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/in$^{2)}$ and ideally 2,280 kPa (331 lb/in^2) 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'.

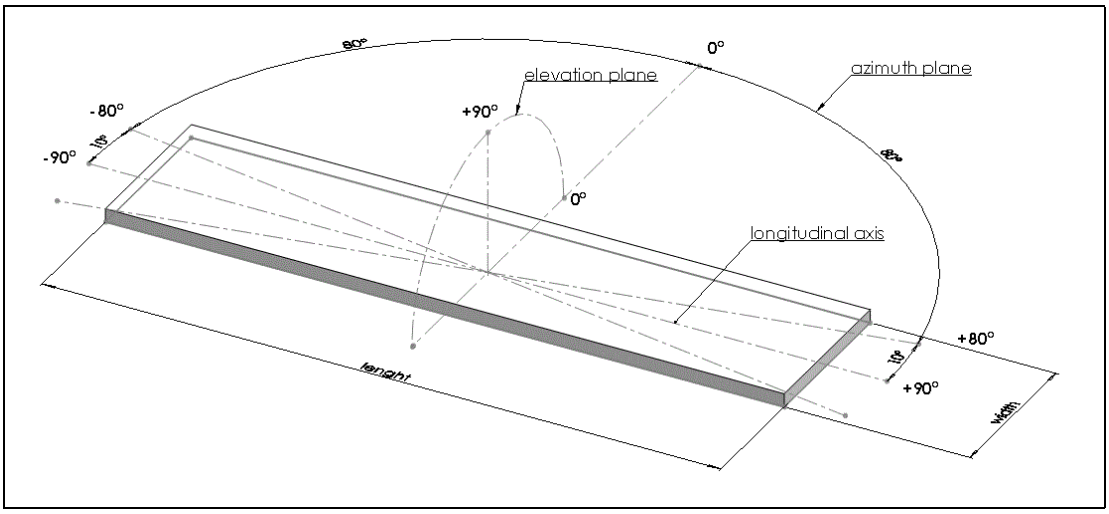

Figure 1 TD/PM Segment Measurement Axis System

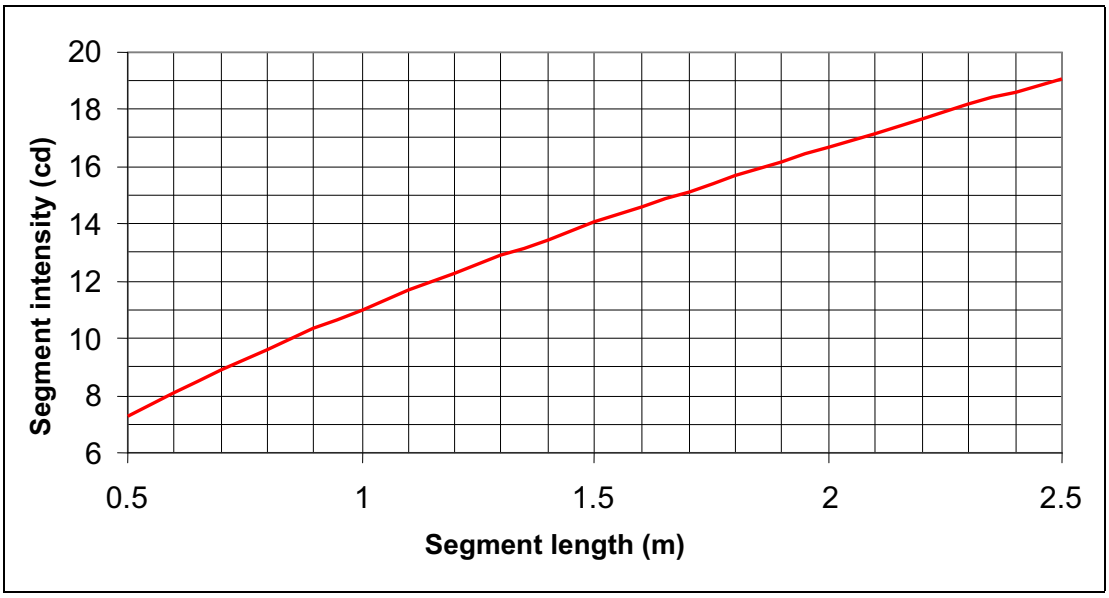

Figure 2 TD/PM Segment Intensity versus Segment Length

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.

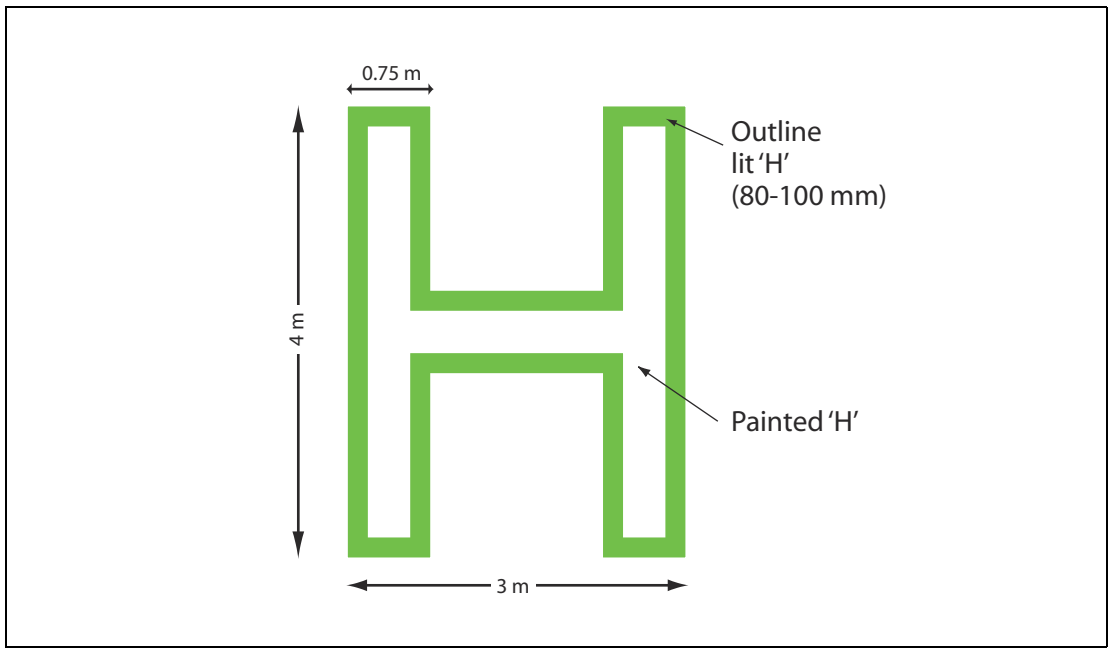

Figure 3 Configuration and Dimensions of Heliport Identification Marking 'H'

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/in$^{2)}$ and ideally 2,280 kPa (331 lb/in^{2}) 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.