ANNEX 6 TECHNICAL STANDARD FOR HELICOPTER LANDING AREAS

Annex 6: Section 1 - Introduction

1.0 Applicability

1.1 This Annex is written so that it provides minimum standards for helicopter landing areas on-board commercial vessels certificated to this Code.

1.2 Operational issues surrounding the landing of helicopters to landing areas on-board LY2 vessels, including flight operation limitations should be directed to the National Aviation Inspection Body (see National Annex).

Annex 6: Section 2 – General Considerations

1.0 General Considerations

1.1 Requirements for helicopter landing areas on vessels results from the need to ensure that helicopters are afforded sufficient space to be able to operate safely at all times in the varying conditions experienced.

1.2 In order to ensure safe operation it is envisaged that limitations regarding the availability of the platform will be applied by either the National Aviation Inspection Body or Classification Society on behalf of the Administration.

1.3 The helicopter's performance requirements and handling techniques are contained in the Rotorcraft Flight Manual and/or the operator's Operations Manual.

Annex 6: Section 3 –Helicopter Landing Areas – Physical Characteristics

1.0 General

1.1 This chapter outlines physical requrements for the characteristics of helicopter landing areas on large yachts. As part of the verification of landing area compliance, it should be stated for each helicopter landing area the maximum size of helicopter in terms of D-value and the maximum take-off weight of the heaviest helicopter in terms of “t” value for which each landing area is certificated with regard to size and strength. The following plans and particulars should be submitted to the National Aviation Inspection Body, Certifying Authority and Administration for approval:

.1 Hangar general arrangement (showing dimensions and structural considerations).

.2 Helicopter lift, hoist, and movement arrangements (if appropriate).

.3 Structural fire protection.

.4 Fire detection and extinguishing arrangements

1.2 The criteria which follow are based on helicopter size and weight. This data is summarised in Table 1 below. Where skid fitted helicopters are used routinely, landing nets are not recommended.

Table 1- D-Value and Helicopter Type Criteria

Type	D value (m)	Perimeter ‘D’ marking	Rotor diameter (m)	Max weight (kg)	‘t’ value	Landing net size
Eurocopter EC120	11.52	12	10.00	1715	1.7	Not required
Bell 206 B3	11.96	12	10.16	1451/1519	1.5	Not required
Bell 206 L4	12.91	13	11.28	2018	2.0	Not required
Bell 407	12.61	13	10.66	2268	2.3	Not required
Eurocopter EC130	12.64	13	10.69	2400	2.4	Not required
Eurocopter AS350B3	12.94	13	10.69	2250	2.3	Not required
Eurocopter AS355	12.94	13	10.69	2600	2.6	Not required
Eurocopter EC135	12.10	12	10.20	2720	2.7	Not required
Agusta A119	13.02	13	10.83	2720	2.7	Not required
Bell 427	13.00	13	11.28	2971	3.0	Not required
Eurocopter EC145	13.03	13	11.00	3585	3.6	Not required
Agusta A109	13.04	13	11.00	2850	2.9	Small
Agusta Grand	12.96	13	10.83	3175	3.2	Small
Eurocopter AS365 N3	13.73	14	11.94	4300	4.3	Small
Eurocopter EC155 B1	14.30	14	12.60	4920	4.9	Medium
Bell 430	15.29	15	12.80	4218	4.2	Medium
Sikorsky S76	16.00	16	13.40	5318	5.3	Medium
Agusta Westland 139	16.66	17	13.80	6400	6.4	Medium
Bell 412	17.10	17	14.02	5398	5.4	Not required

2.0 Helicopter Landing Area Design Considerations – Environmental Effects

2.1 Introduction

2.1.1 The safety of helicopter flight operations can be seriously degraded by environmental effects that may be present around vessels. The term “environmental effects” describes the effects of the vesse, its systems, and forcesin the surrounding environment, which result in a degraded local environment in which the helicopter is expected to operate. These environmental effects are typified by structure-induced turbulence, and turbulence / thermal effects caused by exhaust emissions. Controls in the form of platform availability restrictions may be necessary and should be imposed via the National Aviation Inspection Body or Classification Society. Such restrictions can be minimised by careful attention to the design and layout of the vessel topsides and, in particular, the location of the helicopter landing area.

2.2 Guidance for Landing Area Design Considerations

2.2.1 A review of offshore helicopter landing area environmental issues (see CAA Paper 99004) concluded that many of the decisions leading to poor helicopter landing area operability had been made in the very early stages of design, and recommended that it would be easier for designers to avoid these pitfalls if comprehensive helicopter landing area design guidance was made available to run in parallel with the platform requirements. As part of the subsequent research programme, material covering environmental effects on offshore helicopter landing area operations was commissioned by the UK Health and Safety Executive (HSE) and the UK Civil Aviation Authority (CAA). This material is presented in CAA Paper 2004/02: “Helicopter landing area Design Considerations – Environmental Effects” and is available on the Publications section of the UK CAA website at **www.caa.co.uk**. Designers of helicopter landing areas should consult Uk CAA Paper 2004/02 at the earliest possible stage of the design process.

2.2.2 The objective of CAA Paper 2004/02 is to help designers of helicopter landing areas to create topside designs and helicopter landing area locations that are safe and ‘friendly’ to helicopter operations by minimising exposure to environmental effects. It is hoped that, if used from the outset of the design process when facilities are first being laid out, this manual will prevent or minimise many helicopter landing area environmental problems at little or no extra cost to the design or construction of the vessel.

2.3.2 All new helicopter landing areas, or modifications to existing topside arrangements which could potentially have an effect on the environmental conditions around an existing helicopter landing area, or helicopter landing areas where operational experience has highlighted potential airflow problems should be subject to appropriate wind tunnel testing or CFD studies to establish the wind environment in which helicopters will be expected to operate. As a general rule the standard deviation of the vertical airflow velocity should be limited to 2.4m/s. The helicopter pilot/operator and National Aviation Inspection Body should be informed at the earliest opportunity of any wind conditions for which this criterion is not met which would allow the appropriate platform availability restrictions to be defined.

2.3.3 Designers of helicopter landing areas should commission a survey of ambient temperature rise based on a Gaussian dispersion model and supported by wind tunnel tests or CFD studies for new build helicopter landing areas, modifications to existing topside arrangements, or for helicopter landing areas where operational experience has highlighted potential thermal problems. When the results of such modelling and/or testing indicate that there may be a rise of air temperature of more than 2°C (averaged over a 3 second time interval), the helicopter pilot/operator and National Aviation Inspection Body should be consulted at the earliest opportunity so that appropriate platform availability restrictions may be applied if necessary.

3.0 Size of Landing Area and Obstacle Protected Surfaces

3.1 For any particular type of single main rotor helicopter, the helicopter landing area should be sufficiently large to contain a circle of diameter [D] equal to the largest dimension of the helicopter when the rotors are turning. This D circle should be totally unobstructed (see Table 1 for D values). Due to the actual shape of most helicopter landing areas the D circle will be 'imaginary' but the helicopter landing area shape should be capable of accommodating such a circle within its physical boundaries.

3.2 From any point on the periphery of the above mentioned D circle an obstacle-free approach and take-off sector should be provided which totally encompasses the safe landing area (and D circle) and which extends over a sector of at least 210°. Within this sector, and out to a distance of 1000 metres from the periphery of the landing area, only the following items may exceed the height of the landing area, but should not do so by more than 25 centimetres:

- the guttering (associated with the requirements in paragraph 4.2);
- the lighting required by Secton 4;
- the outboard edge of the safety net required in paragraph 6.0;
- the foam monitors;
- those handrails and other items associated with the landing area which are incapable of complete retraction or lowering for helicopter operations.

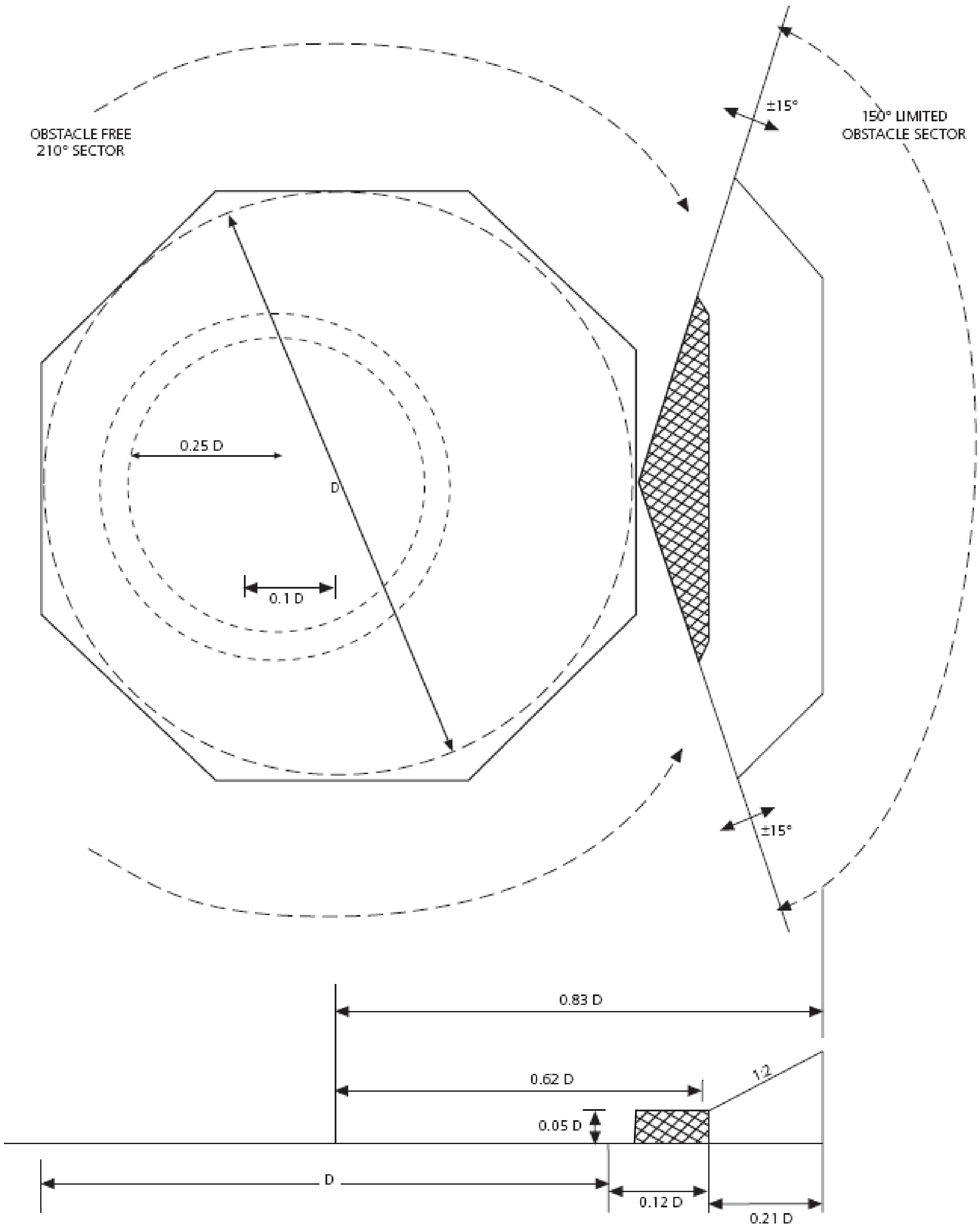
3.3 The bisector of the 210° obstacle free sector (OFS) should normally pass through the centre of the D circle. The sector may be 'swung' by up to 15°as shown in Figure 1 below. Acceptance of the 'swung' criteria will normally only be applicable to existing vessels.

3.3.5 If, for an existing vessel, the 210° obstacle free sector is swung, then it would be normal practice to swing the 180° falling 5:1 gradient by a corresponding amount to indicate, and align with, the swung OFS.

3.4 The diagram at Figure 1 shows the extent of the two segments of the 150° Limited Obstacle Sector (LOS) and how these are measured from the centre of the (imaginary) 'D' Circle and from the perimeter of the safe landing area (SLA). This diagram assumes, since helicopter landing areas are designed to the minimum requirement of accommodating a [1 'D'] Circle, that the 'D' Circle perimeter and SLA perimeter are coincidental. No objects above 0.05D are permitted in the first (hatched area in Figure 1) segment of the LOS. The first segment extends out to 0.62D from the centre of the 'D' Circle, or 0.12D from the SLA perimeter marking. The second segment of the LOS, in which no obstacles are permitted within a rising 1:2 slope from the upper surface of the first segment, extends out to 0.83D from the centre of the 'D' Circle, or a further 0.21D from the edge of the first segment of the LOS.

The exact point of origin of the LOS is assumed to be at the periphery of the 'D' Circle.

Figure 1 - Obstacle Limitation showing position of Aiming Circle



3.4.1 Some helicopter landing areas are able to accommodate a SLA which covers a larger area than the declared ‘D’ value; a simple example being a rectangular deck with the minor dimension able to contain the ‘D’ Circle. In such cases it is important to ensure that the origin of the LOS (and OFS) is at the SLA perimeter as marked by the perimeter line. Any SLA perimeter should guarantee the obstacle protection afforded by both segments of the LOS. The respective measurements of 0.12D from the SLA perimeter line, plus a further 0.21D are to be applied. On these larger decks there is thus some flexibility in deciding the position of the perimeter line and SLA in order to meet the LOS requirements and when considering the position and height of fixed obstacles. Separating the origin of the LOS from the perimeter of the ‘D’ Circle in Figure 1 and moving it to the right of the page will demonstrate how this might apply on a rectangular SLA.

3.4.2 The extent of the LOS segments will, in all cases, be lines parallel to the SLA perimeter line and follow the boundaries of the SLA perimeter (see Figure 1 above). Only in cases where the SLA perimeter is circular will the extent be in the form of arcs to the ‘D’ circle. However, taking the example of an octagonal SLA as drawn at Figure 1, it would be possible to replace the angled corners of the two LOS segments with arcs of 0.12D and 0.33D centred on the two adjacent corners of the SLA; thus cutting off the angled corners of the LOS segments. If these arcs are applied they should not extend beyond the two corners of each LOS segment so that minimum clearances of 0.12D and 0.33D from the corners of the SLA are maintained. Similar geometric construction may be made to a square or rectangular SLA but care should be taken to ensure that the LOS protected surfaces minima can be satisfied from all points on the SLA perimeter.

3.5 Whilst application of the criteria in paragraph 3.2 above will ensure that no unacceptable obstructions exist above the helicopter landing area level over the whole 210° sector, it is necessary to consider the possibility of helicopter loss of height due to power unit failure during the latter stages of the approach or early stages of take-off. Accordingly, a clear zone should be provided below landing area level on all helicopter landing areas. This falling 5:1 protected surface should be provided over **at least** 180° and ideally it should cover the whole of the 210° OFS, with an origin at the centre of the ‘D’ Circle, and extending outwards for 1000 metres (see Figure 2). All objects that are underneath anticipated final approach paths should be assessed.

3.6 For practical purposes the falling obstacle limitation surface can be assumed to be defined from points on the outboard edge of the helicopter landing area perimeter safety netting supports (1.5 metres from deck edge). Minor infringements of the surface by foam monitor platforms or access/escape routes may be accepted only if they are essential to the safe operation of the helicopter landing area but these infringements may also attract platform availability restrictions.

Figure 2 Obstacle Free Areas – Below Landing Area Level)

Comment: Figure 2 (elevation) will be amended to ensure that the 5:1 falling gradient denotes its origin from the edge of the 1.5m safety net rather than the edge of the load bearing area (as presently implied) – see 'Note' below.

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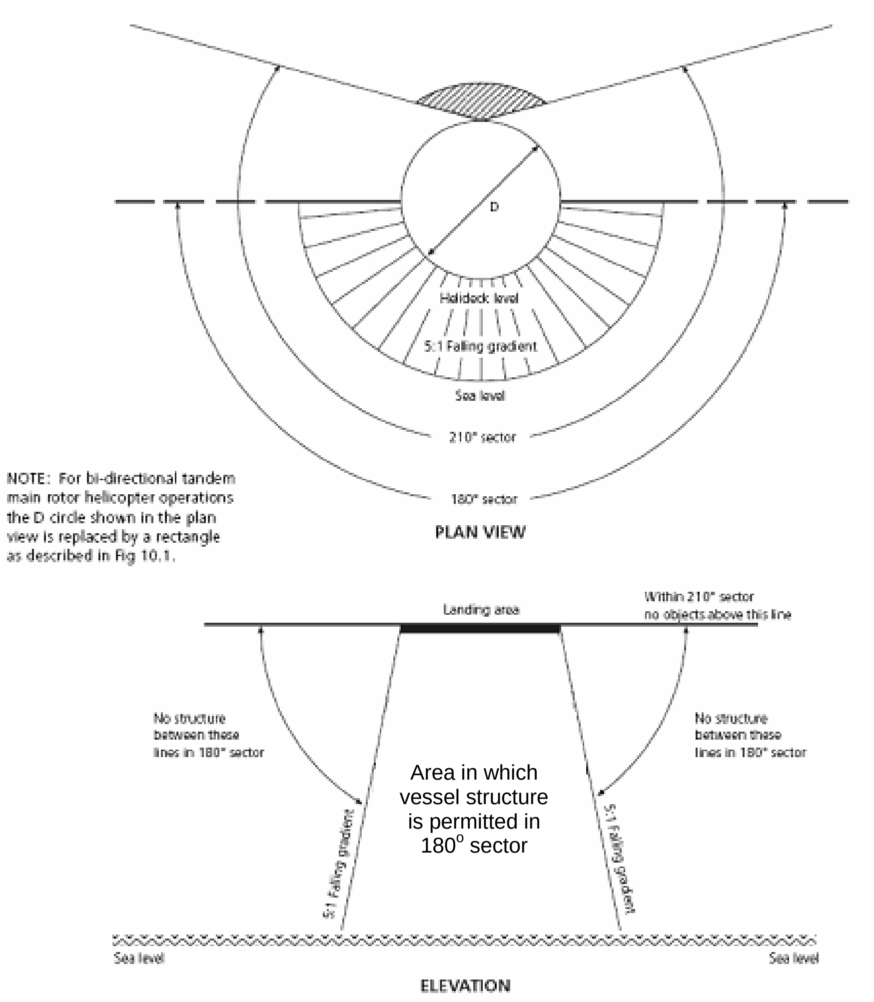


4.0 Landing Area Surface

4.1 The landing area should have an overall coating of non-slip material and all markings on the surface of the landing area should be made with the same non-slip materials. Whilst extruded section or grid construction aluminium (or other) decks may incorporate adequate non-slip profiles in their design, it is preferable that they are also coated with a non-slip material unless adequate friction properties have been designed into the construction. It is important that the friction properties exist in all directions. Over-painting friction surfaces on such designs may compromise the friction properties. Recognised surface friction material is available commercially.

4.2 Helicopter landing areas should be cambered to a maximum gradient of 1:100. Any distortion of the helicopter landing area surface due to, for example, loads from a helicopter at rest should not modify the landing area drainage system to the extent of allowing spilled fuel to remain on the deck. A system of guttering should be provided around the perimeter to prevent spilled fuel from falling on to other parts of the vessel and to conduct the spillage to an appropriate drainage system. The capacity of the drainage system should be sufficient to contain the maximum likely spillage of fuel on the deck. The calculation of the amount of spillage to be contained should be based on an analysis of helicopter type, fuel capacity, typical fuel loads and uplifts. The design of the drainage system should preclude blockage by debris. The helicopter landing area should be properly sealed so that spillage will only route into the drainage system.

4.3 For operations in adverse weather conditions a tautly-stretched rope netting should be provided to aid the landing of helicopters with wheeled undercarriages. The intersections should be knotted or otherwise secured to prevent distortion of the mesh. It is preferable that the rope be 20 mm diameter sisal, with a maximum mesh size of 200 mm. The rope should be secured every 1.5 metres round the landing area perimeter and tensioned to at least 2225 N. Netting made of material other than sisal will be considered but netting should not be constructed of polypropylene type material which is known to rapidly deteriorate and flake when exposed to weather. Tensioning to a specific value may be impractical offshore. As a rule of thumb, it should not be possible to raise any part of the net by more than approximately 250 mm above the helicopter landing area surface when applying a vigorous vertical pull by hand. The location of the net should ensure coverage of the area of the Aiming Circle but should not cover the helicopter landing area Identification marking or ‘t’ value markings. Some nets may require modification to outboard corners so as to keep the Identification Marking uncovered. In such circumstances the dimensions given in Table 2 below may be modified.

4.4 There are three sizes of netting as listed below in Table 2. The minimum size depends upon the type of helicopter for which the landing area is to be used as indicated in Table 1. Sizes are presented here for guidance only and nets of other sizes may be acceptable providing arrangements cover the whole of the aiming circle without obscuring the landing area identification markings.

Table 2 - Helicopter Deck Netting

Small	9 metres by 9 metres
Medium	12 metres by 12 metres
Large	15 metres by 15 metres

5.0 Helicopter Tie-Down Points

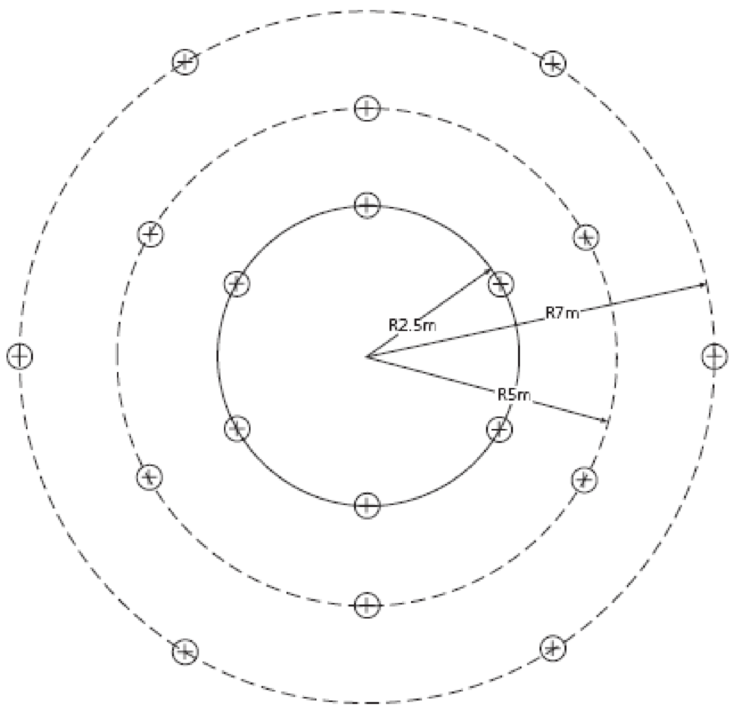
5.1 Sufficient flush fitting (when not in use) or removable semi-recessed tie-down points should be provided for securing the maximum sized helicopter for which the helicopter landing area is designed. They should be so located and be of such strength and construction to secure the helicopter when subjected to expected weather conditions. They should also take into account the inertial forces resulting from the movement of the vessel.

5.2 Tie-down rings should be compatible with the dimensions of tie-down strop attachments. Tie-down rings and strops should be of such strength and construction so as to secure the helicopter when subjected to expected weather conditions. The maximum bar diameter of the tie-down ring should be compatible with the strop hook dimension of the tie down strops carried by the helicopter operator.

An example of a suitable tie-down configuration is shown at Figure 3. The National

Aviation Inspection Body or helicopter operator will provide guidance on the configuration of the tie-down points for specific helicopter types.

Figure 3 Example of Suitable Tie-down Configuration



NOTES:
1 The tie-down configuration should be based on the centre of the Aiming Circle marking.
2 Additional tie-downs will be required in a parking area.
3 The outer circle is not required for 'D' values of less than 22.2m.

6.0 Safety Net

6.1 Safety nets for personnel protection should be installed around the landing area except where adequate structural protection against falls exists. The netting used should be of a flexible nature, with the inboard edge fastened level, just below the edge of the helicopter landing area. The net itself should extend 1.5 metres in the horizontal plane and be arranged so that the outboard edge is slightly above the level of the landing area, but by not more than 0.25 metres, so that it has an upward and outward slope of at least 10°.

6.2 A safety net designed to meet these criteria should not act as a trampoline giving a 'bounce' effect. Where lateral or longitudinal centre bars are provided to strengthen the net structure they should be arranged and constructed to avoid causing injury to persons falling on to them. The ideal design should produce a 'hammock' effect which should securely contain a body falling, rolling or jumping into it, without serious injury. When considering the securing of the net to the structure and the materials used, care should be taken that each segment will meet adequacy of purpose considerations. Polypropylene deteriorates over time; various wire meshes have been shown to be suitable if properly installed.

6.3 A full risk assessment to control the restricted movement of personnel on the helicopter landing area should be submitted for approval by the National Aviation Inspection Body and Classification Society to demonstrate that safe passenger movement may take place without endangering the safety of the helicopter or the life of personnel on-board. The risk assessment of passenger movement described above must be used to demonstrate full mitigation of associated risks should non-fitment of a safety net as described in 6.1 and 6.2 above be requested.

7.0 Access Points

7.1 Many helicopters have passenger access on one side only and helicopter landing orientation in relation to landing area access points becomes important because it is necessary to ensure that embarking and disembarking passengers are not required to pass around the helicopter tail rotor, or under the main rotor of those helicopters with a low profile rotor, should a ‘rotors-running turn-round’ be conducted.

7.2 There should be a minimum of two access/egress routes to the helicopter landing area. The arrangements should be optimised to ensure that, in the event of an accident or incident on the helicopter landing area, personnel will be able to escape upwind of the landing area. Adequacy of the emergency escape arrangements from the helicopter landing area should be included in any evacuation, escape and rescue analysis for the vessel, and may require a third escape route to be provided.

7.3 Where foam monitors are co-located with access points care should be taken to ensure that no monitor is so close to an access point as to cause injury to escaping personnel by operation of the monitor in an emergency situation.

7.4 Where handrails associated with landing area access/escape points exceed the height limitations given at paragraph 3.2 they should be retractable, collapsible or removable. When retracted, collapsed or removed the rails should not impede access/egress. Handrails which are retractable, collapsible and removable should be painted in a contrasting colour scheme. Procedures should be in place to retract, collapse, or remove them prior to helicopter arrival. Once the helicopter has landed, and the crew have indicated that passenger movement may commence, the handrails may be raised and locked in position. The handrails should be retracted, collapsed, or removed again prior to the helicopter taking-off

7.5 The helicopter crew will switch off the anti-collision lights to indicate that the movement of passengers and/or freight may take place (under the control of the Helicopter Landing Officer HLO). Vessel safety notices placed on approach to the helicopter landing area access should advise personnel not to approach the helicopter when the anti-collision lights are on.

Annex 6: Section 4 - Visual Aids

1.0 General

1.1 The following sections outline the requirements for helicopter landing area markings which should be permanantly painted on the deck. Plans of the marking arrangements including dimensions should be submitted to the National Aviation Inspection Body and Classification Society for approval.

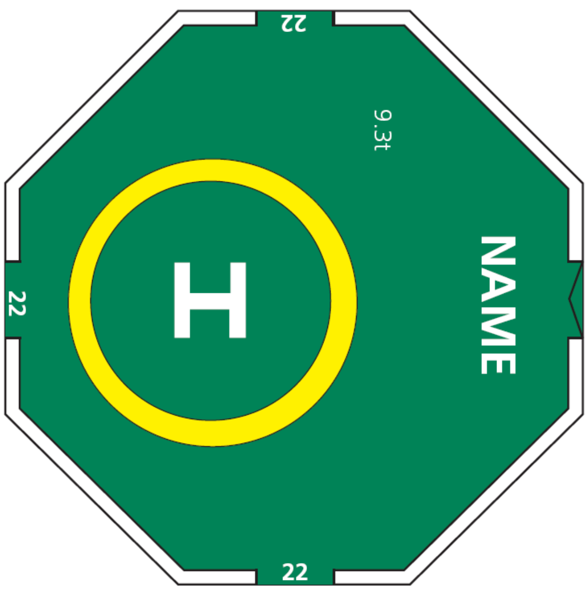
1.2 Helicopter landing area perimeter line marking and lighting serves to identify the limits of the Safe Landing Area (SLA) for day and night operations.

1.3 A wind direction indicator (windsock) should be provided during helicopter operations and located so as to indicate the clear area wind conditions at the vessel location. It is often inappropriate to locate the windsock as close to the helicopter landing area as possible where it may compromise obstacle protected surfaces, create its own dominant obstacle or be subjected to the effects of turbulence from structures resulting in an unclear wind indication. The windsock should be illuminated for night operations.

2.0 Helicopter Landing Area Markings (See Figure 1 Below)

2.1 The colour of the helicopter landing area should be a contrasting colour to the rest of the vessel's deck (preferrably dark grey or dark green). The perimeter of the SLA should be clearly marked with a white painted line 0.3 metres wide. (See Section 3, paragraph 4.1).

Figure 1 - Markings (Single Main Rotor Helicopters)



2.1.1 The light grey colour of aluminium may be acceptable in specific helicopter landing area applications where these are agreed with the National Aviation Inspection Body. This should be discussed in the early design phase. In such cases the conspicuity of the helicopter landing area markings may need to be enhanced by, for example, outlining the deck marking lines and characters with a thin black line. Alternatively, conspicuity may be enhanced by overlaying white markings on a painted black background.

2.2 The origin of the 210° obstacle-free sector for approach and take-off as specified in Section 3 should be marked on the helicopter landing area by a black chevron, each leg being 0.79 metres long and 0.1 metres wide forming the angle in the manner shown in Figure 2 below. On minimum sized helicopter landing areas where there is no room to place the chevron where indicated, the chevron marking, but **not** the point of origin, may be displaced towards the D circle centre. Where the obstacle-free sector is swung in accordance with the provision of Section 3 paragraph 3.3 this should be reflected in the alignment of the chevron. The purpose of the chevron is to delineate the separation of the 210° OFS and 150° LOS. Prior to the helicopter being given clearance to land, the HLO should ensure that there are no obstacles in the 210° OFS. The black chevron may be painted on top of the (continuous) white perimeter line to achieve maximum clarity for the helicopter landing area crew.

2.3 The actual D-value of the helicopter landing area (See Section 3, paragraph 3.1) should be painted on the helicopter landing area inboard of the chevron in alphanumeric symbols of 0.1 metres high.

2.4 The helicopter landing area D-value should also be marked around the perimeter of the helicopter landing area in the manner shown in Figure 1 in a colour contrasting (preferably white: avoid black or grey for night use) with the helicopter landing area surface. The D-value should be to the nearest whole number with 0.5 rounded down e.g. 18.5 marked as 18 (see Section 3 Table 1).

2.5 A maximum allowable mass marking should be marked on the helicopter landing area in a position which is readable from the preferred final approach direction i.e. towards the obstacle-free sector origin. The marking should consist of a two or three digit number expressed to one decimal place rounded to the nearest 100 kg and followed by the letter ‘t’ to indicate the allowable helicopter weight in tonnes (1000 kg). The height of the figures should be 0.9 metres with a line width of approximately 0.12 metres and be in a colour which contrasts with the helicopter landing area surface (preferably white: avoid black or grey).

2.6 An aiming circle (touchdown / positioning marking) for each helicopter landing area should be provided as follows: (see Figures 1 and 3).

2.6.1 The marking should be a yellow circle with an inner diameter of 0.5 of the certificated D-value of the helicopter landing area and a line width of 1 metre. On larger areas, its centre should be displaced 0.1 D from the centre of the D circle towards the outboard edge of the helicopter landing area along the bisector of the obstacle-free sector in order to achieve an increased safety margin for tail rotor clearance. On smaller helicopter landing areas with a D value up to and including 16.00m and for bow-mounted helicopter landing areas there is a case for making the aiming circle concentric with the helicopter landing area centre to ensure maximisation of space all around for safe personnel movement and optimisation of the visual cueing environment. For the smallest landing areas, where deck space is limited, it may be necessary to reduce the line width of the aiming circle marking to not below 0.5m. (See Figure 3 below).

Figure 2 - Helicopter landing area D Value and Obstacle-free Marking (Not to scale)

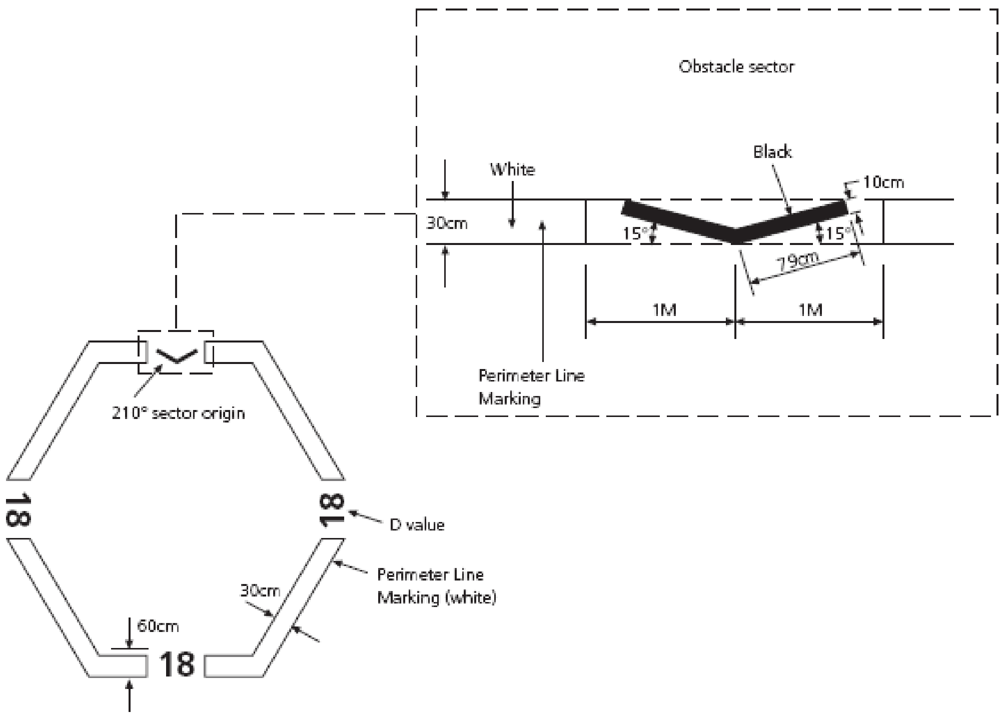


Figure 3 Aiming Circle Marking (Aiming Circle to be painted yellow)

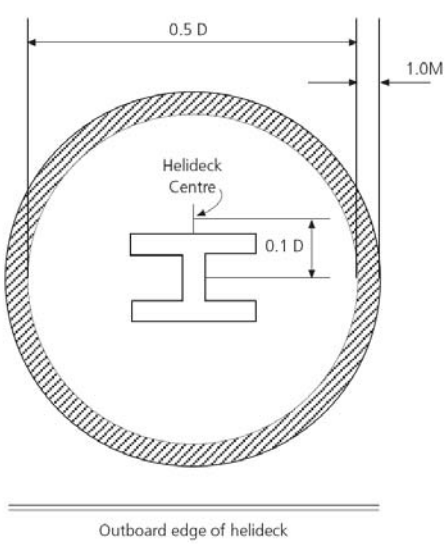
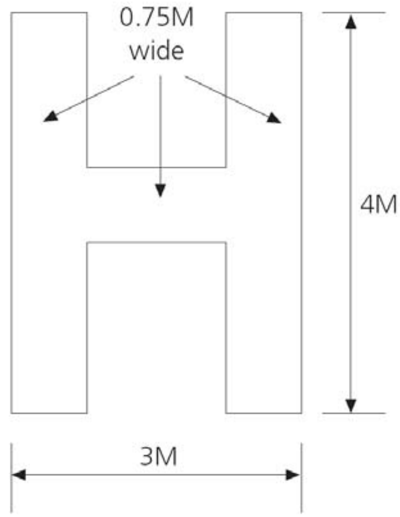


Figure 4 Dimensions of ‘H’



2.6.2 On those decks where the aiming circle is concentric with the centre of the D circle or SLA, the need for some mitigation against concerns over tail rotor clearances should be considered; either by achieving more obstacle clearance in the 150° LOS or by adopting appropriate operational procedures (e.g. vessel to provide relative wind from beam or stern).

2.6.3 A “H” painted in a colour contrasting with the deck (preferably white) should be co-located with the aiming circle with the cross bar of the “H” lying along the bisector of the obstacle-free sector. Its dimensions are as shown in Figure 4. For the smallest landing areas, it may be necessary to reduce the size of the “H” marking accordingly.

2.6.4 Where the obstacle-free sector has been swung in accordance with Section 3 paragraph 3.3 the positioning of the aiming circle and “H” should comply with the normal unswung criteria. The “H” should, however, be orientated so that the bar is parallel to the bisector of the swung sector.

2.7 Prohibited landing heading sectors should be marked where it is necessary to protect the helicopter from landing or manoeuvring in close proximity to limiting obstructions which, for example, infringe the 150° limited obstacle sector protected surface. In addition, for existing vessels where the number of deck access points is limited prohibited landing heading sectors may be desirable to avoid placing the tail rotor in close proximity to access stairs. Where required, prohibited sector(s) are to be shown by red hatching of the aiming circle, with white and red hatching extending from the red hatching out to the edge of the safe landing area as shown in Figures 5 and 6.

2.7.1 When positioning over the touchdown area helicopters should be manoeuvred so as to keep the aircraft nose clear of the hatched prohibited sector(s) at all times.

2.8 For certain operational or technical reasons the master of the vessel may have to prohibit helicopter operations. In such circumstances, where the helicopter landing area cannot be used, the ‘closed’ state of the helicopter landing area should be indicated by use of the signal shown in Figure 7.

2.9 Colours should conform with the following BS 381C (1996) standard or the equivalent BS 4800 colour.

.1 RED

BS 381C: 537 (Signal Red)
BS 4800: 04.E.53 (Poppy)

.2 YELLOW

BS 381C: 309 (Canary Yellow)
BS 4800: 10.E.53 (Sunflower Yellow)

.3 DARK GREEN

BS 381C: 267 (Deep Chrome Green)
BS 4800: 14.C.39 (Holly Green)

.4 DARK GREY

BS 381C: 632 (Dark Admiralty Grey)
BS 4800: 18.B.25 (Dark Admiralty Grey)

Figure 5 - Specification for the layout of prohibited landing heading segments on helicopter landing areas

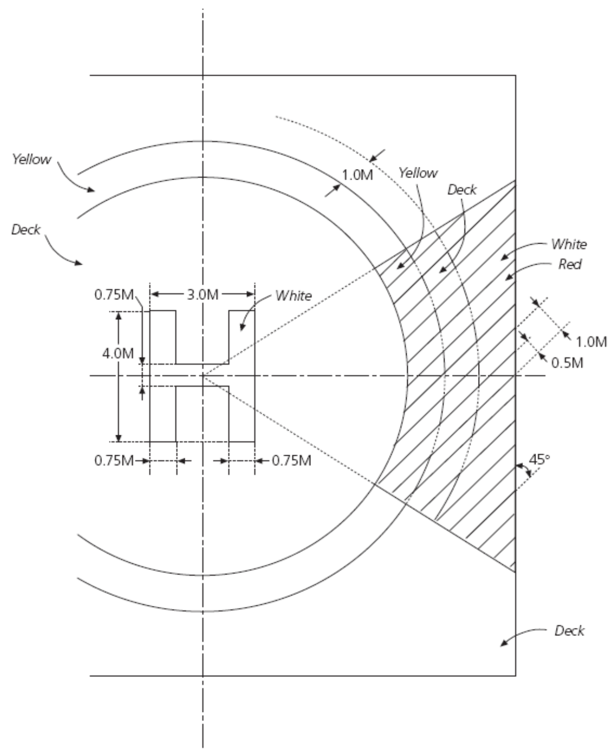


Figure 6 - Example of Prohibited Landing Heading Marking

The position of the H and the orientation of the prohibited landing heading segment will depend on the obstacle.

Figure 7 - Signal Showing Landing on the Vessel is Prohibited

Signal covers ‘H’ inside aiming circle.

3.0 Lighting

3.1 The safe landing area (SLA) should be delineated by green perimeter lights visible omnidirectionally from on or above the landing area. These lights should be above the level of the deck but should not exceed the height limitations in Section 3 paragraph 6.2. The lights should be equally spaced at intervals of not more than 3 metres around the perimeter of the SLA, coincident with the white line delineating the perimeter (see paragraph 4.2.1). In the case of square or rectangular decks there should be a minimum of four lights along each side including a light at each corner of the safe landing area.The ‘main beam’ of the green perimeter lights should be of at least 30 candelas intensity (the full vertical beam spread specification is shown in Table1). Flush fitting lights may be used at the inboard (150° LOS origin) edge of the SLA.

3.2 Where the declared D-value of the helicopter landing area is less than the physical helicopter landing area, the perimeter lights should delineate the limit of the safe landing area (SLA) so that the helicopter may land safely by reference to the perimeter lights on the limited obstacle sector (LOS -150°) ‘inboard’ side of the helicopter landing area without risk of main rotor collision with obstructions in this sector. By applying the LOS clearances (given in Section 3 paragraph 3.4) from the perimeter marking, adequate main rotor to obstruction separation should be achieved. On helicopter landing areas where insufficient clearance exists in the LOS, a suitable temporary arrangement to modify the lighting delineation of the SLA, where this is found to be marked too generously, should be agreed with the National Aviation Inspection Body by replacing existing green lights with red lights of 30 candelas intensity around the ‘unsafe’ portion of the SLA (the vertical beam spread characteristics for red lights should also comply with Table 1). The perimeter line, however, should be repainted in the correct position immediately and the area of deck between the old and new perimeter lines should be painted in a colour that contrasts with the main helicopter landing area. Use of flush fitting lights in the 150° sector perimeter will provide adequate illumination while causing minimum obstruction to personnel and equipment movement.

Table 1: ISO-candela diagram for helicopter landing area perimeter lights

Elevation	Intensity
0º - 90º	60cd max*
>20º - 90º	3cd min
>10º - 20º	15cd min
0º -10º	30cd min

-180º Azimuth +180º

3.3 The whole of the safe landing area (SLA) should be adequately illuminated if intended for night use. In the past, owners and operators have sought to achieve compliance by providing deck level floodlights around the perimeter of the SLA and/or by mounting floodlights at an elevated location ‘inboard’ from the SLA, e.g. floodlights angled down from the top of a bridge or hangar. Experience has shown that floodlighting systems, even when properly aligned, can adversely effect the visual cueing environment by reducing the conspicuity of helicopter landing area perimeter lights during the approach, and by causing glare and loss of pilots’ night vision during hover and landing. Furthermore, floodlighting systems often fail to provide adequate illumination of the centre of the landing area leading to the so-called 'black-hole effect'. It is essential therefore, that any interim floodlighting arrangements take full account of these problems.

3.4 Through research programmes undertaken since the mid 1990's, The UK CAA has been seeking to identify more effective methods of achieving the requirements to provide an effective visual cueing environment for night operations, particularly in respect of illuminating the centre of the landing area. It has been demonstrated that arrays of segmented point source lighting (ASPSL) in the form of encapsulated strips of light emitting diodes (LEDs) can be used to illuminate the aiming circle and heliport identification marking ('H'). This scheme has been found to provide the visual cues required by the pilot earlier on in the approach and more effectively than by using floodlighting, and without the disadvantages associated with floodlighting such as glare.

3.5 The floodlighting should be arranged so as not to dazzle the pilot and, if elevated and located off the landing area clear of the LOS, the system should not present a hazard to helicopters landing and taking off from the helicopter landing area. All floodlights should be capable of being switched on and off at the pilot's request. Setting up of lights should be undertaken with care to ensure that the issues of adequate illumination and glare are properly addressed and regularly checked. Adequate shielding of 'polluting' light sources can easily be achieved early on in the design stage, but can also be implemented on existing installations using simple measures. Temporary working lights which pollute the helicopter landing area lighting environment should be switched off during helicopter operations.

3.6 It is important to confine the helicopter landing area lighting to the landing area, since any light overspill may cause reflections from the sea. The floodlighting controls should be accessible to, and controlled by, the HLO or Radio Operator.

3.7 The quoted intensity values for lights apply to the intensity of the light emitted from the unit when fitted with all necessary filters and shades (see also paragraph 4 below).

3.8 The emergency power supply of the vessel shouldinclude the helicopter landing area lighting. Any failures or outages should be reported immediately to the helicopter pilot/operator. The lighting should be fed from an Uninterrupted Power Supply (UPS) system capable of providing the required load for 15 minutes. This can be a stand alone supply or be an additional loading requirement for the vessel's emergency power supplies

4.0 Obstacles – Marking and Lighting

4.1 Fixed obstacles identified as a hazard to helicopters by the helicopter pilot / operator, or the National Aviation Inspection Body should be readily visible from the air. If a paint scheme is necessary to enhance identification by day, alternate black and white, black and yellow, or red and white bands are recommended, not less than 0.25 metres wide. The colour should be chosen to contrast with the background to the maximum extent. Paint colours should conform with the references at paragraph 2.9 above.

4.2 Omnidirectional red lights of at least 10 candelas intensity should be fitted at suitable locations to provide the helicopter pilot with visual information on the proximity and height of objects which are higher than the landing area and which are close to it or to the LOS boundary. Objects which are more than 15 metres higher than the landing area should be fitted with intermediate red lights of the same intensity spaced at 10 metre intervals down to the level of the landing area (except where such lights would be obscured by other objects).

4.3 An omnidirectional red light of intensity 25 to 200 candelas should be fitted to the highest point of the vessel. Where this is not practicable the light should be fitted as near to the extremity as possible.

4.4 Red lights should be arranged so that the location of the objects which they delineate are visible from all directions above the landing area.

4.5 The emergency power supply of the vessel should include all forms of obstruction lighting. Any failures or outages should be reported immediately to the helicopter pilot/operator. The lighting should be fed from an Uninterrupted Power Supply (UPS) system.

Annex 6: Section 5 - Helicopter Landing Areas – Operational Standards

1.0 Wind Direction

1.1 Because the ability of a vessel to manoeuvre may be helpful in providing an acceptable wind direction in relation to the helicopter landing area location, information provided to the National Aviation Inspection Body and helicopter operator is to include whether the vessel is normally fixed at anchor, single point moored, semi or fully manoeuvrable.

2.0 Helicopter Landing Area Movement

2.1 Vessels experience dynamic motions due to wave action which represent a potential hazard to helicopter operations. Operational limitations are therefore set for helicopter operations to / from the vessel as per Annex 6 Section 7 and should be incorporated in the helicopter operations manual. Helicopter landing area downtime due to excessive deck motion can be minimised by careful consideration of the location of the landing area on the vessel at the design stage. Guidance on helicopter landing area location and how to assess the impact of the resulting motion on operability is presented in UK CAA Paper 2004/02 “Helideck Landing Area Design Considerations – Environmental Effects” which is available on the Publications section of the UK CAA website at www.caa.co.uk. Designers of helicopter landing areas should consult UK CAA Paper 2004/02 at the earliest possible stage of the design process.

2.2 The helicopter landing area will be limited to receiving helicopters in the conditions agreed by the National Aviation Inspection Body or Classification Society.

2.3 It is necessary for details of pitch, roll, and heave motions to be recorded on the vessel prior to, and during, all helicopter movements. Pitch and roll reports to helicopters should include values, in degrees, about both axes of the true vertical datum (i.e. relative to the true horizon) and be expressed in relation to the vessel’s head. Roll should be expressed in terms of ‘port’ and ‘starboard’; pitch should be expressed in terms of ‘up’ and ‘down’; heave should be reported in a single figure, being the total heave motion of the helicopter landing area rounded up to the nearest metre. Heave is to be taken as the vertical difference between the highest and lowest points of any single cycle of the helicopter landing area movement. The parameters reported should be the maximum peak levels recorded during the ten minute period prior to commencement of helicopter operations.

2.3.1 The helicopter pilot is concerned, in order to make vital safety decisions, with the amount of ‘slope’ on, and the rate of movement of, the helicopter landing area surface. It is therefore important that the roll values are only related to the true vertical and do not relate to any ‘false’ datum (i.e. a ‘list’) created, for example, by anchor patterns or displacement. There are circumstances in which a pilot can be aided by amplification of the heave measurement by reference to the time period (seconds) in terms of ‘peak to peak’.

2.4 Reporting Format:

A standard radio message should be passed to the helicopter which contains the information on helicopter landing area movement in an unambiguous format. This will, in most cases, be sufficient to enable the helicopter crew to make safety decisions. Should the helicopter crew require other motion information or amplification of the standard message, the crew will request it (for example, yaw and heading information). Standard report example:

Situation: The maximum vessel movement (over the preceding ten minute period) about the roll axis is 1° to port and 3° to starboard (i.e. this vessel may have a permanent list of 1° to starboard and is rolling a further 2° either side of this 'false' datum). The maximum vessel movement (over the preceding ten minute period) about the pitch axis is 2° up and 2° down. The maximum recorded heave amplitude over a single cycle (over the preceding ten minute period) is 1.5 metres.

Report: *'Roll 1° left and 3° right; Pitch 2° up and 2° down; heave two metres'*.

2.5 It is important to ensure that the deck motions reported to the helicopter pilot relate to the motion at the helicopter landing area. Very often pitch, roll and heave measurements are taken from a source far removed from the helicopter landing area location. If this source should happen to be midships and the helicopter landing area is located, for example, high up on the bow, the actual heave (and, in future accelerations,) at the helicopter landing area are likely to be far in excess of the source measurement. Software packages are available to provide helicopter landing area location corrected movement data from a source at a different location. Ideally, deck motion measuring equipment should be located at (attached to the underside of) the helicopter landing area.

3.0 Aircraft Operational Data – Reporting and Recording

3.1 In addition to the data covered by paragraph 2.3 above, it is essential that vessels are provided with means of ascertaining and reporting at any time:

.1 the wind speed and direction using aviation approved equipment to ICAO standard;

.2 the air temperature;

.3 the barometric pressure using aviation approved equipment to ICAO standard;

.4 the visibility, cloud base and cover; and

.5 the sea state.

3.2 Air temperature and barometric pressure should be measured by conventional instruments approved to ICAO standards. An indication of wind speed and direction will be provided visually to the pilot by the provision of a windsock coloured so as to give maximum contrast with the background. However, for recording purposes, an anemometer positioned in an unrestricted airflow is required. A second anemometer, located at a suitable height and position can give useful information on wind velocity at hover height over the helicopter landing area in the event of turbulent or deflected airflows over the deck. Visibility, cloud conditions, and sea state will normally be assessed by visual observations.

3.3 Measuring instruments used to provide the data listed in paragraph 3.1 above should be periodically calibrated in accordance with the manufacturer's recommendations in order to provide continuing accuracy.

4.0 Location in Respect to Other Landing Areas in the Vicinity

4.1 Vessels with helicopter landing areas may be positioned adjacent to other vessels or large land-based structures so that interference/overlap of obstacle protected surfaces occur. Also on some vessels there may be more than one helicopter landing area which may result in a confliction of obstacle free sectors.

5.0 Control of Crane Movement in the Vicinity of Landing Areas

5.1 Cranes can adversely distract pilots' attention during helicopter approach and take-off from the helicopter landing area as well as infringe fixed obstacle protected surfaces. Therefore it is essential that when helicopter movements take place (±5 mins) crane work ceases and jibs, etc. are positioned clear of the obstacle protected surfaces and flight paths.

5.2 The Helicopter Landing Officer should be responsible for the control of cranes in preparation for and during helicopter operations.

6.0 General Precautions

6.1 Whenever a helicopter is stationary on board a vessel with its rotors turning, no person should, except in case of emergency, enter upon or move about the helicopter landing area other than within view of a crew member or the HLO and at a safe distance from the engine exhausts and tail rotor of the helicopter. It may be dangerous to pass close to the front of those helicopters which have a low main rotor profile.

6.2 The practical implementation of paragraph 6.1 above is best served through consultation with the helicopter pilot/operator for a clear understanding of the approach paths approved for personnel and danger areas associated with a rotors-running helicopter. These areas are type-specific but, in general, the approved routes to and from the helicopter are at the 2–4 o'clock and 8–10 o'clock positions. Avoidance of the 12 o'clock (low rotor profile helicopters) and 6 o'clock (tail rotor danger areas) positions should be maintained.

6.3 Personnel should not approach the helicopter while the helicopter anti-collision (rotating/flashing) beacons are operating. The helicopter landing area should be kept clear of all personnel while anti-collision lights are on.

7.0 Helicopter Landing Area Operations Manual and General Requirements

7.1 The maximum helicopter weight and 'D' value for which the helicopter landing area has been designed and the maximum size and weight of helicopter for which the vessel is certified should be included in the Helicopter Landing Area Operations Manual. The extent of the obstacle-free area should also be stated and reference made to any helicopter landing area operating limitation imposed by helicopter operators as a result of non-compliance. Non-compliances should also be listed.

8.0 Helicopter Operations Support Equipment

8.1 Provision should be made for equipment needed for use in connection with helicopter operations including:

.1 chocks and tie-down stropsheavy-duty, calibrated, accurate scales for passenger baggage and freight weighing;

.2 a suitable power source for starting helicopters if helicopter shut-down is seen as an operational requirement; and

.3 equipment for clearing the helicopter landing area of snow and ice and other contaminants.

8.2 Chocks should be compatible with helicopter undercarriage/wheel configurations. Helicopter operating experience has shown that the most effective chock for use on helicopter landing areas is the 'NATO sandbag' type. Alternatively, 'rubber triangular' or 'single piece fore and aft' type chocks may be used as long as they are suited to all helicopters likely to operate to the helicopter landing area. The ‘rubber triangular’ chock is generally only effective on decks without nets.

8.3 For securing helicopters to the helicopter landing area only adjustable tie-down strops should be used.

Annex 6: Section 6 - Example Inspection Checklist

1.0 General

The following checklist indicates in general terms the minimum number of helicopter landing area physical characteristics which the Administration considers should be examined during periodic surveys carried out by the National Aviation Inspection Body to confirm that there has been no alteration or deterioration in condition. 1.6, 1.7, and 1.8 should be checked during periodic surveys carried out as part of the construction and safety equipment surveys of the Classification Society and Administration respectively.

1.1 Helicopter Landing Area Dimensions:

.1 D-value as measured;

.2 Declared D-value;

.3 Deck shape;

.4 Scale drawings of deck arrangement.

1.2 Helicopter Landing Area Conditions:

.1 Type of surface, condition, friction, contaminant free;

.2 Fuel retention;

.3 Deck landing area net;

.4 Perimeter safety netting;

.5 Tie-down points.

1.3 Environment:

.1 Machinery exhausts;

.2 Hot and cold gas emissions;

.3 Presence of turbulence;

.4 Adjacent vessel exhausts, and turbulence created by such vessels.

1.4 Obstacle Protected Surfaces (Minima):

.1 Obstacle free sector (210°);

.2 Limited obstacle sector (150°);

.3 Falling 5:1 gradient;

.4 Note if .1 or .3 above are swung from normal axis.

1.5 Visual Aids:

.1 Deck surface;

.2 General condition of painted markings;

.3 Location of H;

.4 Aiming circle;

.5 Safe Landing Area perimeter line – relationship to Chevron;

.6 D-value marked within perimeter line;

.7 Chevron marking (if reduced the sector is to be marked in degrees);

.8 Certification marking (exact D-value);

.9 Maximum allowable weight marking;

.10 Conspicuity of painted markings;

.11 Wind indicator;

.12 Perimeter lighting;

.13 Floodlighting;

.14 Obstruction lighting;

.15 Marking of dominant obstacles;

.16 Shielding of working lights (helicopter landing area light pollution).

1.6 Fuel System:

.1 Jet A-1 installation;

.2 Hose;

.3 Earthing equipment.

.4 Fuel Records

1.7 Rescue and Fire fighting Facilities

.1 Principal agent

.2 Complementary media

.3 Rescue equipment

.4 Personal protective equipment

1.8 Crew Training Certification

.1 Training records

Annex 6: Section 7 – Helicopter Hangar Facilities

1.0 General

1.1 Helicopter hangar arrangements on board should be in accordance with requirements for helicopter refuelling and hangar facilities contained within SOLAS II-2. In addition, the requirements outlined in this section of Annex 6 of the Code should be complied with in full. The requirements in this section are based upon the use of helicopters run on Jet A1 fuel. When developing hangar arrangements, consideration should be given to the type of fuel on which the helicopter to be stowed is run.

1.2 The following plans and particulars are to be submitted to the Classification Society and Administration for approval:

.1 Hangar general arrangement and structure;

.2 Helicopter lift, hoist, and movement arrangements (if appropriate);

.3 Structural fire protection;

.4 Fire detection and extinguishing arrangements;

.5 ventilation arrangements.

2.0 Hangar Design Considerations

2.1 Helicopter hangar(s) on board should be positioned, as far as is practicable, so as to preclude excessive movement and acceleration forces. Guidance on this should be sought from the helicopter manufacturer / operator. Where possible, the positioning of hangar(s) should be determined through the use of computer modelling.

2.2 The perimeter of hangar(s) and any associated entrance or hatchway inclusive of helicopter lift arrangements should provide a stowage / maintenance box allowing for a minimum 0.5m clearance at any point around the helicopter and rotors when the helicopter is in its stowed condition.

2.3 It is recommended that CCTV be used to ensure visibility of the aircraft at all times.

Annex 6: Section 8 – Helicopter Fueling Facilities

1.0 General

This section outlines the requirements for the storage and transfer of Jet A1 fuel. When developing fuelling arrangements, consideration should be given to the type of fuel on which the helicopter to be landed / stowed is run. In addition, all facilities for the storage and handling of aviation fuels on board should be grade identified using the appropriate American Petrolium Industry (API) markings for the grade of fuel used. Aviation fuel facilities should also be fully segregated from any other fuel system.

1.1 Helicopter fueling facilities on board should be in accordance with requirements for helicopter refuelling and hangar facilities in SOLAS II-2. In addition, the requirements outlined in this section of Annex 6 of the Code should be complied with in full unless a safety case is made to, and approved by, the Administration, based on an alternative arrangement according to Classification Society Rules or guidance from the Aviation or Petro-Chemical industries.

1.3 Refuelling and defuelling operational considerations should be agreed with the helicopter pilot / operator and National Aviation Inspoection Body.

1.3 The following plans and particulars are to be submitted to the National Aviation Inspection Body and Classification Society for approval:

- .1 Description of fuel with statement of minimum flash point (closed cup test);
- .2 Arrangement of fuel storage and piping;
- .3 Storage tanks not forming part of the ship’s structure;
- .4 Arrangements for drainage, ventilation and sounding of spaces adjacent to storage tanks;
- .5 Details of pumping units;
- .6 Structural fire protection arrangements of all spaces to contain aviation fuel;
- .7 Fire detection and extinguishing arrangements;
- .8 ventilation arrangements.

1.4 When developing operational procedures for the movement of aviation fuel onboard, the restricted use of VHF and HF radio with regard to transmission sparks should be considered.

2.0 Storage of Aviation Fuel

2.1 Fuel storage tanks should be of baffle-free, stainless steel, cylindrical construction, located in a designated area as remote as practicable from machinery and accommodation spaces, and be suitably isolated from areas where there are sources of ignition.

2.2 Fuel storage tanks should be provided with an intrinsically safe level indicator fitted through the top of the tank, and a sampling valve at the bottom of the tank (to allow for samples to be taken as per paragraph 5.3 of this annex). The minimum slope of the tank to the sampling point should be 1:50.

2.3 The storage and handling area should be permanently marked. Instructions for filling fuel and, if appropriate, emptying fuel, should be posted in the vicinity of the filling area.

2.4 Tank ventilation (breather) pipes should be fitted with an approved vent head with pressure-vacuum valve, flame arrester, and desiccant. The vent outlet should be located no less than 2.4m above the weather deck in a safe position away from accommodation spaces, ventilation intakes and equipment that may constitute an ignition hazard. Particular attention should also be directed to the height of the tank vent and overflow with respect to the design head of the tank. High level alarm arrangements should be provided to indicate when fuel storage tanks are close to being filled in excess of maximum operating levels. Alternative arrangements for tank venting may be accepted subject to approval from the Administration.

2.5 A coaming surrounding the fuel storage tanks, associated piping and the pumpingunit should be provided. The height of this coaming should be at least 150 mm, so as to contain fuel spillage as well as fire extinguishing agents. Where the pumping unit is situated at a remote distance from the fuel storage tank, a separate coaming of the same minimum height should be provided around the pumping unit. For tanks forming an integral part of the vessel's structure, cofferdams with permanently fitted gas detectors should be provided as necessary to contain leakage and prevent contamination of the fuel. Also, it should be ensured that there is no common boundary between the fuel storage tank and accommodation or high fire risk spaces.

2.6 Arrangements for drainage from within the coaming area described in 2.6 above should be as follows.

.1 Permanent piping and a suitable holding (waste) tank (compliant with 2.1 and 2.2) should be fitted so that drainage can be either led to the holding tank (for draining fuel) or discharged overboard (for draining water) through a three-way valve. No other valve should be permitted in the drain piping. The holding tank should be clearly labeled to distinguish between itself and the main storage tank.

.2 The cross sectional area of the drain pipe should be twice that of the storage tank outlet pipe.

.3 The area within the coaming should be sloped towards the drain pipe.

2.7 Drainage of cofferdam spaces should be entirely separate from the machinery space drainage arrangements. As far as is practicable, fuel sampling points should be low points on piping and should provide a "closed sampling" visi-jar system fitted with arrangements to prevent the spring-loaded valve from being locked in an open position.

2.8 Air pipes for the cofferdam space should be led to a point at least 2.4m above the weather deck through a safe space and fitted with an approved air pipe head having a wire gauze diaphram of corrosion resistant material.

2.9 Access to each cofferdam should be provided by at least two manholes from the open deck, each fitted with gas-tight manhole covers. Cofferdams should be cleaned prior to opening manhole covers, using an induced draught certified safe ventilation fan for a minimum of 20 minutes. A notice to this effect should be fitted to each manhole.

3.0 Fuel Pumping and Storage Tank Filling

3.1 All tank outlet valves and filling valves should be mounted directly onto the tank and be capable of being closed from a remote location outside the compartment in the event of a fire in the compartment. Ball valves are to be of the stainless steel, anti-static, fire tested type.

3.2 Filling arrangements for fuel tanks should be through closed piping systems with outlet ends configured to reduce turbulence and foaming of the fuel.

3.3 Pumping units should be easily accessible and capable of being controlled from both the fuel station and a position remote from the fuel station. The device to prevent over-pressurisation as required by SOLAS 2-II should be fitted with a relief valve to discharge either to the suction side of the pump(s) or to a holding tank complying with the arrangements of this section of Annex 6 of the Code.

3.4 When not in use, fuel filling equipment should be stowed in a locker that is well ventilated and drained.

3.5 Suitable filtration arrangements in accordance with appropriate American Petrolium Industry (API) and British Energy Institute (or equivalent) standards should be provided to reduce the level of water and particulate contamination of the fuel to within the limits specified by the helicopter manufacturer. The minimum requirements are; delivery into storage through a filter water seperator(FWS), filtration out of storage through filter water seperator (FWS), filtration at the point of filling (e.g. on the helicopter landing area), via a filter monitor (FM).

3.6 In general, all piping systems should be located clear of accommodation spaces, escape routes, embarkation stations and ventilation openings and should not pass through category A machinery spaces. However, where arrangements are such that piping has to pass through accommodation spaces, service spaces, escape routes, or embarkation stations double skinned piping is to be used or pipes should be enclosed in a cofferdam.

3.7 Means should be provided for keeping deck spills away from accommodation and service areas.

3.8 Drip trays for collecting replenishment oil residues in pipelines and hoses should be provided beneath pipe and hose connections in the manifold area.

4.0 Refueling and Defueling Helicopters

4.1 Refueling and defueling hoses should be of one continuous length, smooth bore, synthetic rubber construction, and semi-conducting, conforming to API (or equivalent) standards. A hose end pressure controller should also be provided for fuelling hoses to prevent the possibility of the helicopter fuel tanks being subject to excessive pressure. Delivery Nozzles should be fitted with maximum 60 mesh gauze strainers, and in the case of gravity overwing nozzles, they should be situated in the spout. Trigger mechanisms should not have hold-open ratchets.

4.2 Provision should be made to electrically bond the helicopter to the vessel prior to commencement, and throughout the process of, any refueling and defueling procedures. The maximum resistance of such bonding systems should be less than 10ohms.

4.3 It is recommended that CCTV be used to ensure full view from the bridge of all helicopter refueling activities that would normally be hidden from view.

5.0 Prevention of Fuel Contamination

5.1 Materials and/or their surface treatment used for the storage and distribution of fuel should be selected such that they do not introduce contamination or modify the properties of the fuel. The use of copper or zinc compounds in fuel piping systems where they may come into contact with the fuel is not permitted. Copper-nickel materials are permissible but should be limited to positions after filtration and water absorption equipment.

5.2 The location and arrangement of air pipes for fuel tanks are to be such that in the event of a broken vent pipe, this does not directly lead to ingress of seawater or rain water.

5.3 Fuel samples should be taken on a daily basis throughout the fuel handling, storage, and distribution process. Fuel samples should be recorded then disposed of in the aviation fuel waste / holding tank referred to in paragraph 2.7.1. A record should be kept of all fuel movements on board. Guidance on how to take fuel samples and record fuel movements may be obtained from Chapter 4 of UK CAA CAP 748 which is accessible via the UK CAA website www.caa.co.uk.

5.4 At least one member of crew on-board the vessel should be trained in the handling of aviation (JetA1) fuel and associated quality control procedures. This person(s) should oversee all operations involving the movement of aviation fuel on-board. Further guidance on such training may be obtained from the fuel supplier, and marine aviation consultants.

6.0 Fuel Pumping Spaces / Compartments

6.1 Where it is intended to install fuel transfer pumps for handling aviation fuel in a separate compartment, the pump room(s); should be totally enclosed and have no direct communication, through e.g. bilge piping systems and ventilation systems, with machinery spaces; should be situated adjacent to the fuel storage tanks; and should be provided with ready means of access from the weather deck.

6.2 Alarms and safety arrangements should be provided as indicated in 6.3 and Table 1, below.

Table 1 - Alarms

Item	Alarm	Note
Bulkhead gland temperature	High (See Note 1)	Any machinery item
Pump bearing and casing temperature	High (See Note 1)	Any machinery item
Bilge level	High	—
Hydrocarbon concentration	High (See Note 2)	> 10% LEL

NOTES

1. The alarm signal is to trigger continuous visual and audible alarms in the pump room or the pump control station.
2. This alarm signal is to trigger a continuous audible and visual alarm in the pump room, pump control station and machinery control room.

6.3 A system for continuously monitoring the concentrations of hydrocarbon gases ithin the pump room should be fitted. Monitoring points are to be located in positions where potentially dangerous concentrations may be readily detected.

7.0 Ventilation

7.1 Fuel pump room(s), fuel storage room(s) and other closed spaces which contain fuel handling equipment, and to which regular access is required during cargo handling operations, are to be provided with permanent ventilation system(s) of the mechanical extraction type.

7.2 The ventilation system(s) should be capable of being operated from outside the compartment being ventilated and a notice should be fixed near the entrance stating that no person is to enter the space until the ventilation system has been in operation for at least 15 minutes.

7.3 The ventilation system(s) should be capable of 20 air changes per hour, based on the gross volume of the pump room or space.

7.4 Protection screens of not more than 13 mm square mesh should be fitted in outside openings of ventilation ducts, and ventilation intakes should be so arranged as to minimise the possibility of re-cycling hazardous vapours from any ventilation discharge opening. Vent exits are to be arranged to discharge upwards.

7.5 The ventilation should be interlocked to the lighting system (except emergency lighting) such that the pump room lighting may only come on when the ventilation is in operation. Failure of the ventilation system is not to cause the lighting to go out and failure of the lighting system is not to cause loss of the ventilation system.

7.6 Non - Sparking Fans for Hazardous Areas

7.6.1 The air gap between impeller and housing of ventilation fans should be not less than 0,1 of the impeller shaft bearing diameter or 2 mm whichever is the larger, subject also to compliance with 7.6.2.5 Generally, however, the air gap need be no more than 13 mm.

7.6.2 The following combinations of materials are permissible for the impeller and the housing in way of the impeller:

.1 Impellers and/or housings of non-metallic material, due regard being paid to the elimination of static electricity.

.2 Impellers and housings of non-ferrous metals.

.3 Impellers and housings of austenitic stainless steel.

.4 Impellers of aluminium alloys or magnesium alloys and a ferrous housing provided that a ring of suitable thickness of non-ferrous material is fitted in way of the impeller.

.5 Any combination of ferrous impellers and housings with not less than 13 mm tip clearance.

.6 Any combination of materials for the impeller and housing which are demonstrated as being spark proof by appropriate rubbing tests.

7.6.3 The following combinations of materials for impellers and housing are not considered spark proof and should not be permitted:

.1 Impellers of an aluminium alloy or magnesium alloy and a ferrous housing, irrespective of tip clearance.

.2 Impellers of a ferrous material and housings made of an aluminium alloy, irrespective of tip clearance.

.3 Any combination of ferrous impeller and housing with less than 13 mm tip clearance, other than permitted by 3.3.2.3

7.6.4 Electrostatic charges both in the rotating body and the casing should be prevented by the use of antistatic materials (i.e. materials having an electrical resistance between 5 x 104 ohms and 108 ohms), or special means should be provided to avoid dangerous electrical charges on the surface of the material.

7.6.5 Type approval tests on the complete fan should be carried out to the satisfaction of the Classification Society.

7.6.6 Protection screens of not more than 13 mm square mesh should be fitted in the inlet and outlet of ventilation ducts to prevent the entry of objects into the fan housing.

7.6.7 The installation of the ventilation units on board should be such as to ensure the safe bonding to the hull of the units themselves.