.4 Colour

The colour of the light emitted by the perimeter lights should be green, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.1.1(c), whose chromaticity lies within the following boundaries:

Yellow boundary $x = 0.360 - 0.080y$
White boundary $x = 0.650y$
Blue boundary $y = 0.390 - 0.171x$

3.5 Serviceability

The perimeter lighting is considered serviceable provided that at least 90% of the lights are serviceable, and providing that any unserviceable lights are not adjacent to each other.

4 The Touchdown/Positioning Marking Circle Requirement

4.1 Configuration

The lit TD/PM Circle should be superimposed on the yellow painted marking. It should comprise one or more concentric circles of at least 16 discrete lighting segments, of 40 mm minimum width. A single circle should be positioned at the mean radius of the painted circle. Multiple circles should be symmetrically disposed about the mean radius of the painted circle. The lighting segments should be of such a length as to provide coverage of between 50% and 75% of the circumference and be equidistantly placed with the gaps between them not less than 0.5 m. The mechanical housing should be coloured yellow – see CAP 437, Chapter 4, paragraph 2.11.

4.2 Mechanical Constraints

- 4.2.1 The height of the segments and lighting elements of the TD/PM Circle and any associated cabling should be as low as possible and should not exceed 25 mm. The overall height of the system, taking account of any mounting arrangements, should be kept to a minimum. So as not to present a trip hazard, the segments should not present any vertical outside edge greater than 6 mm without chamfering at an angle not exceeding 30° from the horizontal.
- 4.2.2 The overall effect of the lighting strips and cabling on deck friction should be minimised. Wherever practical, the surfaces of the lighting segments should meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.
- 4.2.3 The TD/PM Circle lighting components, fitments and cabling should be able to withstand a pressure of at least 1,655 kPa (240 lb/in²) and ideally 2,280 kPa (331 lb/in²) without damage.

4.3 Intensity

- 4.3.1 The light intensity for each of the lighting segments, when viewed at angles of azimuth over the range +80° to -80° from the normal to the longitudinal axis of the strip (see Figure 1), should be as defined in Table 3.

Table 3 Light Intensity for Lighting Segments on the TD/PM Circle

Elevation	Intensity	
	Min	Max
>0° to 10°	As a function of segment length as defined in Figure 2	60 cd
>10° to 20°	25% of min intensity >0° to 10°	45 cd
>20° to 90°	5% of min intensity >0° to 10°	15 cd

- 4.3.2 For the remaining angles of azimuth on either side of the longitudinal axis of the segment, the maximum intensity should be as defined in Table 3.
- 4.3.3 Note that the intensity of each lighting segment should be nominally symmetrical about its longitudinal axis.
- 4.3.4 Note also that the design of the TD/PM Circle should be such that the luminance of the TD/PM Circle segments is equal to or greater than the sub-sections of the 'H'.

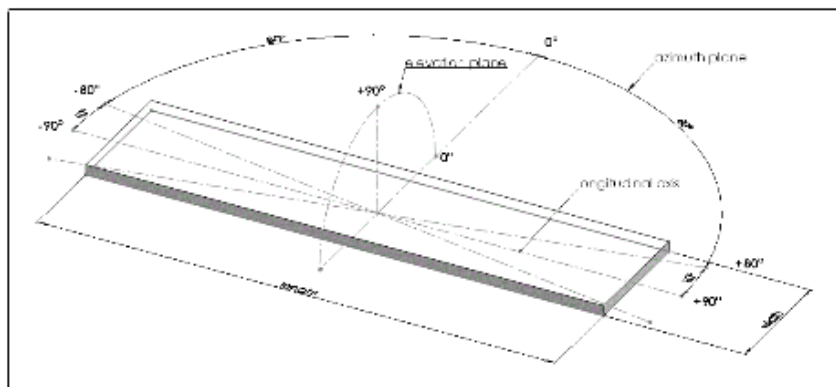


Figure 1 TD/PM Segment Measurement Axis System

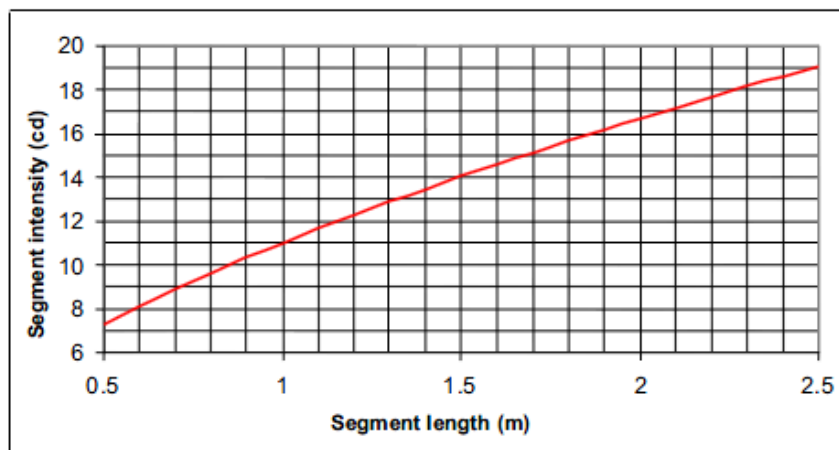


Figure 2 TD/PM Segment Intensity versus Segment Length

NOTE: Given the minimum gap size of 0.5 m and the minimum coverage of 50%, the minimum segment length is 0.5 m. The maximum segment length depends on deck size, but is given by selecting the minimum number of segments (16) and the maximum coverage (75%).

- 4.3.5 If a segment is made up of a number of individual lighting elements (e.g. LEDs) then they should be the same nominal performance (i.e. within manufacturing tolerances) and be equidistantly spaced throughout the segment to aid textural cueing. Minimum spacing should be 3 cm and maximum spacing 10 cm. The minimum intensity of each lighting element (i) should be given by the formula:

$$i = I / n$$

where: I = required minimum intensity of segment at the 'look down' (elevation) angle (see Table 3).

n = the number of lighting elements within the segment.

- 4.3.6 If the segment comprises a continuous lighting element (e.g. fibre optic cable, electroluminescent panel), then to achieve textural cueing at short range, the element should be masked at 3 cm intervals on a 1:1 mark:space ratio.

4.4 Colour

The colour of the light emitted by the TD/PM Circle should be yellow, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.1.1(b), whose chromaticity lies within the following boundaries:

Red boundary	$y = 0.382$
White boundary	$y = 0.790 - 0.667x$
Green boundary	$y = x - 0.120$

4.5 Serviceability

The TD/PM Circle is considered serviceable provided that at least 90% of the segments are serviceable. A TD/PM Circle segment is considered serviceable provided that at least 90% of the lighting elements are serviceable.

5 The Heliport Identification Marking Requirement

5.1 Configuration

- 5.1.1 The lit Heliport Identification Marking ('H') should be superimposed on the 4 m x 3 m white painted 'H' (limb width 0.75 m). The limbs should be lit in outline form as shown in Figure 3.

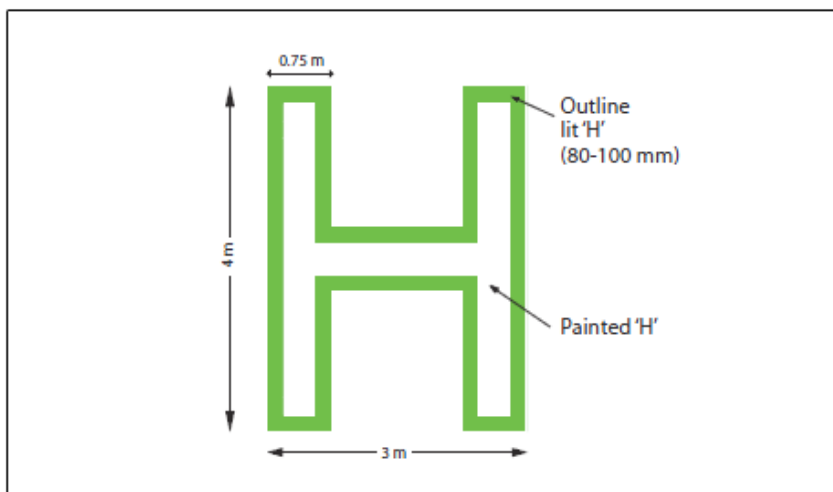


Figure 3 Configuration and Dimensions of Heliport Identification Marking 'H'

- 5.1.2 An outline lit 'H' should comprise sub-sections of between 80 mm and 100 mm wide around the outer edge of the painted 'H' (see Figure 3). There are no restrictions on the length of the sub-sections, but the gaps between them should not be greater than 10 cm. The mechanical housing should be coloured white – see CAP 437, Chapter 4, paragraph 2.11.

5.2 Mechanical Constraints

- 5.2.1 The height of the subsections and lighting elements of the lit 'H' and any associated cabling should be as low as possible and should not exceed 25 mm. The overall height of the system, taking account of any mounting arrangements, should be kept to a minimum. So as not to present a trip hazard, the lighting strips should not present any vertical outside edge greater than 6 mm without chamfering at an angle not exceeding 30° from the horizontal.
- 5.2.2 The overall effect of the lighting sub-sections and cabling on deck friction should be minimised. Wherever practical, the surfaces of the lighting sub-sections should meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.
- 5.2.3 The 'H' lighting components, fitments and cabling should be able to withstand a pressure of at least 1,655 kPa (240 lb/in²) and ideally 2,280 kPa (331 lb/in²) without damage.

5.3 Intensity

- 5.3.1 The intensity of the lighting along the 4 m edge of an outline 'H' over all angles of azimuth is given in Table 4 below.

Table 4 Light Intensity of the 4 m Edge of the 'H'

Elevation	Intensity	
	Min	Max
2° to 12°	3.5 cd	60 cd
>12° to 20°	0.5 cd	30 cd
>20° to 90°	0.2 cd	10 cd

NOTE: For the purposes of demonstrating compliance with this specification, a sub-section of the lighting forming the 4 m edge of the 'H' may be used. The minimum length of the sub-section should be 0.5 m.

- 5.3.2 The 'H' should consist of the same lighting element material throughout.

- 5.3.3 If the 'H' is made up of individual lighting elements (e.g. LEDs) then they should be of nominally identical performance (i.e. within manufacturing tolerances) and be equidistantly spaced within the limb to aid textural cueing. Minimum spacing should be 3 cm and maximum spacing 10 cm. The intensity of each lighting element (i) should be given by the formula:

$$i = I / n$$

where: I = intensity of the segment between 2° and 12°.

n = the number of lighting elements within the segment.

- 5.3.4 If the 'H' is constructed from a continuous lighting element (e.g. fibre optic cables or panels, electroluminescent panels), the luminance (B) of the 4 m edge of the outline 'H' should be given by the formula:

$$B = I / A$$

where: I = intensity of the limb (see Table 4).

A = the projected lit area at the 'look down' (elevation) angle.

5.4 Colour

The colour of the 'H' should be green, as defined in ICAO Annex 14 Volume 1 Appendix 1, paragraph 2.1.1(c), whose chromaticity lies within the following boundaries:

Yellow boundary $x = 0.360 - 0.080y$

White boundary $x = 0.650y$

Blue boundary $y = 0.390 - 0.171x$

5.5 Serviceability

The 'H' is considered serviceable provided that at least 90% of the sub-sections are serviceable. An 'H' sub-section is considered serviceable provided that at least 90% of the lighting elements are serviceable.

6 Other Considerations

- 6.1 All lighting components and fitments should meet safety regulations relevant to a helideck environment such as explosion proofing (Zone 1 or 2 as appropriate) and flammability (by a notified body in accordance with the ATEX directive).
- 6.2 All lighting components and fitments installed on the surface of the helideck should be resistant to attack by fluids such as fuel, hydraulic fluid, and those used for de-icing, cleaning and fire-fighting. In addition they should be resistant to UV light, rain, sea spray, guano, snow and ice. Installation arrangements for the lighting components and fitments should be acceptable to the CAA.
- 6.3 All lighting components and fitments that are mounted on the surface of the helideck should be able to operate within a temperature range appropriate for the local ambient conditions.
- 6.4 All lighting components and fitments should, as a minimum, meet IEC International Protection (IP) standard IP66, i.e. dust tight and resistant to powerful water jetting.
- 6.5 All cabling should utilise low smoke/toxicity, flame retardant cable. Any through-the-deck cable routing and connections should use sealed glands, type approved for helideck use.
- 6.6 All lighting components should be tested by an independent test house. The optical department of this test house should be accredited according to ISO/IEC 17025.
- 6.7 Provision should be included in the design of the system to allow for the drainage of the helideck, in particular the area inside the TD/PM Circle.