Safety Regulation Group

CAP 437

Offshore Helicopter Landing Areas - Guidance on Standards

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Revision History

Edition 1 **September 1981**

The first edition of CAP 437 was published to give guidance on the criteria applied by the CAA in assessing the standard of helicopter offshore landing areas for worldwide use by helicopters registered in the UK. The criteria in the CAP relating to fixed and mobile installations in the area of the UK Continental Shelf were based on the helicopter landing area standards of the Department of Energy. Additional criteria were given relating to vessels used in the support of offshore mineral exploitation and tankers, cargo vessels and passenger vessels which were not subject to the Department of Energy certification. These criteria were evolved following consultation with the Department of Trade (Marine Division) and the Inter-governmental Maritime Consultative Organisation. In addition to explaining the reasons behind the chosen criteria, the first edition of CAP 437 described their application to particular classes of landing area.

Edition 2 **December 1993**

The guidance in CAP 437 was revised in the light of International Civil Aviation Organization (ICAO) recommendations and Health and Safety Executive (HSE)/CAA experience gained from offshore helideck inspections.

Edition 3 **October 1998**

Amendments were made to incorporate the results of valuable experience gained by CAA staff during three and a half years of offshore helideck inspecting with the HSE and from cooperation with the British Helicopter Advisory Board (BHAB). Analysis of the results of the inspection regime, completed in April 1995, resulted in changes to the way in which helidecks were authorised for use by helicopter operators. Other changes reflected knowledge gained from accidents, incidents, occurrences and research projects. The section concerning the airflow environment, and the impact on this environment from exhaust and venting systems, was revised. Also the paragraph numbering was changed for easier reference.

Edition 4 **September 2002**

The CAP was amended to incorporate new house-style.

Edition 5 **August 2005**

The CAP was extensively revised to incorporate valuable experience gained from CAA funded research projects conducted with the support of the UK offshore industry into improved helideck lighting, helideck environmental effects and operations to moving helidecks. The sections concerning helideck lighting were considerably revised to ensure that UK good practice adequately reflected the changes made in 2004 to the ICAO Standards and Recommended Practices (SARPs) for TLOF lighting. The fifth edition also pulled together revised requirements harmonised amongst North Sea States as a result of initiatives taken by the Group of Aerodrome Safety Regulators (GASR) Helideck Working Group.

Edition 6 **December 2008**

The sixth edition is revised to incorporate further results of valuable experience gained from CAA funded research projects conducted with the support of the UK offshore industry into improved helideck lighting and the conclusion of projects, jointly funded with the Health and Safety Executive (HSE), relating to offshore helideck environmental issues. In respect of helideck lighting, a detailed specification for stage 2 lighting systems (addressing illumination of the heliport identification 'H' marking and the Touchdown/Positioning Marking Circle) is provided in an Appendix; and a new reference to the final specification for helideck status lights systems is provided in Chapter 4. In regard to now-completed helideck environmental projects, Chapter 3 provides formal notification of the new turbulence criterion and the removal of the long-standing vertical flow criterion.

The sixth edition has also been amended to include new ICAO SARPs relating to offshore helidecks and shipboard heliports, which generally become applicable from November 2009. This edition has also been revised to include material which is part of the fourth edition of the International Chamber of Shipping (ICS) Guide to Helicopter/Ship Operations, published in December 2008. For the first time, guidance is included for the design of winching area arrangements located on wind turbine platforms.

Edition 6, Amendment 01/2010 April 2010

This amendment was issued to provide operators with additional guidance relating to the provision of meteorological information from offshore installations. Editorial amendments convenient to be included at this time have also been incorporated.

Edition 6, Amendment 02/2010 August 2010

This amendment was issued to correct an error in Chapter 10, paragraph 2 that referred to a requirement for a medium intensity (rather than a low intensity) steady red obstruction light. The opportunity has been taken to update part of Chapter 4 relating to helideck lighting and part of Chapter 5 relating to the location of foam-making equipment. Editorial amendments convenient to be included at this time have also been incorporated.

Foreword

1 This publication has become an accepted world-wide source of reference. The amendments made to the sixth edition incorporate further results of valuable experience gained from CAA funded research projects conducted with the support of the UK offshore industry into improved helideck lighting and the conclusion of projects jointly funded with the Health and Safety Executive (HSE) relating to offshore helideck environmental issues. In particular the sections concerning helideck environmental effects and helideck lighting have been further revised; in respect of helideck lighting, a detailed specification for stage 2 lighting systems (addressing illumination of the heliport identification 'H' marking and the Touchdown/Positioning Marking Circle) is provided in an Appendix; and a new reference to the final specification for helideck status lights systems is provided in Chapter 4. In regard to now-completed helideck environmental projects, Chapter 3 provides formal notification of the new turbulence criterion and the removal of the long-standing vertical flow criterion.

2 At an international level the UK CAA has been participating in the International Civil Aviation Organization (ICAO) Heliport Design Working Group (HDWG) tasked with the substantial revision of Annex 14 Volume II including a review of the International Standards and Recommended Practices relating to offshore helidecks and shipboard heliports. The first tranche of material was formally approved by the ICAO Air Navigation Commission in 2008 with an applicability from November 2009. CAP 437 addresses the agreed changes recognising their formal adoption into Annex 14 Volume II (third edition).

3 Also at international level, the UK CAA has participated in a review group consisting of marine and aviation experts tasked with reviewing and updating the International Chamber of Shipping's (ICS) Guide to Helicopter/Ship Operations. A fourth edition of the Guide was published in December 2008 and the current best practice from the ICS Guide is reflected in substantially revised Chapters 9 and 10 of the sixth edition of CAP 437. The UK CAA is grateful to the ICS for providing a number of new figures for these chapters.

4 In Europe, since October 2001, the UK CAA has been participating in the Group of Aerodrome Safety Regulators (GASR) Helideck Working Group comprising National Aviation Authorities from Norway, Denmark, Holland, the UK, Ireland and Romania. The group was established to promote a 'level playing field' with harmonised offshore helicopter landing area 'requirements' across Europe. A number of the changes adopted in the fifth edition of CAP 437 and now refined for sixth edition were taken in support of this top-level objective. The requirements of the sixth edition of CAP 437 have been transposed by the GASR Helideck Working Group into a JAR-style document called WPH 015 "Proposal for GASR Helideck Requirements – GAR2 – AGA Helidecks" intended to provide a template for future European helideck 'requirements' in a succinct style in contrast to the more descriptive style of CAP 437.

5 CAP 437 gives guidance on the criteria required by the CAA in assessing the standard of offshore helicopter landing areas for world-wide use by helicopters registered in the UK. These landing areas may be located on:

- fixed offshore installations;
- mobile offshore installations;
- vessels supporting offshore mineral exploitation; or
- other vessels.

In this publication the term 'helideck' refers to all helicopter landing areas on fixed and mobile installations and vessels unless specifically differentiated. The term 'offshore' is used to differentiate from 'onshore'.

6 The criteria described in CAP 437 form part of the guidance issued by the CAA to UK helicopter operators which is to be accounted for in Operations Manuals required under UK aviation legislation and by the Joint Aviation Requirements (JAR-OPS 3). Helidecks on the UK Continental Shelf (UKCS) are regarded as 'unlicensed landing areas' and offshore helicopter operators are required to satisfy themselves that each helideck to which they operate is fit for purpose. The helicopter operators have chosen to discharge the legal responsibility placed on them in the Air Navigation Order by accepting Helideck Landing Area Certificates (HLACs) as a product of helideck inspections completed by the Helideck Certification Agency (HCA) (see Glossary of Terms). The Procedure for authorising offshore helidecks is described in Appendix F. The HCA, acting for the interests of the offshore helicopter operators, provides the single focal point for helideck matters in the UK to ensure that a level playing field is maintained between the operators. The operators have each given an undertaking to use the HCA system of authorisation by agreeing a Memorandum of Understanding (MoU) and by publishing relevant material in their company Operations Manuals.

7 If an offshore helideck does not meet the criteria in CAP 437, or if a change to the helideck environment is proposed, the case should be referred to the HCA in the first instance to enable them to provide guidance and information on behalf of the helicopter operators so that the process for authorising the use of the helideck can be completed in a timely fashion. Early consultation with the HCA is essential if maximum helicopter operational flexibility is to be realised and incorporated into the installation design philosophy. It is important that changes are not restricted to consideration of the physical characteristics and obstacle protected surfaces of the helideck. Of equal, and sometimes even more, importance are changes to the installation or vessel, and to adjacent installation or vessel structures which may affect the local atmospheric environment over the helideck (and adjacent helidecks) or on approach and take-off paths. In the case of 'new-builds' or major modifications to existing Installations that may have an effect on helicopter operations, the CAA has published guidance on helideck design considerations in CAA Paper 2008/03, which is available to assist with the interpretation and the application of criteria stated in CAP 437.

8 This procedure described for authorising the use of helidecks in the UKCS is co-ordinated by the HCA in a process which involves Oil and Gas UK (OGUK, previously UKOOA); the British Rig Owners' Association (BROA); and the International Association of Drilling Contractors (IADC) members' individual owner/operator safety management systems.

9 The HCA provides secretarial support to the Helideck Steering Committees which exist for the Northern North Sea, the Southern North Sea and Norway respectively with committee representation from all offshore helicopter operators. The Helideck Steering Committees function to ensure that commonality is achieved between the offshore helicopter operators in the application of operational limitations and that non-compliances, where identified, are treated in a consistent manner by each operator. The HCA publishes the Helideck Limitations List (HLL) which contains details of known helidecks including any operator-agreed limitations applied to specific helidecks in order to compensate for any failings or deficiencies in meeting CAP 437 criteria such that the safety of flights is not compromised.

10 Although the process described above is an industry-agreed system, the legal responsibility for acceptance of the safety of landing sites always rests with the

helicopter operator (see Appendix F). The CAA accepts the process described above as being an acceptable way in which the assessment of the CAP 437 criteria can be made. The CAA, in discharging its regulatory responsibility, will audit the application of the process on which the helicopter operator relies. As part of such an audit, the CAA will review HCA procedures and processes and assess how they assist the legal responsibilities and requirements of the offshore helicopter operators.

11 The criteria in this publication relating to fixed and mobile installations in the area of the UKCS provide guidance which is accepted by the HSE and referred to in HSE offshore legislation. The criteria are guidance on **minimum** standards required in order to achieve a clearance which will attract no helicopter performance (payload) limitations. CAP 437 is an amplification of internationally agreed standards contained in ICAO Annex 14 to the Convention on International Civil Aviation, Volume II, 'Heliports'. Additionally it provides advice on 'best practice' obtained from many aviation sources. 'Best practice', naturally, should be moving forward continuously and it should be borne in mind that CAP 437 reflects 'current' best practice at the time of publication. There may be alternative means of meeting the criteria in the guidance and these will be considered on their merits.

12 Additional criteria are given relating to vessels used in support of offshore mineral exploitation which are not necessarily subject to HSE offshore regulation and also for tankers, cargo vessels, passenger vessels and other vessels.

13 Whenever the term 'CAA' is used in this publication, it means the UK Civil Aviation Authority unless otherwise indicated.

14 OGUK is updating the UKOOA Issue 5 Guidelines for the Management of Offshore Helideck Operations (anticipated in due course). The CAA is assisting in the update of this guidance; until these guidelines are revised it is recommended that offshore duty holders consult the UKOOA Issue 5 'Guidelines' which, last amended in February 2005, were produced for industry to complement the technical material described in CAP 437.

15 As guidance on best practice, this document applies the term "should" whether referring to either an ICAO standard or a recommended practice. The term "may" is used when a variation or alternative approach could be acceptable to the CAA. The UK HSE accepts that conformance with CAP 437 will demonstrate compliance with applicable offshore regulations. CAP 437 is under continuous review resulting from technological developments and experience; comments are always welcome on its application in practice. The CAA should be contacted on matters relating to interpretation and applicability of this guidance and Aviation Law.

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Glossary of Terms and Abbreviations

AMSL	Above Mean Sea Level.
ANO	The Air Navigation Order.
AOC	Air Operator's Certificate.
API	American Petroleum Institute.
ASPSL	Arrays of Segmented Point Source Lighting.
CFD	Computational Fluid Dynamics.
Class Societies	Organisations that establish and apply technical standards to the design and construction of marine facilities including ships.
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 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).
DIFFS	Deck Integrated Fire Fighting System(s).
DSV	Diving Support Vessel.
Falling 5:1 Gradient	A surface extending downwards on a gradient of 5:1 measured from the edge of the safety netting located around the landing area below the elevation of the helideck to water level for an arc of not less than 180° that passes through the centre of the landing area and outwards to a distance that will allow for safe clearance from obstacles below the helideck in the event of an engine failure for the type of helicopter the helideck is intended to serve. For helicopters operated in Performance Class 1 or 2 the horizontal extent of this distance will be compatible with the one-engine inoperative capability of the helicopter type to be used.
FMS	Fixed Monitor System.
FOD	Foreign Object Debris/Damage.
FPSO	Floating Production Storage and Offloading units.
FSU	Floating Storage Unit.

HCA	Helideck Certification Agency (formerly known as BHAB Helidecks). The HCA is the certifying agency acting on behalf of the UK offshore helicopter operators that audits and inspects all helidecks on offshore installations and vessels operating in UK waters to the standards laid down in CAP 437. In the text of this document the term 'Helideck Certification Agency' is used in relation to the UK system for clearing helidecks for helicopter operations. Outside the UK, where this system is not in place, the term should be replaced by 'Helicopter Operator(s)'.
HDWG	Heliport Design Working Group.
Helideck	A landing area on an offshore installation or vessel.
HLAC	The Helideck Landing Area Certificate issued by the HCA, and required by UK offshore helicopters operators, to authorise the use of a helideck.
HLL	Helideck Limitations List (formerly known as the Installation/Vessel Limitation List (IVLL)). Published and distributed by the HCA in UKCS **or** other National Authority accepted bodies in other North Sea States.
HLO	Helicopter Landing Officer.
HSE	Health and Safety Executive.
IATA	International Air Transport Association.
ICAO	International Civil Aviation Organization.
ICP	Independent and competent person as defined in the Offshore Installations (Safety Case) Regulations 2005 who is selected to perform functions under the verification scheme.
ICS	International Chamber of Shipping.
IMO	International Maritime Organization.
ISO	International Standards Organization.
Landing Area	A generic term referring to the load-bearing area primarily intended for the landing or 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.
LED	Light Emitting Diode.
LFL	Lower Flammable Limit.
LOS	Limited Obstacle Sector. The 150° sector within which obstacles may be permitted, provided the height of the obstacles is limited.
MEK	Methyl Ethyl Ketone.
MTOM	Maximum Certificated Take-Off Mass.
NAI	Normally Attended Installation.
NM	Nautical Miles.
NUI	Normally Unattended Installation.

OFS	Obstacle Free Sector. The 210° sector, extending outwards to a distance that will allow for an unobstructed departure path appropriate to the helicopter the helideck is intended to serve, within which no obstacles above helideck level are permitted. For helicopters operated in Performance Class 1 or 2 the horizontal extent of this distance will be compatible with the one-engine inoperative capability of the helicopter type to be used.
OGUK	Oil and Gas UK (formerly known as the United Kingdom Offshore Operators Association (UKOOA)).
OIAC	Offshore Industry Advisory Committee.
OIAC-HLG	Offshore Industry Advisory Committee – Helicopter Liaison Group.
Perimeter D Marking	The marking located in the perimeter line in whole numbers; i.e. the D-value (see above) rounded up or down to the nearest whole number.
PPE	Personal Protective Equipment.
RD	Rotor Diameter.
RFF	Rescue and Fire Fighting.
Run-Off Area	An extension to the Landing Area designed to accommodate a parked helicopter; sometimes referred to as the Parking Area.
SCBA	Self-Contained Breathing Apparatus.
TD/PM Circle	Touchdown/Positioning Marking Circle. Described as the Aiming Circle in earlier editions of CAP 437, the TD/PM Circle is the aiming point for a normal 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.
UKCS	UK Continental Shelf (Geographical area).
UKOOA	United Kingdom Offshore Operators Association (now known as Oil and Gas UK).
UPS	Uninterrupted Power Supply.
Verification Scheme	A suitable written scheme as defined in the Offshore Installations (Safety Case) Regulations 2005 for ensuring the suitability and proper maintenance of safety-critical elements.
VMC	Visual Meteorological Conditions
WMO	World Meteorological Organisation.

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Chapter 1 Introduction

1 History of Development of Criteria for Offshore Helicopter Landing Areas, 1964-1973

1.1 In the early 1960s it became apparent that there would be a continuing requirement for helicopter operations to take place on fixed and mobile offshore installations. Various ideas were put forward by oil companies and helicopter operators as to the appropriate landing area standards for such operations. In 1964, draft criteria were published which used helicopter rotor diameter as a determinant of landing area size and associated obstacle-free area. In the light of experience and after further discussions, the criteria were amended and re-published in 1968. These criteria were then, and still are, based upon helicopter overall length (from most forward position of main rotor tip to most rearward position of tail rotor tip, or rearmost extension of fuselage if 'fenestron' is used). This length is commonly referred to as 'D' for any particular helicopter as the determinant of landing area size, associated characteristics, and obstacle-protected surfaces.

2 Department of Energy and the Health and Safety Executive Guidance on the Design and Construction of Offshore Installations, 1973 Onwards

2.1 In the early 1970s, the Department of Energy began the process of collating guidance standards for the design and construction of 'installations' – both fixed and mobile. This led to the promulgation of the Offshore Installations (Construction and Survey Regulations) 1974, which were accompanied by an amplifying document entitled 'Offshore Installations: Guidance on the design and construction of offshore installations' (the 4th Edition Guidance). This guidance included criteria for helicopter landing areas which had been slightly amended from those issued in 1968. During 1976 and 1977, the landing area criteria were developed even further during a full-scale revision of this guidance document, following consultations between the CAA, the British Helicopter Advisory Board and others. This material was eventually published in November 1977 and amended further in 1979. This latter amendment introduced the marking of the landing area to show the datum from which the obstacle-free area originated, the boundary of the area, and the maximum overall length of helicopter for which operations to the particular landing area were suitable. The first edition of CAP 437 was published in 1981, amended in 1983 and revised in December 1993 (second edition) and October 1998 (third edition). Following a further amendment in January 2001, a fourth edition of CAP 437, incorporating the new house style, was placed on the Publications section of the CAA website at www.caa.co.uk in September 2002. This was superseded by the fifth edition of CAP 437 in August 2005. Since the early 1990s changes have been introduced which incorporate the results of valuable experience gained from various 'helideck' research programmes as well as useful feedback from the HCA (formerly BHAB Helidecks) following several years' experience in carrying out helideck inspections; changes also include the latest helideck criteria internationally agreed and published as Volume II (Heliports) of Annex 14 to the Convention on International Civil Aviation. A further amendment to Annex 14 Volume II was adopted in 2009 (applicable from 19 November 2009); and the latest helideck criteria generated by the ICAO amendment is reflected in this sixth edition of CAP 437.

2.2 In April 1991 the Health and Safety Commission and the HSE took over from the Department of Energy the responsibility for offshore safety regulation. The Offshore Safety Act 1992, implementing the Cullen recommendations following the Piper Alpha disaster, transferred power to the HSE on a statutory footing. The HSE also took over sponsorship of the 4th Edition Guidance and Section 55 'Helicopter landing area' referring to all installations.

2.3 Since April 1991, the HSE has introduced four sets of modern goal-setting regulations which contain provisions relating to helicopter movements and helideck safety on offshore installations. These update and replace the old prescriptive legislation. The provisions are as follows:

	Regulations	Covers
1.	The Offshore Installations (Safety Case) Regulations 2005 (SCR) (SI 2005/3117)	**Regulation 2(1)** defines a major accident and this includes the collision of a helicopter with an installation. **Regulation 2(1)** defines safety-critical elements (SCEs) and **Regulation 2(5)** refers to a verification scheme for ensuring by means described in **Regulation 2(6)** that the SCEs will be suitable and remain in good repair and condition. Helidecks and their associated systems are deemed to be SCEs. **Regulation 6** requires the submission of a design notification containing the particulars specified in Schedule 1. **Regulation 12(1)** requires that a safety case should demonstrate: the adequacy of the safety management system to ensure compliance with relevant statutory provisions; the adequacy of arrangements for audit; that all hazards with the potential to cause a major accident have been identified and evaluated; and that measures have been taken to ensure that the relevant statutory provisions will be complied with.
2.	The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER) (SI 1995/743)	**Regulation 6(1)(c)** requires a sufficient number of personnel trained to deal with helicopter emergencies to be available during helicopter movements. **Regulation 7** requires the operator/owner of a fixed/ mobile installation to ensure that equipment necessary for use in the event of an accident involving a helicopter is kept available near the helicopter landing area. Equipment provided under **Regulation 7** must comply with the suitability and condition requirements of **Regulation 19(1)** of PFEER. **Regulations 9**, **12** and **13** make general requirements for the prevention of fire and explosion, the control of fire and explosion which would take in helicopter accidents. **Regulation 17** of PFEER requires arrangements to be made for the rescue of people near the installation from helicopter ditchings.

3.	The Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995 (MAR) (1995/738)	**Regulation 8** requires people to co-operate with the Helicopter Landing Officer to enable him to perform his function referred to in **Regulation 13**. **Regulation 11** requires comprehensible instructions to be put in writing and brought to the attention of everybody to whom they relate. Circumstances where written instructions might be needed include helideck operations (particularly if involving part-time helideck crew). **Regulation 12(b)** requires arrangements which are appropriate for health and safety purposes to be in place for effective communication between an installation, the shore, aircraft and other installations. Arrangements must also be in place for effective communication where a helicopter is to land on or take off from an installation aboard which there will be no person immediately before landing or after the take-off, and between the helicopter and a suitable offshore installation with persons on board or, where there is no suitable installation, suitable premises ashore. **Regulation 13** requires the operator/owner of a fixed/mobile installation to ensure that a competent person is appointed to be in control of helideck operations on the installation (i.e. the Helicopter Landing Officer (HLO)), is present on the installation and is in control throughout such operations, and procedures are established and plant provided as will secure so far as is reasonably practicable that helideck operations including landing/take-off are without risks to health and safety. **Regulation 14** requires the duty holder to make arrangements for the collection and keeping of meteorological and oceanographic information and information relating to the movement of the offshore installation. This is because environmental conditions may affect helicopter operations and the ability to implement emergency plans. **Regulation 19** requires the operator/owner of an offshore installation to ensure that the installation displayed its name in such a manner as to make the installation readily identifiable by sea or air; and displays no name, letters or figures likely to be confused with the name or other designation of another offshore installation.

4.	The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996 (DCR) (SI 1996/913)	**Regulation 11** – Helicopter Landing Area requires the operator/owner of a fixed/ mobile installation to ensure that every landing area forming part of an installation is large enough and has sufficient clear approach/departure paths to enable any helicopter intended to use the landing area safely, to land and take off in any wind and weather conditions permitting helicopter operations and is of a design and construction adequate for its purpose.
The HSE has published guidance documents on SCR, MAR and DCR and, in the case of PFEER, combined guidance and an Approved Code of Practice.		

2.4 In February 2005 UKOOA published "Guidelines for the Management of Offshore Helideck Operations" (Issue 5) preceded in 2004 by an HSE publication "Offshore Helideck Design Guidelines" which was sponsored by the HSE and the CAA, and endorsed by the Offshore Industry Advisory Committee – Helicopter Liaison Group (OIAC-HLG). It is understood that the UKOOA 'Guidelines' are in the process of being updated and in due course will be republished under the new name and title: Oil and Gas UK "Guidelines for the Management of Offshore Helicopter Operations". Where these "Guidelines" are referred to throughout CAP 437 the reader should ensure that the latest version of the "Guidelines" is consulted. When referring to the "Offshore Helideck Design Guidelines" it is the responsibility of the reader to ensure that no conflict exists with the sixth edition of CAP 437. Where potential differences arise, the current best practice in CAP 437 should take precedence. Where doubt exists, the reader is advised to seek guidance from CAA Flight Operations Inspectorate (Helicopters) Section.

3 Applicability of Standards in Other Cases

3.1 For vessels engaged in supporting mineral exploitation (such as crane or derrick barges, pipe-laying vessels, fire and rescue vessels, seismic research vessels, etc.), which are not classed as 'offshore installations' and so are not subject to a verification scheme, the CAA recommends the application of the same standards for the helicopter landing areas contained in this CAP. Compliance with this recommendation will enable helicopter operators to fulfil their own legal obligations and responsibilities (see Appendix F).

3.2 On other merchant vessels where it is impracticable for these standards to be achieved, for example where the landing area has to be located amidships, the criteria to be used are included in Chapter 9 of this publication. Also in that chapter is guidance applicable to vessels involved in infrequent helicopter services in parts of the world other than the UKCS. Guidance on helicopter winching activities is included in Chapter 10. Whilst this material covers the main aspects of criteria for a helicopter landing or manoeuvring area, there may be operational factors involved with these vessels such as air turbulence; flue gases; excessive helideck motion; or the size of restricted amidships landing areas, on which guidance should be obtained from the helicopter operator or the HCA or from other competent specialists.

4 Worldwide Application

4.1 It should be noted that references are made to United Kingdom legislatory and advisory bodies. However, this document is written so that it may provide useful guidance on minimum standards applicable for the safe operation of helicopters to offshore helidecks throughout the world.

4.2 The guidance is therefore particularly relevant to UK registered helicopters operating within and outside the UKCS areas; whether or not they have access to the HCA process. In cases where the accepted HCA process is not applicable or available, where reference is made to the HCA in this document it can be substituted by the phrase 'the helicopter operator' – who should have in place a system for assessing and authorising the operational use of each helideck. Within Europe, through Joint Aviation Requirements (JAR-OPS 3), authorisation of each helideck is a specific Requirement (JAR-OPS 3.220) and guidance on the criteria for assessment is given in an 'acceptable means of compliance' (AMC) to this Requirement.

4.3 Outside UKCS other European helicopter operators have in place systems which comply with the JAR-OPS 3 Requirement but which may not utilise the HCA process in favour of a more local system which satisfies the National Authority. Throughout the range of operations covered by JAR-OPS, agreement has been made to share all helideck information between helicopter operators by the fastest possible means.

4.4 Other helicopter operators, who operate outside the areas covered by JAR-OPS 3 and who are using this guidance document, are recommended to establish a system for assessing and authorising each helideck for operational use. It is a fact that many installations and vessels do not fully comply with the criteria contained in the following chapters. A system for the assessment of the level of compliance plus a system for imposing compensating operational limitations is the only way of ensuring that the level of safety to flights is not compromised.

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Chapter 2 Helicopter Performance Considerations

1 General Considerations

1.1 The guidance for helicopter landing areas on offshore installations and vessels results from the need to ensure that UK registered helicopters are afforded sufficient space to be able to operate safely at all times in the varying conditions experienced offshore.

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

1.3 Helicopter companies operating for public transport are required to hold an Air Operator's Certificate (AOC) which is neither granted nor allowed to remain in force unless they provide procedures for helicopter crews which safely combine the space and performance requirements mentioned above.

2 Safety Philosophy

2.1 Aircraft performance data is scheduled in the Flight Manual and/or the Operations Manual which enables flight crew to accommodate the varying ambient conditions and operate in such a way that the helicopter has sufficient space and sufficient engine performance to approach, land and take off from helidecks in safety.

2.2 Additionally, Operations Manuals recognise the remote possibility of a single engine failure in flight and state the flying procedures and performance criteria which are designed to minimise the exposure time of the aircraft and its occupants during the short critical periods during the initial stage of take-off, or final stage of landing.

2.3 The CAA is currently researching the effects upon helicopter performance and control created by the offshore helideck environment in order to establish whether there is a need for additional procedures and/or revised criteria (see Chapter 3, section 3.2).

3 Factors Affecting Performance Capability

3.1 On any given day helicopter performance is a function of many factors including the actual all-up mass; ambient temperature; pressure altitude; effective wind speed component; and operating technique. Other factors, concerning the physical and airflow characteristics of the helideck and associated or adjacent structures, will also combine to affect the length of the exposure period referred to in paragraph 2.2 above. These factors are taken into account in the determination of specific and general limitations which may be imposed in order to ensure adequate performance and to ensure that the exposure period is kept to a minimum. In many circumstances the period will be zero. It should be noted that, following a rare power unit failure, it may be necessary for the helicopter to descend below deck level to gain sufficient speed to safely fly away, or in extremely rare circumstances to land on the water. In certain circumstances, where exposure periods would otherwise be unacceptably long, it will probably be necessary to reduce helicopter mass (and therefore payload) or even to suspend flying operations.

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Chapter 3 Helicopter Landing Areas – Physical Characteristics

1 General

1.1 This chapter provides guidance on the physical characteristics of helicopter landing areas (helidecks) on offshore installations and vessels. It should be noted that where a Verification Scheme is required it should state for each helicopter landing area the maximum size of helicopter in terms of D-value and the mass for which that area is verified with regard to its size and strength. Where the criteria cannot be met in full for a particular size of helicopter, the agencies responsible should liaise with the HCA on any operational restrictions that may be considered necessary in order to compensate for deviations from these criteria. The HCA will inform the helicopter operators of any restrictions through the HLL.

1.2 The criteria which follow are based on helicopter size and mass. This data is summarised in Table 1 below.

Table 1 D-Value, 't' Value and other Helicopter Type Criteria

Type	D-value (metres)	Perimeter 'D' marking	Rotor diameter (metres)	Max weight (kg)	't' value	Landing net size
Bolkow Bo 105D	12.00	12	9.90	2400	2.4t	Not required
EC 135 T2+	12.20	12	10.20	2910	2.9t	Not required
Bolkow 117	13.00	13	11.00	3200	3.2t	Not required
Agusta A109	13.05	13	11.00	2600	2.6t	Small
Dauphin AS365 N2	13.68	14	11.93	4250	4.3t	Small
Dauphin AS365 N3	13.73	14	11.94	4300	4.3t	Small
EC 155B1	14.30	14	12.60	4850	4.9t	Medium
Sikorsky S76	16.00	16	13.40	5307	5.3t	Medium
Agusta/Westland AW 139[1]	16.66	17	13.80	6400	6.4t	Medium
Bell 412	17.13	17	14.02	5397	5.4t	Not Required
Bell 212	17.46	17	14.63	5080	5.1t	Not required
Super Puma AS332L	18.70	19	15.60	8599	8.6t	Medium
Bell 214ST	18.95	19	15.85	7936	8.0t	Medium
Super Puma AS332L2	19.50	20	16.20	9300	9.3t	Medium
EC 225	19.50	20	16.20	11000	11.0t	Medium
Sikorsky S92[1]	20.88	21	17.17	12020	12.0t	Large
Sikorsky S61N	22.20	22	18.90	9298	9.3t	Large
EH101	22.80	23	18.60	14600	14.6t	Large

1. Manufacturer derived data has indicated that the Maximum Certificated Take-Off Mass (MTOM) of the military, and perhaps civil variant, of the S92 may grow to 12,834 kg. It is understood that structural design considerations for new build S92 helidecks will normally be based on the higher take-off mass (12,834 kg). Where structural design is verified by an ICP to be in accordance with the 'growth' take-off mass, duty holders are permitted to display the higher 't' value marking on the helideck, i.e. '12.8t'. (NOTE: It is understood that the AW 139 may, in future, grow from 6.4t to 6.8t.)

NOTE: Where skid-fitted helicopters are used routinely, landing nets are not recommended.

2 Helideck 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 installations or vessels and their helidecks. The term "environmental effects" is used here to represent the effects of the installation or vessel and/or its systems and/or processes on 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, turbulence and thermal effects caused by gas turbine exhausts, thermal effects of flares and diesel exhaust emissions, and unburnt hydrocarbon gas emissions from cold flaring or, more particularly, emergency blowdown systems. It is almost inevitable that helidecks installed on the cramped topsides of offshore installations will suffer to some degree from one or more of these environmental effects, and controls in the form of operational restrictions may be necessary in some cases. Such restrictions can be minimised by careful attention to the design and layout of the installation topsides and, in particular, the location of the helideck.

2.1.2 Guidance on the design and placement of offshore helidecks is provided in this document, and includes certain environmental criteria (see paragraph 2.2.1 below). These criteria have been set to define safe operating boundaries for helicopters in the presence of known environmental hazards. Where these criteria cannot be met, a limitation is placed in the HLL. These entries are usually specific to particular combinations of wind speed and direction, and either restrict helicopter mass (payload), or prevent flying altogether in certain conditions.

2.1.3 The HLL system is operated by the HCA for the benefit of the offshore helicopter operators and should ensure that landings on offshore helidecks are properly controlled when adverse environmental effects are present. On poorly designed helidecks, severe operational restrictions may result, leading to significant commercial penalties for an installation operator or vessel owner. Well designed and 'helicopter friendly' platform topsides and helidecks should result in efficient operations and cost savings for the installation operator.

NOTE: It is important that the HCA are always consulted at the earliest stage of design to enable them to provide guidance and information on behalf of the helicopter operators so that the process for authorising the use of the helideck can be completed in a timely fashion and in a manner which ensures that maximum helicopter operational flexibility is realised. Information from helideck flow assessment studies (see paragraphs 2.3.2 and 2.3.3 below) should be made available to the HCA as early as possible to enable them to identify any potential adverse environmental effects that may impinge on helicopter flight operations and which, if not addressed at the design stage, could lead to operational limitations being imposed to ensure that safety is not compromised.

2.2 Guidance

2.2.1 A review of offshore helideck environmental issues (see CAA Paper 99004) concluded that many of the decisions leading to poor helideck 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 helideck design guidance was made available to run in parallel with CAP 437. As part of the subsequent research programme, material covering environmental effects on offshore helideck operations was commissioned by the HSE and the CAA. This material is now presented in CAA Paper 2008/03: "Helideck Design Considerations – Environmental Effects" and is available on the Publications section of the CAA website at www.caa.co.uk/

publications. It is strongly recommended that platform designers and offshore duty holders consult CAA Paper 2008/03 at the earliest possible stage of the design process.

2.2.2 The objective of CAA Paper 2008/03 is to help platform designers to create offshore installation topside designs, and helideck locations, that are safe and 'friendly' to helicopter operations by minimising exposure to environmental effects. It is hoped that, if used from 'day one' of the offshore installation design process when facilities are first being laid out, this manual will prevent or minimise many helideck environmental problems at little or no extra cost to the design or construction of the installation.

2.3 Design Criteria

2.3.1 The design criteria given in the following paragraphs represent the current best information available and should be applied to new installations, significant modifications to existing installations, and to combined operations (where a mobile platform or vessel is operating in close proximity to another installation). In the case of multiple platform configurations, the design criteria should be applied to the arrangement as a whole.

NOTE: When considering the volume of airspace to which the following criteria apply, installation designers should consider the airspace up to a height above helideck level which takes into consideration the requirement to accommodate helicopter landing and take-off decision points or committal points. This is deemed to be up to a height above the helideck corresponding to 30 ft plus wheels-to-rotor height plus one rotor diameter.

2.3.2 All new build offshore helidecks, modifications to existing topside arrangements which could potentially have an effect on the environmental conditions around an existing helideck, or helidecks where operational experience has highlighted potential airflow problems should be subject to appropriate wind tunnel testing or computational fluid dynamics (CFD) studies to establish the wind environment in which helicopters will be expected to operate. As a general rule, a limit on the standard deviation of the vertical airflow velocity of 1.75 m/s should not be exceeded. The helicopter operator should be informed at the earliest opportunity of any wind conditions for which this criterion is not met. Operational restrictions may be necessary.

NOTES:

1. Following completion of the validation exercise, the provisional limit on the standard deviation of the vertical airflow velocity of 2.4 m/s specified in CAP 437 fifth edition guidance was lowered to 1.75 m/s. This change was made to allow for flight in reduced cueing conditions, for the less able or experienced pilot, and to better align the associated measure of pilot workload with operations experience. It is recommended that use is made of the helicopter operators' existing operations monitoring programmes to include the routine monitoring of pilot workload and that this be used to continuously inform and enhance the quality of the HLL entries for each platform (see CAA Paper 2008/02 – Validation of the Helicopter Turbulence Criterion for Operations to Offshore Platforms).
2. Following the establishment of the new turbulence criterion for helicopters operating to offshore installations, the need for retention of the long-standing CAP 437 criterion related to a vertical wind component of 0.9 m/s has been reviewed. As it has not been possible to link the criterion to any helicopter performance (i.e. torque related) or handling (pilot work related) hazard, it is considered that the vertical mean wind speed criterion can be removed from guidance material. The basis for the removal from guidance is described in detail in CAA Paper 2008/02 Study II – A Review of 0.9 m/s Vertical Wind Component Criterion for Helicopters Operating to Offshore Installations. The conclusions and

recommendations made in the report, including the removal of the vertical mean wind speed criterion from guidance, has been agreed with the offshore helicopter operators and the HCA.

2.3.3 Unless there are no significant heat sources on the installation or vessel, offshore duty holders 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 helidecks, significant modifications to existing topside arrangements, or for helidecks 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 three second time interval), the helicopter operator should be consulted at the earliest opportunity so that appropriate operational restrictions may be applied.

2.3.4 Previous editions of CAP 437 have suggested that ‘some form of exhaust plume indication should be provided for use during helicopter operations, for example, by the production of coloured smoke’. Research has been conducted into the visualisation of gas turbine exhaust plumes and guidance on how this can be achieved in practice has been established. This work is now reported in CAA Paper 2007/02 which recommends that consideration should be given to installing a gas turbine exhaust plume visualisation system on platforms having a significant gas turbine exhaust plume problem in order to highlight the hazards to pilots and thereby minimising its effects by making it easier to avoid encountering the plume. It is further recommended that use is made of the helicopter operators’ existing operations monitoring programmes to establish and continuously monitor the temperature environments around all offshore platforms. This action is aimed at identifying any ‘problem’ platforms, supporting and improving the contents of the HLL, identifying any new problems caused by changes to platform topsides or resulting from combined operations, and identifying any issues related to flight crew training or procedures.

2.3.5 The maximum permissible concentration of hydrocarbon gas within the helicopter operating area is 10% Lower Flammable Limit (LFL). Concentrations above 10% LFL have the potential to cause helicopter engines to surge and/or flame out with the consequent risk to the helicopter and its passengers. It should also be appreciated that, in forming a potential source of ignition for flammable gas, the helicopter can pose a risk to the installation itself. It is considered unlikely that routine ‘cold flaring’ will present any significant risk, but the operation of emergency blowdown systems should be assumed to result in excessive gas concentrations. Installation operators should have in place a management system which ensures that all helicopters in the vicinity of any such releases are immediately advised to stay clear.

NOTE: The installation of ‘Status Lights’ systems (see Chapter 4, paragraph 3.10) is not considered to be a solution to all potential flight safety issues arising from hydrocarbon gas emissions; these lights are only a visual warning that the helideck is in an unsafe condition for helicopter operations.

2.3.6 For ‘permanent’ multiple platform configurations, usually consisting of two or more bridge-linked fixed platforms in close proximity, where there is a physical separation of the helideck from the production and process operation, the environmental effects of hazards emanating from the ‘remote’ production platform should be considered on helideck operations. This is particularly appropriate for the case of hot or cold gas exhausts where there will always be a wind direction that carries any exhaust plumes from a neighbouring platform (bridge-linked module) in the direction of the helideck.

2.3.7 For ‘temporary’ combined operations, where one mobile installation or vessel (e.g. a flotel) is operated in close proximity to a fixed installation, the environmental effects of hazards emanating from one installation (or vessel) on the other installation (or vessel) should be fully considered. This 'assessment' should consider the effect of the turbulent wake from one platform impinging on the helideck of the other, and of any hot or cold gas exhausts from one installation or vessel influencing the approach to the other helideck. On occasions there may be more than two installations and/or vessels in a 'temporary combined' arrangement. Where this is the case, the effect of turbulent wake and hot gas exhausts from each installation or vessel on all helideck operations within the combined arrangement should be considered.

NOTE: Section 2.3 is primarily concerned with the issue of environmental effects on the helideck design. In respect of permanent multi-platform configurations and 'temporary' combined operations there are a number of other considerations that may need to be addressed. These include, but may not be limited to, the effect of temporary combined operations on helideck obstacle protection criteria. Additional considerations are described in more detail in the UKOOA 'Guidelines for the Management of Offshore Helideck Operations'.

3 Structural Design

3.1 The take-off and landing area should be designed for the heaviest and largest helicopter anticipated to use the facility (see Table 1). Helideck structures should be designed in accordance with ICAO requirements (the Heliport Manual), relevant International Standards Organization (ISO) codes for offshore structures and, for a floating installation, the relevant International Maritime Organization (IMO) code. The maximum size and mass of helicopter for which the helideck has been designed should be stated in the Installation/Vessel Operations Manual and Verification and/or Classification document.

3.2 Optimal operational flexibility will be gained from considering the potential life and usage of the facility along with likely future developments in helicopter design and technology.

3.3 Consideration should also be given in the design to other types of loading such as personnel, traffic, snow, freight, fuelling equipment etc. as stated in the ICAO Heliport Manual and other codes. It may be assumed that single main rotor helicopters will land on the wheel or wheels of two landing gear (including skids if fitted). The resulting loads should be distributed between two main undercarriages. Where advantageous a tyre contact area may be assumed in accordance with the manufacturer's specification. Ultimate limit state methods may be used for the design of the helideck structure, including girders, trusses, pillars, columns, plating and stiffeners. A serviceability limit check should also be performed to confirm that the maximum deflection of the helideck under maximum load is within code limits. This check is intended to reduce the likelihood of the helideck structure being so damaged during an emergency incident as to prevent other helicopters from landing.

NOTES:

1. Requirements for the structural design of helidecks will be set out in ISO 19901-3 Petroleum and Natural Gas Industries – Specific Requirements for Offshore Structures, Part 3: Topsides Structure (expected to be published soon). Useful guidance is also given in the Offshore Industry Advisory Committee (OIAC) publication 'Offshore Helideck Design Guidelines' published by the Health and Safety Executive.
2. Consideration should be given to the possibility of accommodating an unserviceable helicopter in the parking or run-off area to the side of the helideck to allow a relief helicopter to land. If this contingency is designed into the construction/operating philosophy of the installation, the helicopter operator

should be advised of any weight restrictions imposed on the relief helicopter by structural integrity considerations.

3. Alternative loading criteria equivalent to those recommended here and in paragraphs 4 and 5 may be used where aircraft-specific loads have been derived by the aircraft manufacturer from a suitable engineering assessment taking account of the full range of potential landing conditions, including failure of a single engine at a critical point, and the behaviour of the aircraft undercarriage and the response of the helideck structure. The aircraft manufacturer should provide information to interested parties, including the owner or operator of the installation, the helicopter operators and the regulators to justify any such alternative criteria. The aircraft manufacturer may wish to seek the opinion of the CAA on the basis of the criteria to be used. In consideration of alternative criteria, the CAA is content to assume that a single engine failure represents the worst case in terms of rate of descent on to the helideck amongst likely survivable emergencies.

4 Loads – Helicopters Landing

4.1 The helideck should be designed to withstand all the forces likely to act when a helicopter lands. The loads and load combinations to be considered include:

a) **Dynamic load due to impact landing.** This should cover both a heavy normal landing and an emergency landing. For the former, an impact load of 1.5 x MTOM of the helicopter should be used, distributed as described in paragraph 3.3 above. This should be treated as an imposed load, applied together with the combined effect of b) to f) below in any position on the landing area so as to produce the most severe load on each structural element. For an emergency landing, an impact load of 2.5 x MTOM should be applied in any position on the landing area together with the combined effects of b) to f) inclusive. Normally, the emergency landing case will govern the design of the structure.

b) **Sympathetic response of landing platform.** After considering the design of the helideck structure's supporting beams and columns and the characteristics of the designated helicopter, the dynamic load (see a) above) should be increased by a suitable structural response factor depending upon the natural frequency of the helideck structure. It is recommended that a structural response factor of 1.3 should be used unless further information allows a lower factor to be calculated. Information required to do this will include the natural periods of vibration of the helideck and the dynamic characteristics of the designated helicopter and its landing gear.

c) **Overall superimposed load on the landing platform.** To allow for snow, personnel etc. in addition to wheel loads, an allowance of 0.5 kN/m^2 should be added over the whole area of the helideck.

d) **Lateral load on landing platform supports.** The landing platform and its supports should be designed to resist concentrated horizontal imposed loads equivalent to 0.5 x MTOM of the helicopter, distributed between the undercarriages in proportion to the applied vertical loading in the direction which will produce the most severe loading on the element being considered.

e) **Dead load of structural members.** This is the normal gravity load on the element being considered.

f) **Wind loading.** Wind loading should be allowed for in the design of the platform. This should be applied in the direction which, together with the imposed lateral loading, will produce the most severe loading condition on each element.

g) **Punching shear.** A check should be made for the punching shear from a wheel of the landing gear with a contact area of 65 x 10^3 mm^2 acting in any probable location. Particular attention to detailing should be taken at the junction of the supports and the platform deck.

5 Loads – Helicopters at Rest

5.1 The helideck should be designed to withstand all the applied forces that could result from a helicopter at rest; the following loads should be taken into account:

a) **Imposed load from helicopter at rest.** All areas of the helideck accessible to a helicopter, including any separate parking or run-off area, should be designed to resist an imposed load equal to the MTOM of the helicopter. This load should be distributed between all the landing gear. It should be applied in any position on the helideck so as to produce the most severe loading on each element considered.

b) **Overall superimposed load, dead load and wind load.** The values for these loads are the same as given in paragraph 4.1 c), e) and f) above and should be considered to act simultaneously in combination with a) above. Consideration should also be given to the additional wind loading from any parked or secured helicopter.

c) **Acceleration forces and other dynamic amplification forces.** The effect of these forces, arising from the predicted motions of mobile installations and vessels, in the appropriate environmental conditions (corresponding to a 10-year return period), should be considered.

6 Size and Obstacle Protected Surfaces

NOTE: The location of a specific helideck is often a compromise given the competing requirements for space. Helidecks should be at or above the highest point of the main structure. This is a desirable feature but it should be appreciated that if this entails a landing area much in excess of 60 m above sea level, the regularity of helicopter operations may be adversely affected in low cloud base conditions.

6.1 For any particular type of single main rotor helicopter, the helideck 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 offshore helidecks the D-circle will be ‘hypothetical’ but the helideck shape should be capable of accommodating such a circle within its physical boundaries.

6.2 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 landing area (and D-circle) and which extends over a sector of at least 210°. Within this sector obstacle accountability should be considered out to a distance from the periphery of the landing area that will allow for an unobstructed departure path appropriate to the helicopter the helideck is intended to serve. For helicopters operated in Performance Class 1 or 2 the horizontal extent of this distance from the helideck will be based upon the one-engine inoperative capability of the helicopter type to be used. In consideration of the above, 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 7.2);
- the lighting required by Chapter 4;
- the foam monitors (where provided); and

- those handrails and other items (e.g. EXIT sign) associated with the landing area which are incapable of complete retraction or lowering for helicopter operations.

6.3 Objects whose function requires that they be located on the surface of the landing area such as landing nets and, in future, "stage 2" lighting systems (see Chapter 4, paragraph 3.4) should not exceed the surface of the landing area by more than 2.5 cm. Such objects should only be present provided they do not cause a hazard to helicopter operations.

6.4 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 illustrated in Figure 1. Acceptance of the 'swung' criteria will normally only be applicable to existing installations.

NOTE: If 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.

6.5 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 (hypothetical) D-circle and from the perimeter of the landing area. This diagram assumes, since most helidecks are designed to the minimum requirement of accommodating a 1 D-circle, that the D-circle perimeter and landing area perimeter are coincidental. No objects above 25 cm 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 landing area perimeter marking. The second segment of the LOS, in which no obstacles are permitted to penetrate, is a rising 1:2 slope originating at a height of 0.05D above the helideck surface and extending out to 0.83D from the centre of the D-circle (i.e. a further 0.21D from the edge of the first segment of the LOS).

NOTE: The exact point of origin of the LOS is assumed to be at the periphery of the D-circle.

6.6 Some helidecks are able to accommodate a landing area 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 perimeter of the landing area as marked by the perimeter line. Any landing area perimeter should guarantee the obstacle protection afforded by both segments of the LOS. The respective measurements of 0.12D from the landing area 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 landing area 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-shaped landing area.

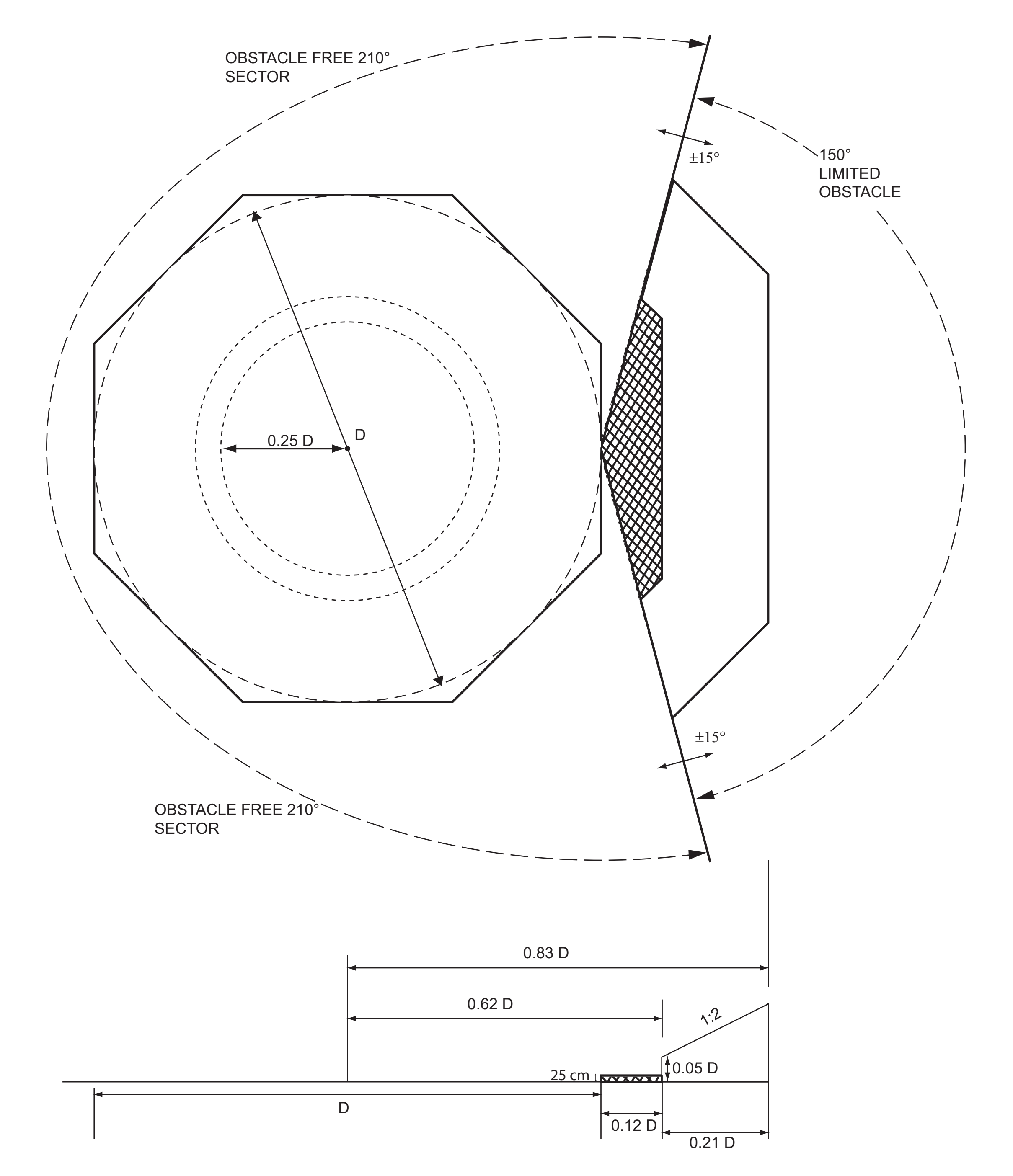

Figure 1 Obstacle Limitation (Single Main Rotor and Side by Side Main Rotor Helicopters) showing position of Touchdown/Positioning Marking circle

6.7 The extent of the LOS segments will, in all cases, be lines parallel to the landing area perimeter line and follow the boundaries of the landing area perimeter (see Figure 1). Only in cases where the perimeter of the landing area is circular will the extent be in the form of arcs to the D-circle. However, taking the example of an octagonal landing area 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 landing area, 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 landing area are maintained. Similar geometric construction may be made to a square or rectangular landing area but care should be taken to ensure that the LOS protected surfaces minima can be satisfied from all points on the inboard perimeter of the landing area.

6.8 Whilst application of the criteria in paragraph 6.2 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 a 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 fixed and mobile installations between the helideck and the sea. The falling 5:1 gradient should be at least 180° with an origin at the centre of the D-circle and ideally it should cover the whole of the 210° OFS. It should extend outwards for a distance that will allow for safe clearance from obstacles below the helideck in the event of an engine failure for the type of helicopter the helideck is intended to serve. (See also Glossary of Terms and Abbreviations.) For helicopters operated in Performance Class 1 or 2 the horizontal extent of this distance from the helideck will be based upon the one-engine inoperative capability of the helicopter type to be used (see Figure 2). All objects that are underneath anticipated final approach and take-off paths should be assessed.

NOTES:

1. For practical purposes the falling obstacle limitation surface can be assumed to be defined from points on the outboard edge of the helideck 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 helideck but may also attract helicopter operational limitations.
2. Research completed in 1999 (see Appendix B references) demonstrated that, following a single engine failure in a twin engine helicopter after take-off decision point, and assuming avoidance of the deck edge, the resulting trajectory will carry the helicopter clear of any obstruction in the range 2:1 to 3:1. It is therefore only necessary for operators to account for performance in relation to specified 5:1 falling gradient when infringements occur to a falling 3:1 rather than a 5:1 slope.

6.9 It is recognised that when support installations, such as 'flotels' and crane-barges, are operating close to other installations, it will not always be possible to meet the horizontal and vertical obstacle protected surface requirements. In these circumstances, installation operators should attempt to meet the above criteria as closely as possible when planning the siting of a combination of installations or an installation and a vessel, and should forward drawings of the proposed configuration to the HCA as early as possible in the process for assessment and consultation on the operational aspects. Consultation with the helicopter operators in the early planning stages will help to optimise helicopter operations for support installation location.

NOTE: As a general rule, on helidecks where obstacle-protected surfaces are infringed by other installations or vessels positioned within a horizontal distance from the helideck which is based upon the airspace requirements needed to accommodate the one-engine inoperative capability of the helicopter type to be used, it may be necessary to impose helicopter operating restrictions on one or all of the helidecks affected. The Management and Control of Combined Operations is discussed in more detail in the UKOOA Guidelines for the Management of Offshore Helideck Operations.

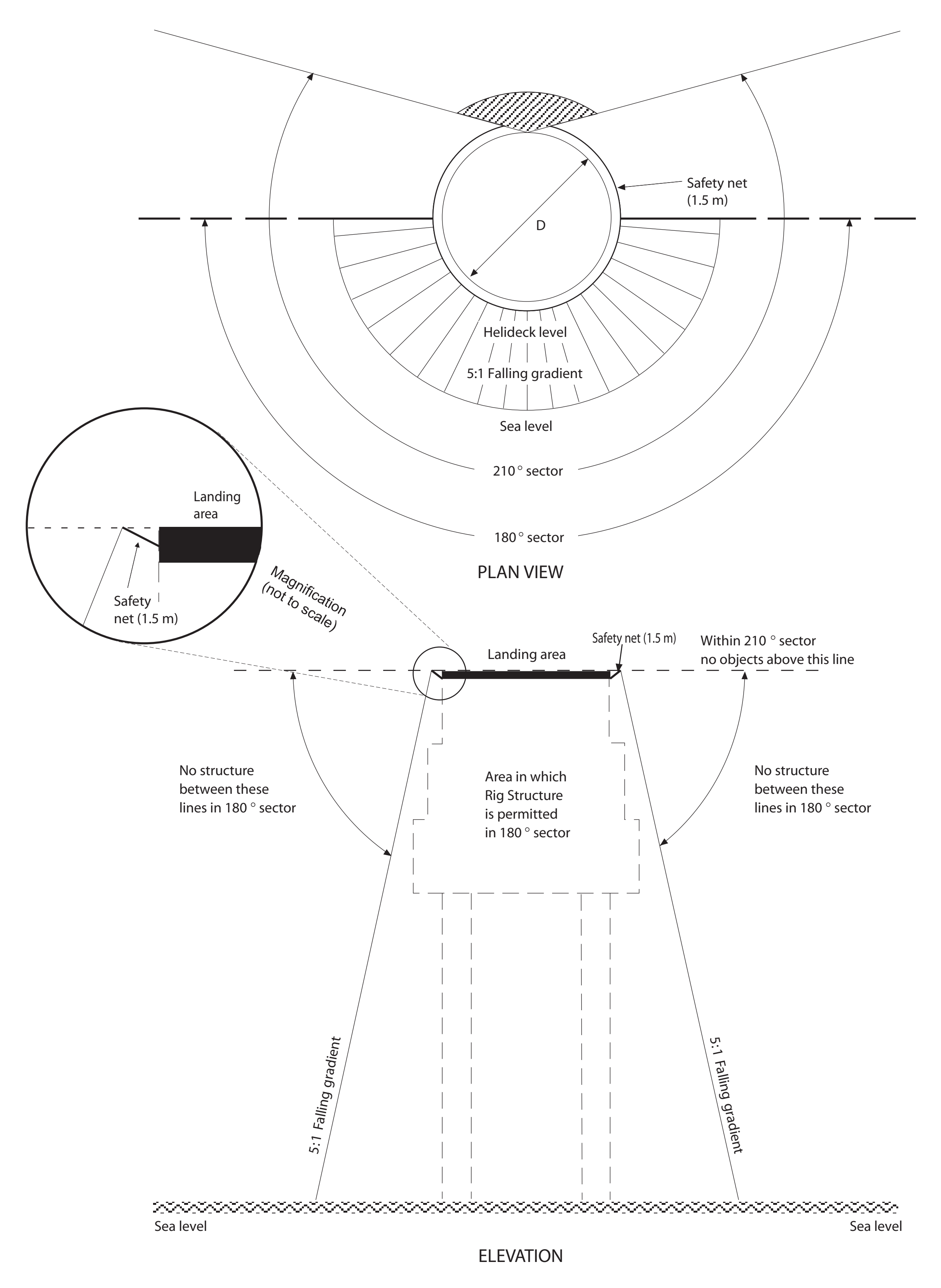

Figure 2 Obstacle Free Areas – Below Landing Area Level (for all types of helicopters)

6.10 It is accepted that, at times, short-term infringement to obstacle-protected surfaces cannot be avoided when, for example, supply/support vessels work close to an installation. It may be impractical to assess such situations within the time available.

However, the helicopter operator may need to apply operational limitations in such circumstances. It is therefore important for helicopter crews to be kept informed of all temporary infringements.

7 Surface

NOTE: Where a helideck is constructed in the form of a grating, e.g. where a passive fire-retarding system is selected (see Chapter 5), the design of the helideck should ensure that ground effect is not reduced.

7.1 The landing area should have an overall coating of non-slip material and all markings on the surface of the landing area should be finished with the same non-slip materials. Whilst extruded section or grid construction aluminium (or other) decks may provide adequate resistance to sliding, they should be coated with a non-slip material unless adequate friction properties have been confirmed by measurement (see paragraph 7.5). It is important that adequate friction exists in all directions. Over-painting friction surfaces on such designs with other than non-slip material will likely compromise the surface friction. Suitable surface friction material is available commercially.

7.2 Every landing area should be equipped with adequate surface drainage arrangements and a free-flowing collection system that will quickly and safely direct any rainwater and/or fuel spillage and/or fire fighting media away from the helideck surface to a safe place. Helidecks on fixed installations should be cambered (or laid to a fall) to approximately 1:100. Any distortion of the helideck surface on an installation 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 on a new build or a slightly raised kerb should be provided around the perimeter to prevent spilled fuel from falling on to other parts of the installation 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 helideck. 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 helideck area should be properly sealed so that spillage will only route into the drainage system.

7.3 Tautly-stretched rope netting should be provided to aid the landing of helicopters with wheeled undercarriages in adverse weather conditions. The intersections should be knotted or otherwise secured to prevent distortion of the mesh. It is preferable that the rope be constructed of 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. Subject to acceptance by the HCA, netting made of material other than sisal may 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 helideck surface when applying a vigorous vertical pull by hand. The location of the net should ensure coverage of the area of the Touchdown/Positioning Marking but should not cover the helideck identification marking or ‘t’ value markings. Some nets may require modification to corners so as to keep the identification markings uncovered. In such circumstances the dimensions given in Table 2 may be modified.

NOTE: It should be borne in mind when selecting an appropriate helideck netting solution that the height of the netting (i.e. the thickness of the installed net including knots) should accord with the requirements specified in paragraph 6.3 above.

7.4 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.

Table 2 Helicopter Deck Netting

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

NOTE: Some helideck nets may be circular rather than square.

7.5 For fixed Normally Attended Installations (NAIs), where no significant movement due to environmental conditions occurs, provided the helideck can be shown to achieve an average surface friction value of not less than 0.65 determined by a test method acceptable to the CAA, the helideck landing net may be removed. The installation operator should ensure thereafter that the helideck is kept free from oil, grease, ice, snow, excessive surface water or any other contaminant (particularly guano) that could degrade surface friction. Assurance should be provided to the helicopter operator that procedures are in place for elimination and removal of contaminants prior to helicopter movements. Following removal of the netting, the helideck should be re-tested at regular intervals. The criteria for initial removal and the frequency of subsequent testing should be approved by an ICP, subject to the guidance contained in CAA Paper 98002. Friction testing periodicity can be determined using a simple trend analysis as described in this paper. Table 3 indicates typical frequencies of inspection for given ranges of friction values.

7.6 Consideration to remove landing nets on Normally Unattended Installations (NUIs) may only be given if procedures are in place which guarantee that the helideck will remain clear of contaminants such that there is no risk of helideck markings and visual cues being compromised or friction properties reduced.

7.7 Landing nets on mobile installations have generally, in the absence of any research, been regarded as essential. However, it may be possible to present a safety case to the HCA for specific installations.

Table 3 Friction Requirements for Landing Area Net Removal

Average surface friction value	**Maximum period between tests**
0.85 and above (Recognised Friction Surface)[1]	36 months
0.7 to 0.84	12 months
0.65 to 0.69	6 months
Less than 0.65[1]	Net to be retained

1. Refer to CAA Paper 98002

7.8 Experience has shown that the removal of landing nets on some installations has resulted in undesirable side-effects. Although the purpose of the landing net is to help prevent the helicopter sliding on the helideck, it does also provide a degree of visual cueing to pilots in terms of rate of closure and lateral movement. Such visual cueing is essential for safe control of the helicopter and, on some installations, removal of the landing net could significantly degrade the cueing environment. Serious consideration should be given to this aspect before a landing net is removed. The helicopter operator should be consulted before existing landing nets are removed and installation operators should be prepared to re-fit landing nets if so advised by the helicopter operator in the case that visual cueing difficulties are experienced. For these reasons it is also recommended that the design of new installations should incorporate the provision of landing net fittings regardless of the type of friction surface to be provided.

8 Helicopter Tie-Down Points

8.1 Sufficient flush fitting (when not in use) tie-down points should be provided for securing the maximum sized helicopter for which the helideck is designed. They should be so located and be of such strength and construction to secure the helicopter when subjected to weather conditions pertinent to the installation design considerations. They should also take into account, where significant, the inertial forces resulting from the movement of floating units.

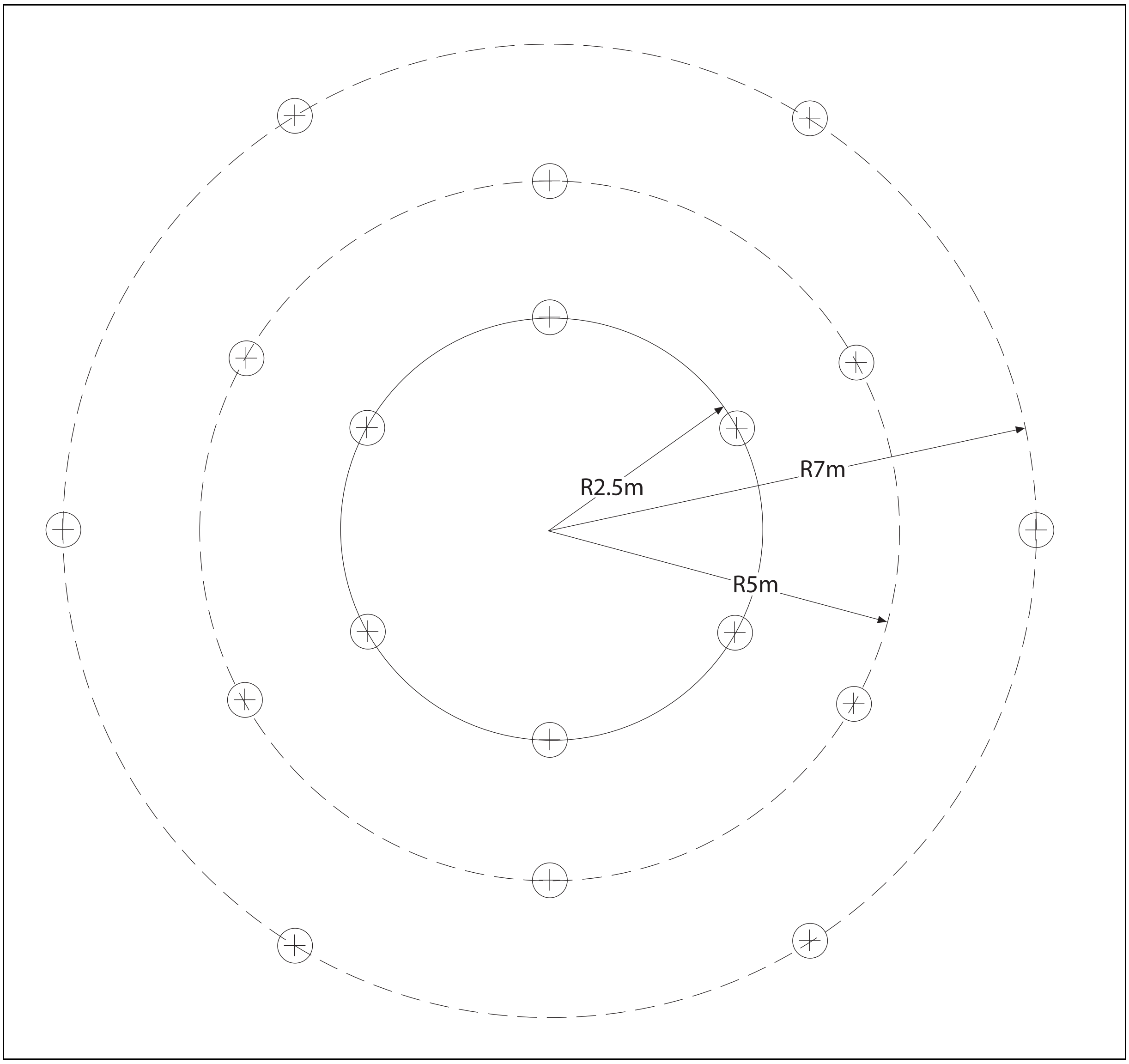

Figure 3 Example of Suitable Tie-down Configuration

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

8.2 Tie-down points should be compatible with the dimensions of tie-down strop attachments. Tie-down points and strops should be of such strength and construction so as to secure the helicopter when subjected to weather conditions pertinent to the installation design considerations. The maximum bar diameter of the tie-down point should be 22 mm in order to match the strop hook dimension of the tie-down strops carried in most UK offshore helicopters. Advice on recommended safe working load requirements for strop/ring arrangements for specific helicopter types can be obtained from the helicopter operator.

8.3 An example of a suitable tie-down configuration is shown at Figure 3. The HCA will provide guidance on the configuration of the tie-down points for specific helicopter types.

9 Safety Net

9.1 Safety nets for personnel protection should be installed around the landing area except where adequate structural protection against a fall exists. The netting used should be of a flexible nature, with the inboard edge fastened just below the edge of the helicopter landing deck. The net itself should extend 1.5 metres in the horizontal plane and be arranged so that the outboard edge does not exceed the level of the landing area and angled so that it has an upward and outward slope of approximately 10°.

9.2 A safety net designed to meet these criteria should ‘contain’ personnel falling into it and not act as a trampoline. Where lateral or longitudinal centre bars are provided to strengthen the net structure they should be arranged and constructed to avoid causing serious 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 be fit for purpose. Polypropylene deteriorates over time; various wire meshes have been shown to be suitable if properly installed.

NOTES:
1. It is not within the scope or purpose of CAP 437 to provide detailed guidance for the design, fabrication and testing of helideck perimeter nets. These specific issues are addressed in the OGUK Joint Industry Guidance for Helideck Perimeter Safety Nets – Issue 2, March 2008. In due course the Joint Industry Guidance will be embodied into the OGUK Offshore Helicopter Operations Guidelines – Issue 6.
2. Perimeter nets may incorporate a hinge arrangement to facilitate the removal of sacrificial panels for testing.

10 Access Points

10.1 For reasons of safety it is necessary to ensure that embarking and disembarking passengers are not required to pass around the helicopter tail rotor, or around the nose of helicopters having a low profile main rotor, when a ‘rotors-running turn-round’ is conducted (in accordance with normal offshore operating procedures). Many helicopters have passenger access on one side only and helicopter landing orientation in relation to landing area access points is therefore very important.

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

10.3 The need to preserve, in so far as possible, an unobstructed falling 5:1 gradient (see paragraphs 6.8 and 6.9 above) and the provision of up to three helideck access/escape routes, with associated platforms, may present a conflict of requirements. A compromise may therefore be required between the size of the platform commensurate with its effectiveness and the need to retain the protection of an unobstructed falling 5:1 gradient. In practice, the 5:1 gradient is taken from the outboard edge of the helideck perimeter safety net supports. Emergency access points which extend outboard from the perimeter safety net constitute a compromise in relation to an unobstructed falling 5:1 gradient which may lead, in some instances, to the imposition of helicopter operating limitations. It is therefore important to construct access point platforms in such a manner as to infringe the falling 5:1 gradient by the smallest possible amount but preferably not at all. Suitable positioning of two major access points clear of the requirements of the protection of the falling 5:1 gradient should always be possible. However, the third access referred to at paragraph 10.2 will probably lie within the falling 5:1 sector and where this is the case it should be constructed within the dimensions of the helideck perimeter safety net supports (i.e. contained within 1.5 metres of the edge of the landing area).

10.4 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.

10.5 Where handrails associated with helideck access/escape points exceed the height limitations given at paragraph 6.2 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 (see Note below), the handrails may be raised and locked in position. The handrails should be retracted, collapsed or removed again prior to the helicopter taking off.

NOTE: 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 HLO). Installation/vessel safety notices placed on approach to the helideck access should advise personnel not to approach the helicopter when the anti-collision lights are on.

11 Winching Operations

11.1 It should be noted that for any installation or vessel, attended or unattended, fixed or mobile for which helicopters are a normal mode of transport for personnel, a helicopter landing area should be provided. Winching should not be adopted as a normal method of transfer. However, if winching operations are required, they should be conducted in accordance with procedures agreed between the helicopter operator and the CAA and contained within the helicopter operator’s Operations Manual. Requirements for winching operations should be discussed with the specific helicopter operator well in advance. Winching area arrangements are described in more detail in Chapter 10.

12 Normally Unattended Installations (NUIs)

12.1 The CAA provides guidance for helicopter operators on the routeing of helicopters intending to land on NUIs. The CAA will also provide such guidance and advice to helicopter operators and installation operators in consideration of specific installation safety cases and risk analyses which address routeing philosophy.

12.2 Guano and associated bird debris is a major problem for NUIs. Associated problems concern the health hazard on board; degradation of visual aids (markings and lighting) and friction surfaces; and the potential for foreign object debris/damage (FOD). Helicopter operators should monitor the condition of NUI helidecks and advise the owner/operator before marking and lighting degradation becomes a safety concern. Experience has shown that, unless adequate cleaning operations are undertaken or effective preventative measures are in place, essential visual aids will quickly become obliterated. NUIs should be monitored continuously for signs of degradation of visual cues and flights should not be undertaken to helidecks where essential visual cues for landing are insufficient.

12.3 Guano is an extremely effective destroyer of friction surfaces whenever it is allowed to remain. Because of the difficulty of ensuring that a friction surface is kept clear of contaminants (see paragraphs 7.5 and 7.6 above), permanent removal of the landing net on NUIs is not normally a viable option unless effective preventative measures are in place.

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Chapter 4 Visual Aids

1 General

1.1 The name of the installation should be clearly displayed in such positions on the installation so that it can be readily identified from the air and sea from all normal angles and directions of approach. For identification from the air the helideck name and the side identification panels are used. It is not necessary, nor is it a legal requirement, to complicate recognition processes by inclusion of 'block numbers', company logos, or other designators. In fact, complication of identifiers can be confusing and will unnecessarily, and undesirably, extend the mental process of recognition at the critical time when the pilots' concentration is being fully exercised by the demands of the landing manoeuvre. The names on both identification markings should be identical, simple and unique and facilitate unambiguous communication via radio. The approved radio callsign of the installation should be the same name as the helideck and side panel identifier. Where the inclusion of 'block numbers' on side identification panels is deemed to be essential (i.e. for purposes other than recognition), the name of the installation should also be included; e.g. 'NAME. BLOCK NO.' The installation identification panels should be highly visible in all light conditions. They should be suitably illuminated at night and in conditions of poor visibility. In order to minimise the possibility of 'wrong rig landings' use of new technology is encouraged so that identification can be confirmed in the early stages of the approach by day and night. Modern technology is capable of meeting this requirement in most ambient lighting conditions. Use of high-intensity light emitting diode (LED) cluster or fibre-optic systems in other applications have been shown to be effective even in severely reduced visibility. Additionally, it is recognised that alternative technologies have been developed consisting of highly visible reflective side signage that has been successfully installed on some installations with the co-operation of the helicopter operator. (HSE Operations Notice 39, re-issued in June 2008, provides 'Guidance on Identification of Offshore Installations'.)

1.2 Helideck markings (specifically the installation identification marking) and side identification panels are used by pilots to obtain a final pre-landing confirmation that the correct helideck is being approached. It is therefore **VITAL** that the helideck markings and side identification panels are maintained in the best possible condition, regularly re-painted and kept free of all visibility-reducing contaminants. Helideck owners/operators should ensure that specific inspection and re-painting maintenance procedures and schedules for helideck markings and side identification panels take account of the importance of their purpose. Side identification panels should be kept free of any obscuring paraphernalia (draped hoses etc.) and be as high as possible on the structure.

1.3 The installation identification (see paragraphs 1.1 and 1.2) should be marked on the helideck surface between the origin of the obstacle-free sector and the TD/PM Circle in symbols not less than 1.2 metres high and in a colour (normally white) which contrasts with the helideck surface. The name should not be obscured by the deck net. Where there is insufficient space to place the helideck marking in this position, the marking position should be agreed with the HCA. (See also Chapter 3, paragraph 7.3.)

1.4 Helideck perimeter line marking and lighting serves to identify the limits of the Landing Area (see Glossary) for day and night operations respectively.

1.5 A wind direction indicator (windsock) should be provided and located so as to indicate the free stream wind conditions at the installation/vessel location. It is often inappropriate to locate the windsock as close to the helideck 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. Some installations may benefit from a second windsock to indicate a specific difference between the local wind over the helideck and the free stream wind.

1.6 For character marking dimensions, where character bar width is not specified, use 15% of character height with 10% of character height between characters (extreme right-hand edge of one character to extreme left-hand edge of next character) and approximately 50% of character height between words.

2 Helideck Landing Area Markings

2.1 The colour of the helideck should be dark green. The perimeter of the landing area should be clearly marked with a white painted line 30 cm wide (see Figure 1). Non-slip materials should be used (see Chapter 3, paragraph 7.1).

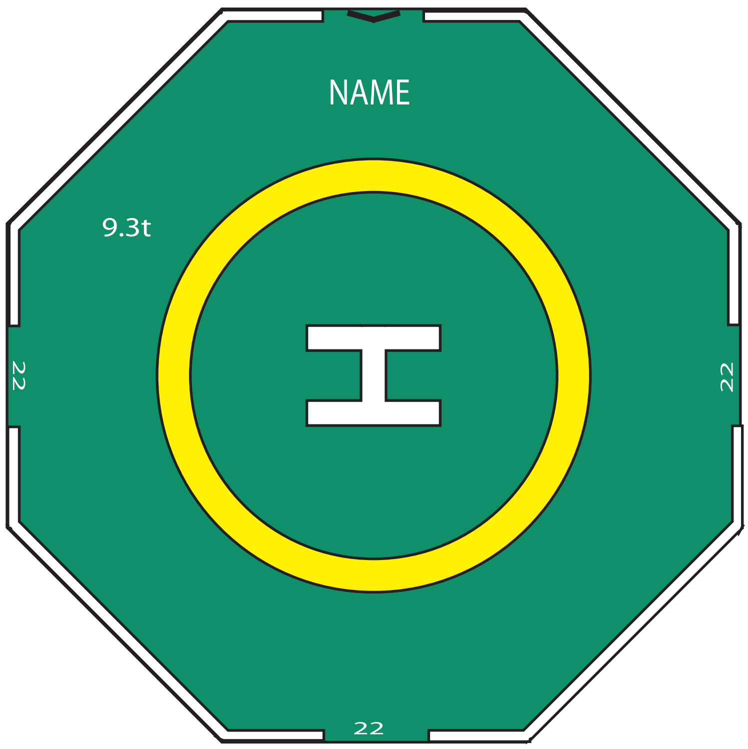

Figure 1 Markings (Single Main Rotor Helicopters)

2.1.1 Aluminium helidecks are in use throughout the offshore industry. Some of these are a natural light grey colour and may present painting difficulties. The natural light grey colour of aluminium may be acceptable in specific helideck applications where these are agreed with the HCA . This should be discussed in the early design phase. In such cases the conspicuity of the helideck markings may need to be enhanced by, for example, overlaying white markings on a painted black background. Additionally, conspicuity of the yellow TD/PM Circle may be enhanced by outlining the deck marking with a thin black line (typically 10 cm).

2.2 The origin of the 210° OFS for approach and take-off as specified in Chapter 3 should be marked on the helideck by a black chevron, each leg being 79 cm long and 10 cm wide forming the angle in the manner shown in Figure 2. On minimum sized helidecks 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. The HCA should be consulted in situations where this is necessary. Where the OFS is swung in accordance with the provision of Chapter 3 paragraph 6.4 this should be reflected in the alignment of the chevron. The purpose of the chevron is to provide visual guidance to the HLO so that he can ensure that the 210° OFS is clear of obstructions before giving a helicopter clearance to land. The black chevron may be painted on top of the (continuous) white perimeter line to achieve maximum clarity for the helideck crew.

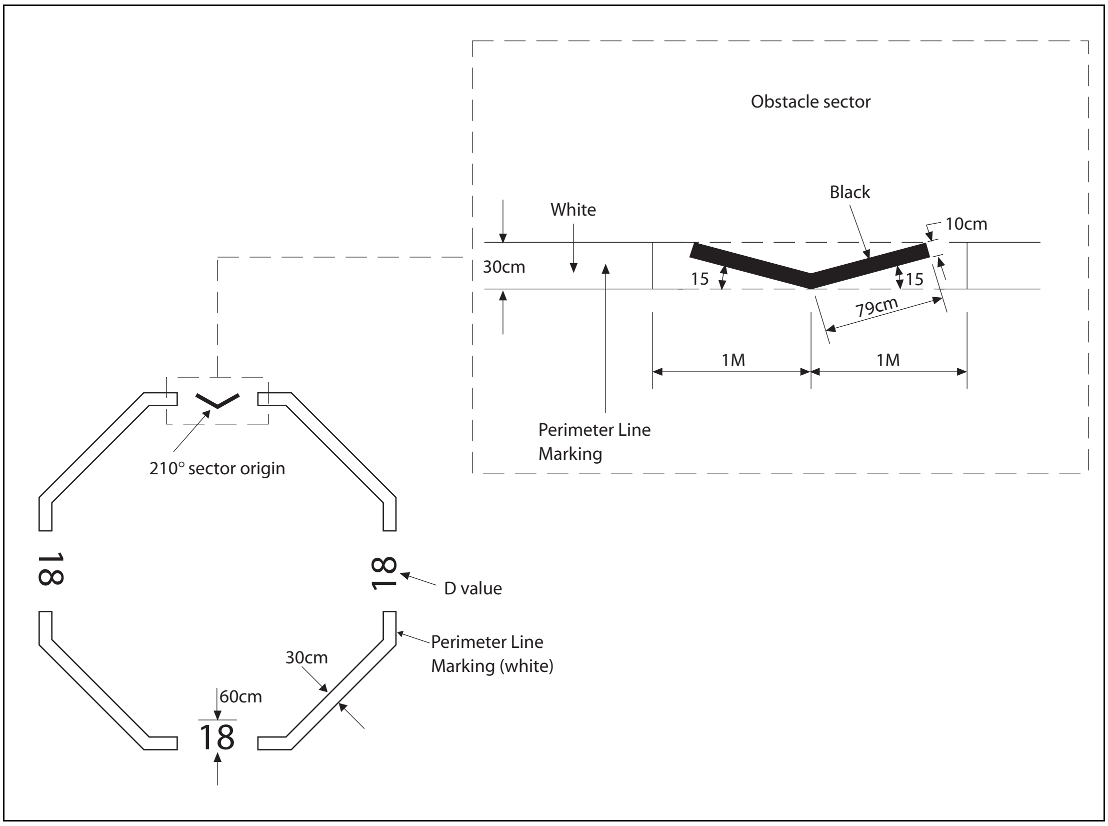

Figure 2 Helideck D-value and Obstacle-free Marking

2.3 The actual D-value of the helideck (see Chapter 3, paragraph 6.1) should be painted on the helideck inboard of the chevron in alphanumeric symbols 10 cm high. Where, for an existing installation, a helideck has been accepted which does not meet the normal minimum OFS requirements of 210°, the black chevron should represent the angle which has been accepted and this value should be marked inboard of the chevron in a similar manner to the certificated D-value. It is expected that new builds will always comply in full with the requirement to provide a minimum 210° OFS.

2.4 The helideck D-value should also be marked around the perimeter of the helideck in the manner shown in Figures 1 and 2 in a colour contrasting (preferably white: avoid black or grey for night use) with the helideck surface. The D-value should be expressed to the nearest whole number with 0.5 rounded down, e.g. 18.5 marked as 18 (see Chapter 3, Table 1).

NOTE: Helidecks designed specifically for AS332L2 and EC 225 helicopters, each having a D-value of 19.5 m, should be rounded up to 20 in order to differentiate between helidecks designed specifically for L1 models.

2.5 A maximum allowable mass marking should be marked on the helideck in a position which is readable from the preferred final approach direction, i.e. towards the OFS 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 mass in tonnes (1000 kg). The height of the figures should be 90 cm with a line width of approximately 12 cm and be in a colour which contrasts with the helideck surface (preferably white: avoid black or grey). Where possible the mass marking should be well separated from the installation identification marking (see paragraph 1.3) in order to avoid possible confusion on recognition. Refer also to Figure 1 and Chapter 3, Table 1.

2.6 A Touchdown/Positioning Marking (TD/PM) should be provided (see Figures 1 and 3). The marking should be a yellow circle with an inner diameter of 0.5 of the certificated D-value of the helideck and a line width of 1 metre. The centre of the marking should be concentric with the centre of the D-circle.

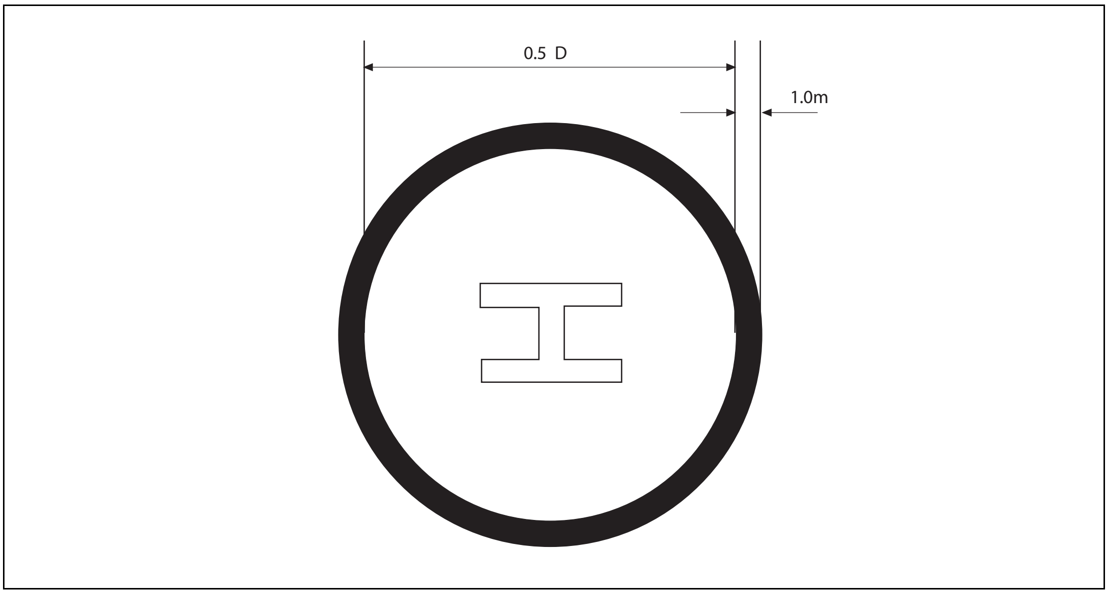

Figure 3 Touchdown/Positioning Marking Circle (TD/PM Circle to be painted yellow)

NOTE: On a helideck the centre of the TD/PM Circle will normally be located at the centre of the landing area, except that the marking may be offset away from the origin of the OFS by no more than 0.1D where an aeronautical study indicates such offsetting to be beneficial, provided that the offset marking does not adversely affect the safety of flight operations or ground handling issues.

2.7 A white heliport identification marking 'H' marking should be marked co-located with the TD/PM with the cross bar of the 'H' lying along the bisector of the OFS. Its dimensions are as shown in Figure 4.

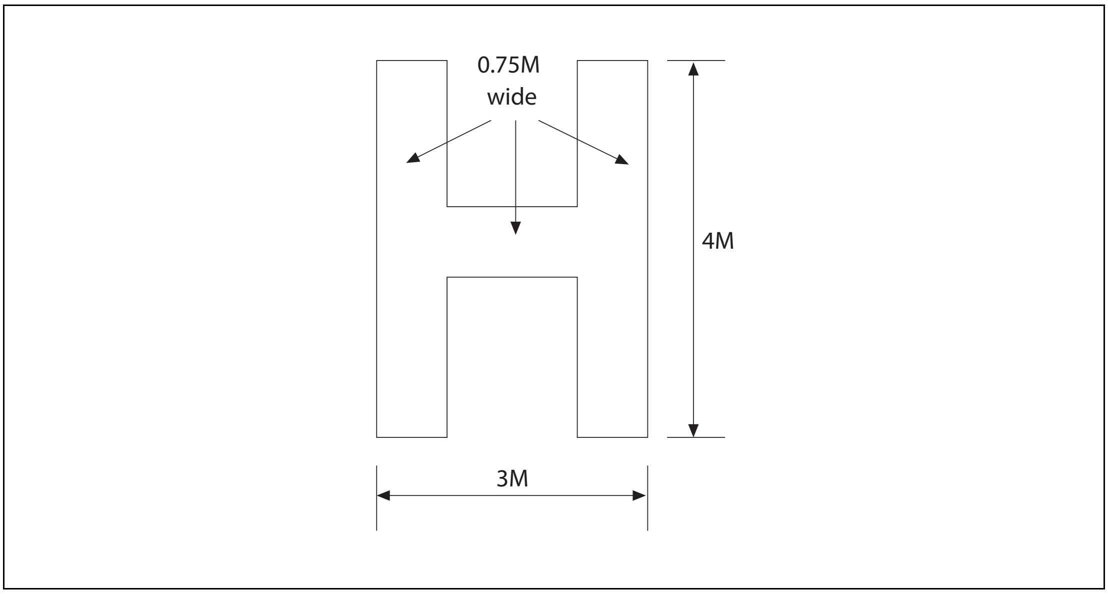

Figure 4 Dimensions of heliport identification marking 'H' ('H' to be painted white)

2.8 Where the OFS has been swung in accordance with Chapter 3 paragraph 6.4 the positioning of the TD/PM and 'H' should comply with the normal unswung criteria. However, the 'H' should be orientated so that the bar is parallel to the bisector of the swung sector.

2.9 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° LOS protected surfaces. In addition, for existing installations where the number of deck access points is limited (see Chapter 3, paragraph 10.2), 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 TD/PM, with white and red hatching extending from the red hatching out to the edge of the landing area as shown in Figures 5 and 6.

NOTE: When positioning over the TD/PM helicopters should be manoeuvred so as to keep the aircraft **nose** clear of the hatched prohibited sector(s) at all times.

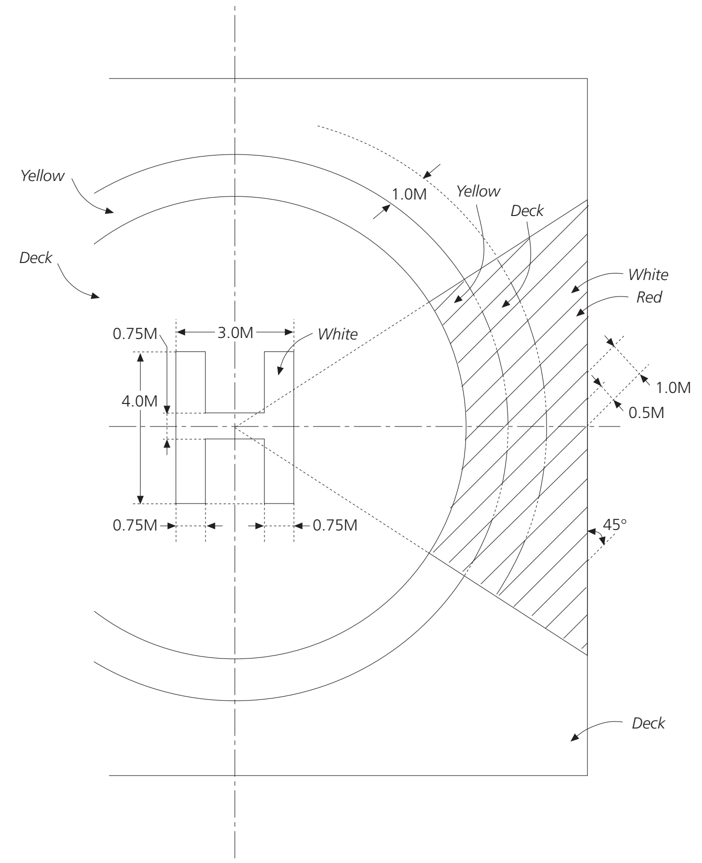

Figure 5 Specification for the Layout of Prohibited Landing Heading Segments on Helidecks

Figure 6 Example of Prohibited Landing Heading Marking

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

2.10 For certain operational or technical reasons an installation may have to prohibit helicopter operations. In such circumstances, where the helideck cannot be used, the 'closed' state of the helideck should be indicated by use of the signal shown in Figure 7. This signal is the standard 'landing prohibited' signal given in the Rules of the Air and Air Traffic Control Regulations, except that it has been altered in size to just cover the letter 'H' inside the TD/PM.

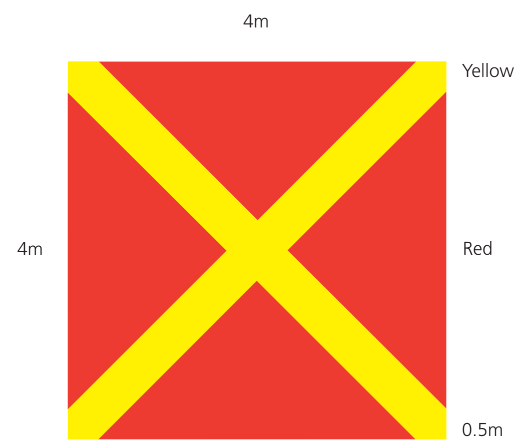

Figure 7 Landing on Installation/Vessel Prohibited

NOTE: Signal covers 'H' inside TD/PM.

2.11 Exceptionally, helideck markings which do not comply with the above may be agreed with the HCA.

2.12 Colours should conform with the following BS 381C (1996) standard or the equivalent BS 4800 colour. White should conform to the RAL charts.

a) RED

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

b) YELLOW

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

c) DARK GREEN

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

d) WHITE

RAL 9010 (Pure White)
RAL 9003 (Signal White)

3 Lighting

NOTE: The specification described immediately below, and in Appendix E, for green helideck perimeter lighting was developed from the results of extensive research aimed at enhancing offshore helideck lighting systems reported in CAA Papers 2004/01, 2005/01 and 2006/03. The specification for helideck perimeter lighting is fully described in Appendix A to CAA Paper 2005/01 and the overall operational requirements are outlined in Appendix E, Section 1. Based on statements made in the appendices it is evident that perimeter lighting is intended to provide effective visual cues for a pilot throughout the approach and landing manoeuvre at night, from the initial acquisition of the helideck (i.e. to enable a pilot to easily locate the position of the helideck at long range on an often well lit platform structure) to guide the helicopter to a point above the landing area for touchdown. The specification makes an assumption that the performance of the green perimeter lights will not be diminished by any other lighting due to the relative intensity, configuration or colour of other lighting sources on the installation. Where other aeronautical or non-aeronautical ground lights have the potential to cause confusion or to diminish or prevent the clear interpretation of helideck perimeter lighting systems, it will be necessary for an installation operator to extinguish, screen or otherwise modify these lights to ensure the effectiveness of perimeter lights is not compromised. This will include, but may not be limited to, an assessment of the effect of general installation lighting and/or helideck floodlighting systems on the performance of green helideck perimeter lighting. The CAA recommends that installation operators give serious consideration to shielding high intensity light sources (e.g. by fitting screens or louvers) from helicopters approaching and landing on the installation, and maintaining a good colour contrast between the helideck perimeter lighting and surrounding installation lighting. Particular attention should be paid to the areas of the installation adjacent to the helideck.

3.1 The periphery of the landing area 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 Chapter 3 paragraph 6.2. The lights should be equally spaced at intervals of not more than three metres around the perimeter of the landing area, coincident with the white line delineating the perimeter (see paragraph 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 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 Table 1). Flush fitting lights may exceptionally be used at the inboard (150° LOS origin) edge of the landing area where an operational need exists to move large items of equipment to and from the landing area, e.g. where a run-off area exists there will be a need to move the helicopter itself to and from the landing area to the adjacent run-off (parking) area. Care should be taken to select flush fitting lights that will meet the iso-candela requirements stated in Table 1. Further guidance on helideck lighting solutions is given in the CAA's letter of 20 July 2004. For ease of reference this letter is reproduced in Appendix C.

3.2 Where the declared D-value of the helideck is less than the physical helideck area, the perimeter lights should be coincidental with the white perimeter marking and black chevron and delineate the limit of the useable landing area so that, in unusual circumstances where a helicopter touches down inboard of the TD/PM, it can land safely by reference to the perimeter lights on the 150° LOS 'inboard' side of the helideck without risk of the main rotor striking obstructions in this sector. By applying the LOS clearances (given in Chapter 3 paragraphs 6.5 to 6.7) from the perimeter marking, adequate main rotor to obstruction separation should be achieved for the worst-case helicopter intended to operate to the helideck. A suitable temporary arrangement to modify the lighting delineation of the landing area, where this is found to be marked too generously, should be agreed with the HCA by replacing existing green lights with red lights of 30 cd intensity around the 'unsafe' portion of the landing area (the vertical beam spread characteristics for red lights should also comply with Table 1). The perimeter line, however, should immediately be repainted in the correct position.

Table 1 Iso-candela Diagram for Helideck Perimeter Lights

Elevation	Azimuth	Intensity
0° - 90°	-180° to +180°	60 cd max[1]
>20° - 90°	-180° to +180°	3 cd min
>10° - 20°	-180° to +180°	15 cd min
0° -10°	-180° to +180°	30 cd min

1. A study of helideck lighting performed for the Dutch CAA by TNO Human Factors (report ref: TM-02-C003) has indicated that lighting intensities greater than 60 cd can represent a source of glare. The value of 60 cd has therefore been adopted as a maximum value. In addition to prescribing an upper limit for the (maximum) intensity of a light, in the context of the glare issue it is also important to consider the luminance of the light source (expressed in cd/m^2).

3.3 The whole of the landing area should be adequately illuminated if intended for night use. In the past, installation and vessel owners and operators have sought to achieve compliance by providing deck level floodlights around the perimeter of the landing area and/or by mounting floodlights at an elevated location 'inboard' from the landing area, 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 helideck perimeter lights during the approach, and by causing glare and loss of pilots' night vision during the 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. Further guidance on suitable arrangements is provided in paragraphs 3.5 to 3.7 and in the further interim guidance letter of 9 March 2006, now reproduced in Appendix D.

3.4 Through research programmes undertaken since the mid 1990s, the 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 LEDs can be used to illuminate the TD/PM 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. Offshore in-service trials to evaluate prototype systems are presently ongoing; however, it is now possible to provide duty holders who wish to implement appropriate systems with a draft system specification to define a minimum acceptable specification for this lighting. A draft specification is reproduced in Appendix E. The CAA should be consulted for the latest specification. A CAA Paper addressing a specification for an offshore helideck lighting system will be published in due course.

3.5 Pending the outcome of offshore in-service trials and the commercial availability of suitable products to implement the TD/PM and 'H' lighting, it is strongly recommended that existing helideck floodlighting systems be reviewed. The following paragraphs, 3.6 and 3.7, describe how to make best use of current floodlighting technologies to achieve the objective of adequately illuminating the whole of the landing area. Although the modified floodlighting schemes described will provide useful illumination of the landing area without significantly affecting the conspicuity of the perimeter lighting and will minimise glare, trials have demonstrated that neither they nor any other floodlighting system is capable of providing the quality of visual cueing available by illuminating the TD/PM and 'H'. These modified floodlighting solutions should therefore be regarded as temporary arrangements only.

3.6 Where installation and vessel owners and operators intend to improve an existing floodlighting arrangement, it is strongly recommended that only systems which comply with the good practice detailed in the CAA's further interim guidance letter dated 9 March 2006 (ref: 10A/253/16/3Q) are considered. This letter, reproduced at Appendix D, provides specific guidance for the implementation of appropriate deck level floodlighting solutions utilising xenon floodlights. It is recommended that operators of existing installations or vessels refer to this letter before committing to any particular interim floodlighting solution. It is essential that floodlighting solutions are considered in collaboration with the HCA and the helicopter operator who should fly a non-revenue approach to a helideck at night before accepting the final configuration.

3.7 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 an obstacle to helicopters landing and taking off from the helideck. 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. For some decks it may be beneficial to improve depth perception by floodlighting the main structure or 'legs' of the platform. Adequate shielding of 'polluting' light sources can most 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 helideck lighting environment should be switched off during helicopter operations.

3.8 It is important to confine the helideck 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.

3.9 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).

3.10 A visual warning system should be installed if a condition can exist on an installation which may be hazardous for the helicopter or its occupants. The system (Status Lights) should be a flashing red light (or lights), visible to the pilot from any direction of approach and on any landing heading. The aeronautical meaning of a flashing red light is either "do not land, aerodrome not available for landing" or "move clear of landing area". The system should be automatically initiated at the appropriate hazard level (e.g. impending gas release) as well as being capable of manual activation by the HLO. It should be visible at a range in excess of the distance at which the helicopter may be endangered or may be commencing a visual approach. CAA Paper 2008/01 provides a specification for a status light system which is summarised below:

- Where required, the helideck status signalling system should be installed either on or adjacent to the helideck. Additional lights may be installed in other locations on the platform where this is necessary to meet the requirement that the signal be visible from all approach directions, i.e. 360° in azimuth.
- The effective intensity should be a minimum of 700 cd between 2° and 10° above the horizontal and at least 176 cd at all other angles of elevation.
- The system should be provided with a facility to enable the output of the lights (if and when activated) to be dimmed to an intensity not exceeding 60 cd while the helicopter is landed on the helideck.

- The signal should be visible from all possible approach directions and while the helicopter is landed on the helideck, regardless of heading, with a vertical beam spread as shown in the second bullet point above.
- The colour of the status light(s) should be red as defined in ICAO Annex 14 Volume 1 Appendix 1, Colours for aeronautical ground lights.
- The light system as seen by the pilot at any point during the approach should flash at a rate of 120 flashes per minute. Where two or more lights are needed to meet this requirement, they should be synchronised to ensure an equal time gap (to within 10%) between flashes. While landed on the helideck, a flash rate of 60 flashes per minute is acceptable. The maximum duty cycle should be no greater than 50%.
- The light system should be integrated with platform safety systems such that it is activated automatically in the event of a process upset.
- Facilities should be provided for the HLO to manually switch on the system and/or override automatic activation of the system.
- The light system should have a response time to the full intensity specified not exceeding three seconds at all times.
- Facilities should be provided for resetting the system which, in the case of NUIs, do not require a helicopter to land on the helideck.
- The system should be designed so that no single failure will prevent the system operating effectively. In the event that more than one light unit is used to meet the flash rate requirement, a reduced flash frequency of at least 60 flashes per minute is considered acceptable in the failed condition for a limited period.
- The system and its constituent components should comply with all regulations relevant to the installation.
- Where supplementary 'repeater' lights are employed for the purposes of achieving the 'on deck' 360° coverage in azimuth, these should have a minimum intensity of 16 cd and a maximum intensity of 60 cd for all angles of azimuth and elevation.

3.11 Manufacturers are reminded that the minimum intensity specification stated above is considered acceptable to meet the **current** operational requirements, which specify a minimum meteorological visibility of 1400 m (0.75 NM). Development of offshore approach aids which permit lower minima (e.g. differential GPS) will require a higher intensity. Revised intensities are specified for the lowest anticipated meteorological visibility of 0.5 NM (900 m) in CAA Paper 2008/01, Appendix A.

3.12 Installation/vessel emergency power supply design should include the landing area lighting. Any failures or outages should be reported immediately to the helicopter operator. The lighting should be fed from an Uninterrupted Power Supply (UPS) system.

4 Obstacles – Marking and Lighting

4.1 Fixed obstacles which present a hazard to helicopters 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 0.5 metres nor more than six 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 2.12 above.

4.2 Obstacles to be marked in these contrasting colours include any lattice tower structures and crane booms which are close to the helideck or the LOS boundary. Similarly, parts of the leg or legs of jack-up units adjacent to the landing area which extend, or can extend, above it should also be marked in the same manner.

4.3 Omnidirectional low intensity steady red obstruction lights conforming to the specifications for low intensity obstacle (Group A) lights described in *CAP 168 Licensing of Aerodromes*, Chapter 4 and Table 6A.1, having a minimum intensity of 10 candelas for angles of elevation between 0 degrees and 30 degrees 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. This should apply, in particular, to all crane booms on the installation. Objects which are more than 15 metres higher than the landing area should be fitted with intermediate low intensity steady red obstruction 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). It is often preferable for some structures such as flare booms and towers to be illuminated by floodlights as an alternative to fitting intermediate steady red lights, provided that the lights are arranged such that they will illuminate the whole of the structure and not dazzle the helicopter pilot. Such arrangements should be discussed with the HCA. Offshore duty holders may, where appropriate, consider alternative equivalent technologies to highlight dominant obstacles in the vicinity of the helideck.

4.4 An omnidirectional low intensity steady red obstruction light should be fitted to the highest point of the installation. The light should conform to the specifications for a low intensity obstacle (Group B) light described in *CAP 168 Licensing of Aerodromes*, Chapter 4 and Table 6A.1, having a minimum intensity of 50 candelas for angles of elevation between 0 and 15 degrees, and a minimum intensity of 200 candelas between 5 and 8 degrees. Where it is not practicable to fit a light to the highest point of the installation (e.g. on top of flare towers) the light should be fitted as near to the extremity as possible.

4.5 In the particular case of jack-up units, it is recommended that when the tops of the legs are the highest points on the installation, they should be fitted with omnidirectional low intensity steady red lights of the same intensity and characteristics as described in paragraph 4.4. In addition the leg or legs adjacent to the helideck should be fitted with intermediate low intensity steady red lights of the same intensity and characteristics as described in paragraph 4.3 at 10 metre intervals down to the level of the landing area. As an alternative the legs may be floodlit providing the helicopter pilot is not dazzled.

4.6 Any ancillary structure within one kilometre of the landing area, and which is significantly higher than it, should be similarly fitted with red lights.

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

4.8 Installation/vessel emergency power supply design should include all forms of obstruction lighting. Any failures or outages should be reported immediately to the helicopter operator. The lighting should be fed from a UPS system.

Chapter 5 Helideck Rescue and Fire Fighting Facilities

1 Introduction

1.1 This Chapter gives guidance regarding provision of equipment, extinguishing media, personnel, training, and emergency procedures for offshore helidecks on installations and vessels.

2 Key Design Characteristics – Principal Agent

2.1 A key aspect in the successful design for providing an efficient, integrated helideck rescue and fire fighting facility is a complete understanding of the circumstances in which it may be expected to operate. A helicopter accident, which results in a fuel spillage with wreckage and/or fire and smoke, has the capability to render some of the equipment inventory unusable or preclude the use of some passenger escape routes.

2.2 Delivery of fire fighting media to the helideck area at the appropriate application rate should be achieved in the quickest possible time. The CAA strongly recommends that a delay of less than 15 seconds, measured from the time the system is activated to actual production at the required application rate, should be the objective. The operational objective should ensure that the system is able to bring under control a helideck fire associated with a crashed helicopter within 30 seconds measured from the time the system is producing foam at the required application rate for the range of weather conditions prevalent for the UKCS.

NOTE: A fire is deemed to be 'under control' at the point when it becomes possible for the occupants of the helicopter to be effectively rescued by trained firefighters.

2.3 Foam-making equipment should be of adequate performance and be suitably located to ensure an effective application of foam to any part of the landing area irrespective of the wind strength/direction or accident location when all components of the system are operating in accordance with the manufacturer's technical specifications for the equipment. However, for a Fixed Monitor System (FMS), consideration should also be given to the loss of a downwind foam monitor either due to limiting weather conditions or a crash situation occurring. The design specification for an FMS should ensure remaining monitors are capable of delivering finished foam to the landing area at or above the minimum application rate. For areas of the helideck or its appendages which, for any reason, may be otherwise inaccessible to an FMS, it is necessary to provide additional hand controlled foam branch pipes as described in paragraph 2.9.

2.4 Consideration should be given to the effects of the weather on static equipment. All equipment forming part of the facility should be designed to withstand protracted exposure to the elements or be protected from them. Where protection is the chosen option, it should not prevent the equipment being brought into use quickly and effectively (see paragraph 2.2 above). The effects of condensation on stored equipment should be considered.

2.5 The minimum capacity of the foam production system will depend on the D-value of the helideck, the foam application rate, the discharge rates of installed equipment and the expected duration of application. It is important to ensure that the capacity of the main helideck fire pump is sufficient to guarantee that finished foam can be applied at the appropriate induction ratio and application rate, and for the minimum duration to the whole of the landing area when all helideck monitors are being discharged simultaneously.

2.6 The application rate is dependent on the types of foam concentrate in use and the types of foam application equipment selected. For fires involving aviation kerosene, ICAO has produced a performance test which assesses and categorises the foam concentrate. Most foam concentrate manufacturers will be able to advise on the performance of their concentrate against this test. The CAA recommends that foam concentrates compatible with seawater and meeting performance level ‘B’ are used. These foams should be applied at a minimum application rate of 6.0 litres per square metre per minute.

2.6.1 **Calculation of Application Rate:** Example for a D-value 22.2 metre helideck. Application rate = $6.0 \times \pi \times r^2$ ($6.0 \times 3.142 \times 11.1 \times 11.1$) = 2322 litres per minute.

2.7 Given the remote location of helidecks the overall capacity of the foam system should exceed that necessary for initial extinction of any fire. Five minutes’ discharge capability is generally considered by the CAA to be reasonable.

2.7.1 **Calculation of Minimum Operational Stocks:** Using the 22.2 metre example as shown in paragraph 2.6.1 above, a 1% foam solution discharged over five minutes at the minimum application rate will require 2322 x 1% x 5 = 116 litres of foam concentrate. A 3% foam solution discharged over five minutes at the minimum application rate will require 2322 x 3% x 5 = 348 litres of foam concentrate.

NOTE: Sufficient reserve foam stocks to allow for replenishment as a result of operation of the system during an incident, or following training or testing, will also need to be held.

2.8 Low expansion foam concentrates can generally be applied in either aspirated or unaspirated form. It should be recognised that whilst unaspirated foam may provide a quick knockdown of any fuel fire, aspiration, i.e. induction of air into the foam solution by monitor or by hand controlled foam branch (see below), gives enhanced protection after extinguishment. Wherever non-aspirated foam equipment is selected during design, additional equipment capable of producing aspirated foam for post-fire security/control should be provided.

2.9 Not all fires are capable of being accessed by monitors and on some occasions the use of monitors may endanger passengers. Therefore, in addition to fixed foam systems, there should be the ability to deploy at least two deliveries with hand controlled foam branchpipes for the application of aspirated foam at a minimum rate of 225 litres/min through each hose line. A single hose line, capable of delivering aspirated foam at a minimum application rate of 225 litres/min, may be acceptable where it is demonstrated that the hose line is of sufficient length, and the hydrant system of sufficient operating pressure, to ensure the effective application of foam to any part of the landing area irrespective of wind strength or direction. The hose line(s) provided should be capable of being fitted with a branchpipe capable of applying water in the form of a jet or spray pattern for cooling, or for specific fire fighting tactics. Where a Deck Integrated Fire Fighting System (DIFFS) capable of delivering foam and/or seawater in a jet/spray pattern to the whole of the landing area (see paragraph 2.10 and Note below) is selected in lieu of an FMS, the provision of additional hand-controlled foam branch pipes may not be necessary to address any residual fire situation. Instead any residual fire may be tackled with the use of hand-held extinguishers (see paragraph 4).

2.10 As an effective alternative to an FMS, offshore duty holders are strongly encouraged to consider the provision of a DIFFS. These systems typically consist of a series of 'pop-up' nozzles, with both a horizontal and vertical component, designed to provide an effective spray distribution of foam to the whole of the landing area and protection for the helicopter for the range of weather conditions prevalent in the UKCS. DIFFS should be capable of supplying performance level B foam solution to bring under control a fire associated with a crashed helicopter within the time constraints stated in paragraph 2.2 and at an application rate, and for a duration, which at least meets the minimum requirements stated in paragraphs 2.6 and 2.7 above.

NOTE: Where a DIFFS is used in tandem with a passive fire-retarding system demonstrated to be capable of removing significant quantities of unburned fuel from the surface of the helideck in the event of a fuel spill from a ruptured aircraft tank, it is permitted to select a seawater-only DIFFS to deal with any residual fuel burn. A seawater-only DIFFS should meet the same application rate and duration as specified for a foam DIFFS in paragraph 2.10 above. (See also paragraph 5.)

2.11 In a similar way to where an FMS is provided (see paragraph 2.3), the performance specification for a DIFFS needs to consider the likelihood that one or more of the pop-up nozzles may be rendered ineffective by the impact of a helicopter on the helideck. A DIFFS supplier should ensure that the system is able to bring under control a helideck fire associated with a crashed helicopter within 30 seconds measured from the time the system is producing foam at the required application rate for the range of weather conditions prevalent for the UKCS (see also paragraph 2.2). Assumptions on the number of pop-up nozzles rendered ineffective by a crash situation will depend on the pattern (spacing) of the nozzle arrangement and the type(s) of helicopters operating to the helideck. DIFFS suppliers should be able to demonstrate compliance with the performance specification to the satisfaction of the HCA or other appropriate authority.

2.12 If life saving opportunities are to be maximised it is essential that all equipment should be ready for immediate use on, or in the immediate vicinity of, the helideck whenever helicopter operations are being conducted. All equipment should be located at points having immediate access to the helicopter landing area. The location of the storage facilities should be clearly indicated.

3 Use and Maintenance of Foam Equipment

3.1 Mixing of different concentrates in the same tank, i.e. different either in make or strength, is generally unacceptable. Many different strengths of concentrate are on the market. Any decision regarding selection should take account of the design characteristics of the foam system. It is important to ensure that foam containers and tanks are correctly labelled.

3.2 Induction equipment ensures that water and foam concentrate are mixed in the correct proportions. Settings of adjustable inductors, if installed, should correspond with strength of concentrate in use.

3.3 All parts of the foam production system, including the finished foam, should be tested by a competent person on commissioning and annually thereafter. The tests should assess the performance of the system against original design expectations. Further information for testing of helideck foam production systems is stated in HSE Safety Notice 2/2004.

4 Complementary Media

4.1 While foam is considered the principal medium for dealing with fires involving fuel spillages, the wide variety of fire incidents likely to be encountered during helicopter operations – e.g. engine, avionic bays, transmission areas, hydraulics – may require the provision of more than one type of complementary agent. Dry powder and gaseous agents are generally considered acceptable for this task.

NOTE: Halon extinguishing agents are no longer specified for new installations. Gaseous agents, including CO_2, have replaced them. The effectiveness of CO_2 is accepted as being half that of halon.

4.2 The CAA recommends the use of dry powder as the primary complementary agent. The minimum total capacity should be 45 kg delivered from one or two extinguishers. The dry powder system should have the capacity to deliver the agent anywhere on the landing area at the recommended discharge rate of 1.35-2 kg/sec. Containers of sufficient capacity to allow continuous and sufficient application of the agent should be provided.

4.3 The CAA recommends the use of a gaseous agent in addition to the use of dry powder as the primary complementary agent. Therefore, in addition to dry powder specified at paragraph 4.2, there should be a quantity of gaseous agent provided with a suitable applicator for use on engine fires. The appropriate minimum quantity delivered from one or two extinguishers is 18 kg. Containers selected should be capable of delivering gaseous agents at the minimum discharge rate stated in paragraph 4.2. Due regard should be paid to the requirement to deliver gaseous agents to the seat of the fire at the recommended discharge rate. Because of the weather conditions prevalent in the UKCS, all complementary agents could be adversely affected during application and training evolutions should take this into account.

4.4 All offshore helicopters have integral engine fire protection systems (predominantly halon) and it is therefore considered that provision of foam as the principal agent plus suitable water/foam branch lines plus sufficient levels of dry powder with a quantity of secondary gaseous agent will form the core of the fire extinguishing system. It should be borne in mind that none of the complementary agents listed will offer any post-fire security/control.

4.5 All applicators are to be fitted with a mechanism which allows them to be hand controlled.

4.6 Dry chemical powder should be of the ‘foam compatible’ type.

4.7 The complementary agents should be sited so that they are readily available at all times.

4.8 Reserve stocks of complementary media to allow for replenishment as a result of activation of the system during an incident, or following training or testing, should be held.

4.9 Complementary agents should be subject to annual visual inspection by a competent person and pressure testing in accordance with manufacturers’ recommendations.

5 Normally Unattended Installations

5.1 In the case of NUIs, serious consideration should be given to the selection and provision of foam as the principal agent. For an NUI, effective delivery of foam to the whole of the landing area, providing a means of escape from the helideck to a safe location, is probably best achieved by means of a DIFFS. See paragraph 2.10.

5.2 For NUIs the CAA may also consider other ‘combination solutions’ where these can be demonstrated to be effective in dealing with a running fuel fire. This could permit, for example, the selection of a seawater-only DIFFS used in tandem with a passive fire-retarding system demonstrated to be capable of removing significant quantities of unburned fuel from the surface of the helideck in the event of a fuel spill from a ruptured aircraft tank.

5.3 DIFFS on NUIs should be integrated with platform safety systems such that they are activated automatically in the event of a heavy or emergency landing on an installation where a fire results. DIFFS should be capable of manual over-ride by the HLO and from the mother installation or an onshore control room. Similar to a DIFFS provided for a manned installation or vessel, a DIFFS provided on an NUI needs to consider the eventuality that one or more nozzles may be rendered ineffective by, for example, a crash. The basic performance assumptions stated in paragraph 2.11 also apply for a DIFFS located on an NUI.

6 The Management of Extinguishing Media Stocks

6.1 Consignments of extinguishing media should be used in delivery order to prevent deterioration in quality by prolonged storage.

6.2 The mixing of different types of foam concentrate may cause serious sludging and possible malfunctioning of foam production systems. Unless evidence to the contrary is available it should be assumed that different types are incompatible. In these circumstances it is essential that the tank(s), pipework and pump (if fitted) are thoroughly cleaned and flushed prior to the new concentrate being introduced.

6.3 Consideration should be given to the provision of reserve stocks for use in training, testing and recovery from emergency use.

7 Rescue Equipment

7.1 In some circumstances, lives may be lost if simple ancillary rescue equipment is not readily available.

7.2 The CAA strongly recommends the provision of at least the following equipment. Sizes of equipment are not detailed but should be appropriate for the types of helicopter expected to use the facility.

Table 1 Rescue Equipment

Helicopter RFF Category		
	H1/H2	**H3**
Adjustable wrench	1	1
Rescue axe, large (non wedge or aircraft type)	1	1
Cutters, bolt	1	1
Crowbar, large	1	1
Hook, grab or salving	1	1
Hacksaw (heavy duty) and six spare blades	1	1
Blanket, fire resistant	1	1
Ladder (two-piece)*	1	1
Life line (5 cm circumference x 15 m in length) plus rescue harness	1	1
Pliers, side cutting (tin snips)	1	1
Set of assorted screwdrivers	1	1
Harness knife and sheath**	**	**
Gloves, fire resistant**	**	**

Table 1 Rescue Equipment (Continued)

Helicopter RFF Category		
	H1/H2	**H3**
Self-contained breathing apparatus (complete)***	2	2
Power cutting tool	–	1

* For access to casualties in an aircraft on its side.
** This equipment is required for each helideck crew member.
*** Refer to Home Office Technical Bulletin 1/1997.

7.3 A responsible person should be appointed to ensure that the rescue equipment is checked and maintained regularly. Rescue equipment should be stored in clearly marked and secure watertight cabinets or chests. An inventory checklist of equipment should be held inside each equipment cabinet/chest.

8 Personnel Levels

8.1 The facility should have sufficient trained fire fighting personnel immediately available whenever aircraft movements are taking place. They should be deployed in such a way as to allow the appropriate fire fighting and rescue systems to be operated efficiently and to maximum advantage so that any helideck incident can be managed effectively. The HLO should be readily identifiable to the helicopter crew as the person in charge of helideck operations. The preferred method of identification is a brightly coloured 'HLO' tabard. For guidance on helideck crew composition refer to the UKOOA Guidelines for the Management of Offshore Helideck Operations.

9 Personal Protective Equipment (PPE)

9.1 All personnel assigned to rescue and fire fighting (RFF) duties should be provided with suitable PPE to allow them to carry out their duties. The level of PPE should be commensurate with the nature of the hazard and the risk. Consideration should be given to the provision of face masks where helicopters are partially or substantially constructed of composite material. The PPE should meet appropriate safety standards and should not in any way restrict the wearer from carrying out his duties.

9.2 Sufficient personnel to operate the RFF equipment effectively should be dressed in protective clothing prior to helicopter movements taking place.

9.3 The CAA recommends that at least two, positive pressure, self-contained breathing apparatus (SCBA) sets complete with ancillary equipment plus two reserve cylinders should be provided. These should be appropriately stored and readily available close to the helideck for fast deployment by the helideck crew.

9.4 Respiratory protective equipment enables the wearer to enter and work in an atmosphere which would not otherwise support life. It is therefore essential that it be stored, tested and serviced in such a way to ensure that it can be used confidently by personnel. SCBA sets should be utilised in a safe and appropriate manner based on current legislation and operating procedures.

9.5 A responsible person(s) should be appointed to ensure that all PPE is installed, stored, used, checked and maintained in accordance with the manufacturer's instructions.

10 Training

10.1 If they are to effectively utilise the equipment provided, all personnel assigned to RFF duties on the helideck should be fully trained to carry out their duties to ensure competence in role and task. The CAA recommends that personnel attend an established helicopter fire fighting course.

10.2 In addition, regular training in the use of all RFF equipment, helicopter familiarisation and rescue tactics and techniques should be carried out. Correct selection and use of principal and complementary media for specific types of incident should form an integral part of personnel training.

11 Emergency Procedures

11.1 The installation or vessel emergency procedures manual should specify the actions to be taken in the event of an emergency involving a helicopter on or near the installation or vessel. Exercises designed specifically to test these procedures and the effectiveness of the fire fighting teams should take place at regular intervals.

12 Further Advice

12.1 Advice is available from the CAA's Aerodrome Standards Department regarding the choice and specification of fire extinguishing agents.

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Chapter 6 Helicopter Landing Areas – Miscellaneous Operational Standards

1 Landing Area Height Above Water Level

1.1 Because of the effects upon aircraft performance in the event of an engine failure (see Chapter 2) the height of the landing area above water level will be taken into account by the HCA in deciding on any operational limitations to be applied to specific helidecks. Landing area height above water level is to be included in the information supplied to the HCA for the purpose of authorising the use of the helideck.

2 Wind Direction (Vessels)

2.1 Because the ability of a vessel to manoeuvre may be helpful in providing an acceptable wind direction in relation to the helideck location, information provided to the HCA is to include whether the vessel is normally fixed at anchor, single point moored, or semi- or fully manoeuvrable. The HCA may specify windspeed and direction requirements and limitations when authorising the use of the helideck.

3 Helideck Movement

3.1 Floating installations and vessels experience dynamic motions due to wave action which represent a potential hazard to helicopter operations. Operational limitations are therefore set by the helicopter operators which are promulgated in the HLL and incorporated in their Operations Manuals. Helideck downtime due to excessive deck motion can be minimised by careful consideration of the location of the helideck on the installation or vessel at the design stage. Guidance on helideck location and how to assess the impact of the resulting helideck motion on operability is now presented in CAA Paper 2008/03 'Helideck Design Considerations – Environmental Effects' which is available on the Publications section of the CAA website at www.caa.co.uk. It is strongly recommended that mobile installation and vessel designers consult CAA Paper 2008/03 at the earliest possible stage of the design process.

3.2 The helideck approval will be related to the helicopter operator's Operations Manual limitations regarding the movement of the helideck in pitch, roll, heave and heading. It is necessary for details of these motions to be recorded on the vessel prior to, and during, all helicopter movements.

3.3 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 heading. Roll should be expressed in terms of 'left' and 'right'; pitch should be expressed in terms of 'up' and 'down'; heave, being the total heave motion of the helideck, should be reported in metres. Heave is to be taken as the vertical difference between the highest and lowest points of any single cycle of the helideck movement. The parameters reported should be the maximum peak values recorded during the 20 minute period prior to commencement of helicopter deck operations. Values of pitch, roll and heave should be reported to one decimal place.

3.3.1 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 helideck 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. In some circumstances the pilot can be aided by being provided with the heave period, i.e. the time period (seconds) between one peak in heave motion and the next.

3.3.2 Reporting Format: A standard radio message should be passed to the helicopter which contains the information on helideck movement in an unambiguous format. This will, in most cases, be sufficient to enable the helicopter flight crew to make safety decisions. Should the helicopter flight crew require other motion information or amplification of the standard message, the crew will request it (for example, yaw and heading information). For further guidance refer to CAP 413 Radiotelephony Manual.

3.3.3 **Standard Report Example:**

Situation: The maximum vessel movement (over the preceding 20 minute period) about the roll axis is 1.6° to port and 3.6° to starboard (i.e. this vessel may have a permanent list of 1° to starboard and is rolling a further 2.6° either side of this 'false' datum). The maximum vessel movement (over the preceding 20 minute period) about the pitch axis is 2.1° up and 2.3° down. The maximum recorded heave amplitude over a single cycle (over the preceding 20 minute period) is 1.5 m.

Report: "Roll 1.6° left and 3.6° right; pitch 2.1° up and 2.3° down; heave 1.5 metres".

3.3.4 The helideck heave limitation is to be replaced with heave rate in the near future. Heave rate is considered a more appropriate parameter and has been used in the Norwegian sector for many years. The measure of heave rate to be used is described in CAA Paper 2008/03, and will require electronic motion-sensing equipment to generate it. It is likely that the heave rate criterion will be introduced with the new helideck motion-sensing scheme mentioned in paragraph 3.4

3.4 Current research has indicated that the likelihood of a helicopter tipping or sliding on a moving helideck is directly related to helideck accelerations and to the prevailing wind conditions. It is therefore probable that future requirements will introduce additional measuring and reporting criteria. The CAA is currently completing research into the definition of these parameters, and how operating limits in terms of these parameters should be set. A CAA paper fully describing the new scheme will be published when the research and in-service trials have been completed. In the meantime, CAA Paper 2008/03 contains a top-level summary of the scheme in its trials form.

3.5 In earlier editions of CAP 437 it was noted that a small number of helideck motion reports to pilots were still based on visual estimations. While this practice is now rare, it is nevertheless emphasised that this is not considered to be an acceptable way of obtaining vital safety information. It is therefore strongly recommended that all moving helidecks are equipped with electronic motion-sensing systems which will not only facilitate implementation of the new scheme mentioned in paragraph 3.4, but also produce accurate pitch, roll and heave information for current reporting requirements.

4 Meteorological Information

(Relevant references are listed in Appendix B.)

(Additional guidance is listed in Appendix G.)

4.1 Accurate, timely and complete meteorological observations are necessary to support safe and efficient helicopter operations.

4.2 **Meteorological Observations**

In addition to the data covered by paragraph 3 above, it is strongly recommended that installations are provided with an automated means of ascertaining the following meteorological information at all times:

a) wind speed and direction (including variations in direction);

b) air temperature and dew point temperature;

c) QNH and, where applicable, QFE;

d) cloud amount and height of base (above mean sea level);

e) visibility; and

f) present weather.

NOTES: 1. Where an installation is within 10 miles of another installation that is equipped with an automated means of ascertaining the meteorological information listed above, and which also makes this information routinely available to others, a manual means of verifying and updating the visual elements of observation, i.e. cloud amount and height of base, visibility and present weather, may be used.

2. Contingency meteorological observing equipment providing manual measurements of air and dew point temperatures, wind speed and direction and pressure is recommended to be provided in case of the failure or unavailability of the automated sensors.

4.2.1 **Assessment of Wind Speed and Direction**

For recording purposes an anemometer positioned in an unrestricted air flow is required. A second anemometer, located at a suitable height and position, can give useful information on wind velocity at hover height over the helideck in the event of turbulent or disturbed air flows over the deck. An indication of wind speed and direction should also be provided visually to the pilot by the provision of a wind sock coloured so as to give maximum contrast with the background (see also Chapter 4, paragraph 1.5).

4.3 **Reporting of Meteorological Information**

Up-to-date, accurate meteorological information is used by helicopter operators for flight planning purposes and by crews to facilitate the safe operation of helicopters in the take-off and landing phases of flight.

4.3.1 **Pre-Flight Weather Reports**

The latest weather report from each installation should be made available to the helicopter operator one hour before take-off. These reports should contain:

- the name and location of the installation;
- the date and time the observation was made;
- wind speed and direction;
- visibility;
- present weather (including presence of lightning);
- cloud amount and height of base;
- temperature and dew point; and
- QNH.

Where measured, the following information may also be included in the weather report:

- significant wave height.

4.3.2 **Radio Messages**

A standard radio message should be passed to the helicopter operator which contains information on the helideck weather in a clear and unambiguous format. When passing weather information to flight crews it is recommended that the information be consistently sent in a standard order as detailed in CAP 413 'Radiotelephony Manual' and in the UKOOA 'Guidelines for the Management of Offshore Helideck Operations'. This message will usually be sufficient to enable the helicopter crew to make informed safety decisions. Should the helicopter crew require other weather information or amplification of the standard message they will request it.

4.4 **Collection and Retention of Meteorological Information**

Records of all meteorological reports that are issued are required to be retained for a period of at least 30 days.

4.4.1 **Real-Time Web-Based Systems**

Offshore installations are strongly encouraged to supply meteorological information produced from the automated sensors to web-based systems that are operated on behalf of the UK offshore industry. These systems enable helicopter operators, installation duty holders and others to access the latest weather information in real time. Where appropriate, AUTO METARS may be generated from these reports which, provided all the required parameters are being generated, may be made available on the Aeronautical Fixed Service (AFS) channels, including the Aeronautical Fixed Telecommunications Network (AFTN).

4.5 **Meteorological Observer Training**

The CAA recommends that personnel who carry out meteorological observations on offshore installations undergo formal meteorological observer training and are certificated by an approved training organisation for this role. Observers should complete refresher training every two years to ensure they remain familiar with any changes to meteorological observing practices and procedures.

4.6 **Calibration of Meteorological Equipment Sensors**

Calibration of meteorological equipment sensors used to provide the data listed in paragraph 4.2 should be periodically calibrated in accordance with the manufacturers' recommendations in order to demonstrate continuing adequacy for purpose.

5 Location in Respect to Other Landing Areas in the Vicinity

5.1 Mobile installations and support vessels with helidecks may be positioned adjacent to other installations so that mutual interference/overlap of obstacle protected surfaces occur. Also on some installations there may be more than one helideck which may result in a confliction of obstacle protected surfaces.

5.2 Where there is confliction as mentioned above, within the OFS and/or falling gradient out to a distance that will allow for both an unobstructed departure path and safe clearance for obstacles below the helideck in the event of an engine failure for the type of helicopter the helideck is intended to serve (see also Glossary of Terms. Note: for helicopters operated in Performance Class 1 or 2 the horizontal extent of this distance from the helideck will be based upon the one-engine inoperative capability of the helicopter type to be used), simultaneous operation of two helicopter landing areas is not to take place without prior consultation with the helicopter operator. It is possible, depending upon the distance between landing areas and the operational conditions which may pertain, that simultaneous operations can be permitted but suitable arrangements for notification of helicopter crews and other safety precautions will need to be established. In this context, 'flotels' will be regarded in the same way as any other mobile installation which may cause mutual interference with the parent installation approach and take-off sector. For a detailed treatment of this subject readers are recommended to refer to the UKOOA 'Guidelines for the Management of Offshore Helideck Operations'. See also Chapter 3 which addresses issues from the perspective of the impact of environmental effects on helideck operations.

6 Control of Crane Movement in the Vicinity of Landing Areas

6.1 Cranes can adversely distract pilots' attention during helicopter approach and take-off from the helideck 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, 'A' frames, etc. are positioned clear of the obstacle protected surfaces and flight paths.

6.2 The HLO should be responsible for the control of cranes in preparation for and during helicopter operations.

7 General Precautions

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

7.2 The practical implementation of paragraph 7.1 above is best served through consultation with the helicopter 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.

7.3 Personnel should not approach the helicopter while the helicopter anti-collision (rotating/flashing) beacons are operating. In the offshore environment, the helideck should be kept clear of all personnel while anti-collision lights are on.

8 Installation/Vessel Helideck Operations Manual and General Requirements

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

9 Helicopter Operations Support Equipment

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

a) chocks and tie-down strops/ropes (strops are preferable);

b) heavy-duty, calibrated, accurate scales for passenger baggage and freight weighing;

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

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

9.2 Chocks should be compatible with helicopter undercarriage/wheel configurations. Helicopter operating experience offshore has shown that the most effective chock for use on helidecks 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 helideck. The 'rubber triangular' chock is generally only effective on decks without nets.

9.3 For securing helicopters to the helideck it is recommended that adjustable tie-down strops are used in preference to ropes. Specifications for tie-downs should be agreed with the HCA.

9.4 Detailed guidance on the provision and operation of aeronautical communications and navigation facilities associated with offshore helicopter landing areas is given in the UKOOA publication 'Guidelines for the Management of Offshore Helideck Operations' and OGUK publication 'Guidelines for Safety Related Telecommunications Systems On Fixed Offshore Installations'.

9.5 Offshore Radio Operators, HLOs, Helideck Assistants and other persons who operate VHF aeronautical radio equipment are required to hold a UK CAA Offshore Aeronautical Radio Station Operator's Certificate of Competence. Further information can be found in CAP 452 'Aeronautical Radio Station Operator's Guide' and CAP 413 'Radiotelephony Manual' which can be found on the CAA website at www.caa.co.uk/cap452 and www.caa.co.uk/cap413.

9.6 Offshore fixed installations, mobile installations and vessels which have aeronautical radio equipment and/or aeronautical Non-Directional Radio Beacons (NDBs) installed on them and are operating in UK Internal Waters, UK Territorial Waters or within the limits of the UKCS are required to hold a valid Wireless Telegraphy (WT) Act licence and Air Navigation Order (ANO) approval. The UK CAA Form SRG 1417 'Application to Establish or Change an Aeronautical Ground Radio Station' may be used to apply for both the WT Act licence and ANO approval and can be found on the CAA website at www.caa.co.uk/srg1417.

9.7 The UK Office of Communications (Ofcom) has an agreement with the UK CAA, Directorate of Airspace Policy (DAP), Surveillance and Spectrum Management (S&SM) to administer WT Act licences for aircraft, aeronautical (ground) radio stations and navigation aids on their behalf. Further information can be found on the CAA website at www.caa.co.uk/radiolicensing.

Chapter 7 Helicopter Fuelling Facilities – Systems Design and Construction

1 General

1.1 The contents of this chapter are intended as general advice/best practice guidance for the design and construction requirements for helicopter fuelling systems intended for use on offshore installations and vessels. The information has been compiled by OGUK in consultation with the UK offshore oil and gas industry and specialist fuelling companies.

1.2 This chapter has been prepared with the relevant content of CAP 748 'Aircraft Fuelling and Fuel Installation Management' in mind. However, supplementary detailed information can be obtained from CAP 748 and aviation fuel suppliers. Where the reader is referred to other standards or alternative guidance, the reference documents used should always be checked by the reader to ensure they are up-to-date and reflect current best practice.

2 Product Identification

2.1 It is essential to ensure at all times that aviation fuel delivered to helicopters from offshore installations and vessels is of the highest quality. A major contributor toward ensuring that fuel quality is maintained and contamination is prevented is to provide clear and unambiguous product identification on all system components and pipelines denoting the fuel type (e.g. Jet A-1) following the standard aviation convention for markings and colour code. Details can be found in API/IP Standard 1542 'Identification markings for dedicated aviation fuel manufacturing and distribution facilities, airport storage and mobile fuelling equipment'. The correct identification markings should initially be applied during system manufacture and routinely checked for clarity during subsequent maintenance inspections.

3 Fuelling System Description

3.1 It should be noted that an offshore fuelling system may vary according to the particular application for which it was designed. Nevertheless the elements of all offshore fuelling systems are basically the same and generally include:

a) transit tanks;

b) static storage facilities and, if installed, a sample reclaim tank (see Note);

c) a pumping system; and

d) a delivery system.

NOTE: In some systems where built-in static storage tanks are not provided, delivery of fuel directly to the aircraft from transit tanks is acceptable. In this case, sample reclaim tanks should not be used.

3.2 General Design Considerations

3.2.1 When preparing a layout design for aviation fuelling systems on offshore installations and vessels it is important to make provisions for suitable segregation and bunding of the areas set aside for the tankage and delivery system. Facilities for containing possible fuel leakage and providing fire control should be given full and proper consideration, along with adequate protection from potential dropped objects (e.g. due to crane operations).

3.3 Transit Tanks

3.3.1 Transit tanks should be constructed to satisfy the requirements of Intergovernmental Marine Consultative Organisation (IMCO) and International Maritime Dangerous Goods (IMDG) Codes and current inspection and repair codes of practice.

3.3.2 Tanks may be constructed from stainless steel or mild steel. If mild steel is used, then the tanks should be lined with suitable fuel resistant epoxy lining.

3.3.3 The tanks should be encased in a robust steel cage with four main lifting eyes and, where possible, stainless steel fasteners in conjunction with stainless steel fittings should be used. The tank frame should incorporate cross-members to provide an integral ‘ladder’ access to the tank top. When horizontal vessels are mounted in the transit frame there should be a tank centre line slope towards a small sump. Vertical vessels should have dished ends providing adequate drainage towards the sump. This slope should be at least 1 in 30, although 1 in 25 is preferred.

3.3.4 Tanks should be clearly and permanently marked on the identification plate with the tank capacity and tank serial number. Tanks should also be clearly marked with the date of the last lifting gear inspection and initial/last IMDG test.

3.3.5 Tanks should normally be equipped with the following:

a) **Manhole.** A 450 mm (18”) or greater manhole to allow physical access to the interior of the tank.

b) **Inspection Hatch.** If the manhole position and/or cover type is unsuitable for inspecting the lower end of the tank, a 150 mm (6”) hatch should be fitted to enable inspection.

c) **Dipstick Connection.** A suitable captive dipstick to determine the tank contents.

d) **Emergency Pressure Relief.** A stainless steel 63.5 mm (2½”) pressure/vacuum relief valve fitted with weatherproof anti-flash cowl. The valve settings will depend on the type of tank in use and manufacturers’ recommendations should be followed.

e) **Sample Connection.** A stainless steel sample point, fitted at the lowest point of the tank. A foot-valve should be fitted in the sample line, complete with an extension pipe terminating with a ball valve with a captive dust cap. Sample lines should be a minimum of 20 mm (¾”) diameter but preferably 25.4 mm (1”) diameter. In order to allow a standard four litre sample jar to be used, the sample point should be designed with sufficient access, space and height to accommodate the jars.

f) **Outlet/Fill Connection.** The outlet/fill connection should be a flanged fitting with a 76 mm (3”) internal valve terminating to a 63.5 mm (2½”) self-sealing coupler complete with captive dust cap. The draw-off point for the tank outlet should be at least 150 mm (6”) higher than the lowest point of the tank.

g) **Document Container.** A suitably robust container should be positioned close to the fill/discharge point to hold the tank and fuel certification documents.

h) **Tank Barrel and Frame External Surface Finishes.** The tank barrel and frame should be suitably primed and then finished in safety yellow (BS 4800, Type 08E51). Where the barrel is fabricated from stainless steel it may remain unpainted. Safety yellow is not mandatory but has been generally accepted for helifuel tanks. All component parts, e.g. tank, frame etc., should be properly bonded before being painted. Whether the tank barrel is painted yellow or otherwise, Jet A-1 Transit Tanks should be correctly identified by placing clear product identification markings on all sides, particularly above the tank filling and dispensing attachment.

i) **Tank Shell Internal Finish.** The internal finish should be sufficiently smooth to ensure that liquid run-off is clean and allow the tank to be wiped down during internal inspections without dragging threads or lint from the cleaning cloth.

3.4 **Static Storage Tanks**

3.4.1 Where static storage tanks are provided they should be constructed to suitable standards. Acceptable standards include ASME VIII and BS 5500 Categories I, II and III. The tank should be cylindrical and mounted with an obstacle free centre line slope (e.g. no baffles fitted) to a small sump. This slope should be at least 1 in 30, although 1 in 25 is preferred.

3.4.2 Tanks may be constructed from stainless steel or mild steel. If mild steel is used, then the tanks should be lined with a suitable white coloured, fuel resistant epoxy surface finish.

3.4.3 The sump should be fitted with a sample line which has a double block valve arrangement and it should have a captive dustcap on the end to prevent the ingress of dirt or moisture.

3.4.4 Sample lines should be a minimum of 20 mm (¾″) diameter and preferably 25.4 mm (1″) diameter. The sample point accessibility should be as described in paragraph 3.3.5(e) above.

3.4.5 Tanks should be clearly and permanently marked on the identification plate with the tank capacity and tank serial number.

3.4.6 Static tanks should be equipped with the following:

a) **Manhole.** A 450 mm (18″) or greater diameter manhole which should normally be hinged to assist easy opening.

b) **Inspection Hatch.** A 150 mm (6″) sample hatch to allow for a visual inspection of the low end of the tank, or for the taking of samples.

c) **Contents Measuring Device.** A suitable dipstick or dip-tape should be provided, with a means of access to the tank interior. Additionally, a sight glass or contents gauge may be provided to determine the tank contents.

d) **Vent.** A free vent or an emergency pressure/vacuum relief valve should be fitted. Type and pressure settings should be in accordance with the manufacturer's recommendations.

e) **Outlet/Fill Connection.** Separate outlet and fill connections with the fill point arranged so that there is no free-fall of product at any stage of the tank filling. The draw-off point for the tank should be at least 150 mm (6″) higher than the lowest point of the tank or by means of floating suction.

f) **Floating Suction.** When floating suction is embodied then a bonded floating suction check wire pull assembly should be fitted directly to the top of the tank. Floating suction offers several advantages over other outlet types and is therefore strongly recommended.

g) **Automatic Closure Valves.** Automatic quick closure valves to the fill and discharge points should be fitted. These valves should be capable of operation from both the helideck and from another point which is at a safe distance from the tank.

h) **Tank Shell Outer Surface Finish.** The static storage tank shell should be suitably primed and then finished in safety yellow (BS 4800, Type 08E51). Where the tank shell is fabricated from stainless steel it may remain unpainted. Safety yellow is not mandatory but has been generally accepted for helifuel tanks. All component parts should be properly bonded before being painted. Whether the tank barrel is painted yellow or otherwise, Jet A-1 static storage tanks should be correctly identified by placing clear product identification markings on all sides, particularly above the tank filling and dispensing attachment.

i) **Tank Shell Inner Surface Finish.** The internal finish should be sufficiently smooth to ensure that liquid run-off is clean and allow the tank to be wiped down during internal inspections without dragging threads or lint from the cleaning cloth.

3.5 **Sample Reclaim Tank**

3.5.1 If the fuelling system includes a static storage tank, water-free and sediment-free fuel samples can be disposed of into a dedicated reclaim tank (if installed). The sample reclaim tank should be equipped with a removable 100 mesh strainer at the fill point, a lockable sealing lid, a conical base with a sample point at the sump and a return line (fitted with a check valve) to the storage tank via a water separator filter.

3.5.2 Where the system does not include a functioning static storage tank and fuelling is direct from transit tanks, if a sample reclaim tank has been installed fuel samples may be drained to it. However, the reclaim tank contents should only be decanted directly from the sample point into drums and then properly disposed of.

3.6 **Delivery System**

3.6.1 The delivery system to transfer fuel from storage tanks to the aircraft should include the following components:

a) **Pump.** The pump should be an electrically or air driven, centrifugal or positive displacement type with a head and flow rate suited to the particular installation. The pump should be able to deliver up to 50 imperial gallons (225 litres) per minute under normal flow conditions. A remote start/stop button should be provided on or immediately close to the helideck and close to the hose storage location (in a position where the operator is able to view the whole fuelling operation). Additionally there should be a local emergency stop button adjacent to the pumps and an automatically switched, flashing amber coloured pump-running warning light that is visible from the helideck.

b) **Filter Water Separators.** Filter water separators should be fitted with automatic air eliminators and sized to suit the discharge rate and pressure of the delivery system. Units should be API 1581 approved and such filters should provide protection down to 1 micron particle size or better. Filter units should be fitted with a sample line to enable contaminants to be drained from the unit. The sample line should terminate with a ball valve and have a captive dust cap. Sample lines on filter units should be a minimum 13 mm (½") nominal bore but, in general, the larger the diameter of the sample line the better.

c) **Flow Meter.** The flow meter should be of the positive displacement type, positioned upstream of the filter water monitor and sized to suit the flow rate. It is also recommended that the flow meter includes both a strainer and an air eliminator. The flow meter should read in litres.

d) **Fuel Monitor.** A fuel monitor should be fitted between the flow meter and delivery hose and be sized to suit the discharge rate and pressure of the delivery system. It should be equipped with an automatic air eliminator. The elements should be API 1583 approved and be designed to absorb any water still present in the fuel and to cut off the flow of fuel if the amount of water in the fuel exceeds an acceptable limit compromising fuel quality. The monitor is described as an Aviation Fuel Filter Monitor with absorbent type elements. Filter units should be fitted with a sample line to enable water to be drained from the unit. The sample line should terminate with a ball valve and have a captive dust cap. Sample lines on filter units should be a minimum 13 mm (½") nominal bore but, in general, the larger the diameter of the sample line the better.

e) **Delivery Hose.** The delivery hose should be an approved semi-conducting type to EN 1361 type C, Grade 2, 38 mm (1½") internal bore fitted with reusable safety clamp adaptors; hoses of larger diameter may be required if a higher flow rate is specified. The hose should be stored on a reel suitable for the length and diameter of the hose being used (the minimum bend radius of the hose should be considered). The selected length of refuelling hose provided should be consistent with easily reaching the helicopter refuelling points when the aircraft is correctly positioned on the helideck.

f) **Bonding Cable.** A suitable high visibility bonding cable should be provided to earth the helicopter airframe before any fuelling commences. The cable should be bonded to the system pipework at one end, and be fitted with a correct earthing adaptor to attach to the aircraft and a means for quick disconnection provided at the aircraft end. In the event that a helicopter has to lift off quickly, a quick-release mechanism may be provided by fitting a 'breakaway joint' into the bonding cable, a short distance away from the clamp at the helicopter end. The electrical resistance between the end connection and the system pipework should not be more than 0.5 ohm. The selected length of bonding cable provided should be consistent with easily reaching the helicopter refuelling points when the aircraft is correctly positioned on the helideck.

g) **Fuelling Nozzle.** Fuel delivery to the aircraft may be either by gravity (overwing) or pressure (underwing) refuelling. It is operationally advantageous to have the ability to refuel by either means to suit the aircraft type using the helideck:

   i) **Gravity** – The nozzle should be 1½" spout diameter fitted with 100 mesh strainer. Suitable types include the EMCO G180-GRTB refuelling nozzle.

   ii) **Pressure** – For pressure refuelling the coupling should be 2½" with 100 mesh strainer and quick disconnect. A Carter or Avery Hardoll pressure nozzle with regulator/surge control (maximum 35 psi) should be used.

   iii) **Pressure Gravity** – To meet both requirements, a pressure nozzle can be fitted to the hose end. A separate short length of hose fitted with an adaptor (to fit the pressure nozzle) and with the gravity nozzle attached can be used as required. This arrangement gives the flexibility to provide direct pressure refuelling or, with the extension hose attached, a means of providing gravity refuelling. Alternatively a GTP coupler may be used.

h) **Weather Protection.** The delivery system, including hoses and nozzles, should be equipped with adequate weather protection to prevent deterioration of hoses and ingress of dust and water into the nozzles.

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Chapter 8 Helicopter Fuelling Facilities – Maintenance and Fuelling Procedures

1 General

1.1 This chapter gives general advice and best practice guidance on the necessary requirements for fuelling system maintenance and the fuelling of helicopters on offshore installations and vessels. It includes recommended procedures for the filling of transit tanks, the transfer of fuel from transit tanks to static storage and the refuelling of aircraft from static storage.

1.2 Fuel storage, handling and quality control are key elements for ensuring, at all times, the safety of aircraft in flight. For this reason, personnel assigned supervisory and operating responsibilities should be certified as properly trained and competent to undertake systems maintenance, inspection and fuelling of aircraft.

1.3 The information in this chapter has been prepared by OGUK to be consistent with the relevant content of CAP 748 'Aircraft Fuelling and Fuel Installation Management', and in consultation with the offshore oil and gas industry and aviation specialists. If required, supplementary information may be obtained from CAP 748 and the specialist aviation fuel suppliers. The reader should ensure when referring to the best practice standards given in the text that they are current and embody the latest amendments.

1.4 Alternative guidance and procedures from other recognised national sources may be used where users can satisfy themselves that the alternative is adequate for the purpose, and achieves equivalence, considering particularly the hostile conditions to which the systems may be subjected and the vital and overriding importance of a supply of clean fuel.

NOTE: Certain companies arrange two-day training courses at onshore locations. The courses are intended for offshore staff who are involved with maintaining and operating helicopter fuel systems offshore. Details of the above mentioned courses may be obtained from Cogent OPITO on +44 (0) 1224 787800.

2 Fuel Quality Sampling and Sample Retention

2.1 Throughout the critical processes of aviation fuel system maintenance and fuelling operations, routine fuel sampling is required to ensure that delivered fuel is scrupulously clean and free from any contamination that may enter the aircraft fuel tanks which could ultimately result in engine malfunctions. The requirement to distinguish between colours during fuel sample testing (e.g. water detector tests) should be taken into account when selecting personnel for this task. The condition of colour blindness could potentially cause erroneous results.

2.2 Fuel Sample Containers

2.2.1 Fuel samples drawn from transit/static storage tanks and the fuel delivery system during daily and weekly tests should be retained in appropriate containers for specified periods. The sample containers should be kept locked in a secure, suitably constructed light-excluding store and kept away from sunlight until they are disposed of (aviation fuel is affected by UV light).

2.2.2 Only scrupulously clean, standard four litre clear glass sampling jars should be used for taking fuel samples. It is strongly recommended that they are also used for initial storage. Supplementary items such as buckets and funnels, fitted with earth cable and clamp, should ideally be manufactured from stainless steel and, to prevent sample contamination, they should be scrupulously cleaned before each use.

2.2.3 It is recommended that the fuel samples are no longer kept in five litre International Air Transport Association (IATA) lacquer lined sample cans because their design prevents scrupulous cleaning and visual confirmation of removal of all sources of contamination (e.g. trace sediments) prior to re-use. Sediments trapped in IATA cans can result in highly inaccurate representations of drawn fuel samples when submitted for laboratory analysis, in the event of an aircraft incident where fuel is a suspected causal factor.

2.2.4 When drawn fuel samples are requested as evidence for analysis, the appropriate samples should be decanted from glass sample jars into unused, purpose made IATA sample cans for transportation.

2.3 Fuel Sampling

2.3.1 Fuel samples taken from any aviation fuelling system should be the correct colour, clear, bright and free from solid matter. They should also be checked for dissolved water by using a syringe and water detection capsule.

2.3.2 Filter vessel and hose end samples should be taken under pump pressure.

2.3.3 Checking for fuel quality should be carried out whilst making observations in the following manner:

a) Samples should be drawn at full flush into scrupulously clean, clear glass sample jars (four litre capacity).

b) The fuel should be of the correct colour, visually clear, bright and free from solid matter and free and dissolved water. (Jet A-1 may vary from colourless to straw colour.)

c) Free water will appear as droplets on the sides, or bulk water on the bottom, of the sample jar.

d) Suspended water will appear as a cloud or haze.

e) Solid matter is usually made up of small amounts of dust, rust, scale etc. suspended in the fuel or settled out on the jar bottom. When testing for dirt, swirl the sample to form a vortex, any dirt present will concentrate at the centre of the vortex making it more readily visible.

f) Testing for dissolved water should be done with a syringe and proprietary water detector capsule (e.g. Shell type). Fit a capsule to the syringe, immerse in fuel and immediately withdraw a 5 ml fuel sample into the syringe. If the capsule is withdrawn from the fuel and there is less than 5 ml in the syringe, the capsule should be discarded and the test repeated using a new capsule. Examine the capsule for any colour change. If there is any colour change the fuel should be rejected.

Capsules should be kept tightly sealed in their container when not in use. Capsule tubes are marked with the relevant expiry date and capsules should be used before the end of the month shown on the container. Capsules should not be re-used.

NOTE: The use of water-finding paper is no longer recommended.

2.4 **Fuel Sample Retention**

2.4.1 The purpose of retaining selected fuel samples during the handling processes is to provide proof of fuel quality when delivered to an aircraft.

2.4.2 In the event of an aircraft incident where fuel may be considered to be a causal factor retained fuel samples will subsequently be requested by the helicopter operator to support technical investigations.

2.4.3 The following table summarises the minimum recommended fuel sampling and retention requirements for offshore helicopter operations.

No.	Sample	Reason for Sampling and When Taken	Sample Retention Period
1	Transit tanks.	Filling onshore.	Until transit tank is returned onshore.
2	Transit tanks.	Within 24 hours of placement in a bunded storage area and weekly thereafter until tank becomes next on-line.	24 hours.
3	Transfer filters.	Prior to fuel transfer or weekly, whichever occurs first.	When a satisfactory result has been obtained, samples can be discarded.
4	Transit tanks.	Prior to decanting to bulk storage tank or daily when on-line or next in-line.	24 hours.
5	Static storage tank.	Daily - prior to system use.	48 hours.
6	Delivery filter separator and filter monitor.	Daily - prior to system use.	When a satisfactory result has been obtained, samples can be discarded.
7	Delivery hose end.	Daily - prior to system use.	When a satisfactory result has been obtained, samples can be discarded.
8	Delivery hose end (or filter monitor if a pressure refuel is being performed).	Before aircraft refuelling. This sample to be checked by the pilot.	When a satisfactory result has been obtained and the flight crew have seen the evidence, samples can be discarded.
9	Delivery hose end (or filter monitor if a pressure refuel is being performed).	After aircraft refuelling.	24 hours. However, if the same aircraft is refuelled again on the same day, the previous sample may be discarded and the new one retained.
10	Tanks and delivery system.	After heavy rainfall or storms and if subject to water/foam deluge due to activation of the on-board fire protection system.	When taken, these samples replace the ones taken for 4 and 5 above.

2.5 **Decanting from Sample Reclaim Tanks**

2.5.1 Before transfer of fuel takes place from a sample reclaim tank to bulk storage, the reclaim tank should be sampled to ensure the fuel is in good condition.

2.5.2 Any samples taken prior to transfer should not be returned until transfer from the sample reclaim tank to the bulk tank has been completed, because this could stir up contaminants on the bottom of the vessel. After each transfer, the residue in the bottom of the vessel should be fully drained and the recovery tank cleaned.

2.5.3 The transfer water separator should also be sampled under pump pressure before the storage tank inlet valve is opened, to ensure that no contamination is present in the filter vessel. Any contaminated samples should be disposed of in a suitable container.

3 Recommended Maintenance Schedules

3.1 Different elements and components of the helicopter fuelling systems require maintenance at different times, ranging from daily checks of the delivery system to annual/biennial checks on static storage tanks.

3.2 Particularly in the UK, responsible bodies within the offshore oil and gas and aviation industries have developed maintenance regimes and inspection cycles to suit their specific operations. There may therefore appear to be anomalies between different source guidance on filter element replacement periodicity, hose inspection and replacement periodicity, static storage tank inspection periodicity and bonding lead continuity checks.

3.3 The various components of fuelling systems are listed with their recommended servicing requirements in the following paragraphs and tables.

3.4 **Transit Tanks**

3.4.1 All transit tanks should be subject to a 'trip examination' each time the tank is filled and, in addition, their condition should be checked weekly. Six-monthly and 12-monthly inspections should be carried out on all lined carbon steel tanks. However, for stainless steel tanks, the inspections can be combined at 12-monthly intervals.

a) **Trip Inspection**

Each time a transit tank is offered for refilling the following items should be checked:

No.	Items	Activity
i)	Tank Shell	Visual check for condition. Has the shell suffered any damage since its previous filling?
ii)	Filling/discharge and sampling points	Visual check for condition, leakage and caps in place.
iii)	Lifting lugs and four-point sling	Visual check for signs of damage.
iv)	Tank top fittings	Check for condition, caps in place, dirt free and watertight.
v)	Tank identification	Check that serial number and contents-identifying label are properly displayed.
vi)	Tank certificate	Ensure valid and located in the document container. (See paragraph 10.)

b) **Weekly Inspection**

Each transit tank whether it is full or empty, onshore or offshore, should be given a weekly inspection similar to the trip inspection at paragraph 3.4.1(a) above to ensure that the tank remains serviceable and fit for purpose. The weekly inspection should primarily be for damage and leakage. The completion of this check should be signed for on the Serviceability Report (see paragraph 10).

c) **Six-Monthly Inspection**

The six-monthly inspection should be carried out onshore by a specialist organisation. This inspection should include:

No.	Items	Activity
i)	Tank identification plate	Check details.
ii)	Tank shell	Visual check for damage.
iii)	Paint condition (external)	Check for deterioration.
iv)	Paint condition (internal)	Check for deterioration, particularly if applicable around seams.
v)	Lining materials (if applicable)	Check for deterioration, lifting, etc. Methyl Ethyl Ketone (MEK) and/or acetone test should be carried out on linings or on any lining repairs.
vi)	Tank fittings (internal)	Check condition.
vii)	Tank fittings (external)	Check condition.
viii)	Access manhole	Check security.
ix)	Pressure relief valve	Check condition, in particular check for leaks.
x)	Dipstick assembly	Check constraint, markings and cover/cap for security.
xi)	Bursting disc	Check for integrity and cover/cap for security.
xii)	Inspection hatch assembly	Check seal condition and security.
xiii)	Bonding	Measure electrical bonding resistance between transit tank and its shell.
xiv)	General	Examination and test procedures to conform with current rules and industry standards.

d) **Re-certification**

It is a legal requirement that "single product" transit tanks are re-certified at least every five years by an authorised Fuel Inspector functioning under an approved verification scheme. There should also be an intermediate check carried out every 2½ years. These checks should also include re-certification of the pressure/ vacuum relief valve. The date of the re-certification should be stamped on the tank inspection plate.

3.5 **Static Storage Tanks**

3.5.1 Static storage tanks are subject to an annual or biennial inspection depending on the type of tank. If the storage tank is mild steel with a lining then it should be inspected at least once per year. If the tank is stainless steel then a two-year interval between inspections is acceptable.

3.5.2 When due for inspection the tank should be drained and vented with the manhole access cover removed.

3.5.3 The inspection should include the following:

No.	Items	Activity
i)	Cleanliness	Clean tank bottom as required.
ii)	Tank internal fittings	Check condition.
iii)	Lining material (if applicable)	Acetone test (note this check need only be carried out on new or repaired linings).
iv)	Paint condition	Check for deterioration, particularly around seams.
v)	Access to tank top fittings	Check condition of access ladder/platform.
vi)	Inspection hatch	Check condition of seal.
vii)	Access manhole cover	Check seal for condition and refit cover securely. Refill tank.
viii)	Pressure relief valve	Check condition and certification, in particular check for leaks.
ix)	Floating suction	Check condition, continuity of bonding and operation.
x)	Valves	Check condition, operation and material.
xi)	Sump/drain line	Check condition, operation and material.
xii)	Grade identification	Ensure regulation Jet A-1 markings applied and clearly visible.
xiii)	Contents gauge	Check condition and operation.
xiv)	Bonding	Measure electrical bonding resistance between tank and system pipework.

3.6 **Delivery Systems**

3.6.1 The offshore delivery system should normally be inspected by the helicopter operator every three months. However, the inspection may be carried out by a specialist fuelling contractor on behalf of the helicopter operator. No system should exceed four months between successive inspections. In addition the system should be subject to daily and weekly checks by offshore fuelling personnel to ensure satisfactory fuel quality.

a) **Daily Checks**

The following checks should be carried out each day.

No.	Items	Activity
i)	Microfilter and/or filter/ water separator and filter monitor	Drain the fuel from the sump until it is clear. The sample taken should be checked and retained as noted in paragraphs 2.3 and 2.4. NOTE: This check excludes the transfer filter which should be checked weekly or prior to use, whichever is the sooner. This can only be done when fuel is being transferred.
ii)	Transit tank/storage tank	A fuel sample should be drawn from each compartment of the transit tank/storage tank (as applicable) and checked for quality as noted in paragraphs 2.3 and 2.4.
iii)	Floating suction	The assembly should be checked for buoyancy and freedom of movement.
iv)	Delivery hose end	A sample should be drawn from the hose end and checked for quality as noted in paragraphs 2.3 and 2.4.
v)	Complete documentation	Daily checks should be recorded on the 'Daily Storage Check' pro forma.

b) **Weekly Checks**

In addition to the daily checks specified in paragraph 3.6.1(a) the following checks should be carried out each week.

No.	Items	Activity
i)	Differential pressure gauge	Under full flow conditions during refuelling the differential pressure gauge reading should be noted and recorded on the filter record sheets.
ii)	Entire system	The system should be checked for leaks and general appearance including the transit tank checks detailed in paragraph 3.4.1(b).
iii)	Tank top fittings	Should be checked to see all are in place, clean and watertight.
iv)	Inlet and outlet couplings	Check caps are in place.
v)	Hose end strainers	Strainers fitted to fuelling nozzles and fuelling couplings should be inspected and cleaned. If significant quantities of dirt are found, the reason should be established and remedial action taken. During these checks the condition of any seal should be inspected for serviceability and to ensure they are correctly located/seated.

(continued)

vi)	Aviation delivery hose	The hose should be checked visually whilst subjected to system pump pressure. This particular check should be recorded on the hose inspection record.
vii)	Delivery nozzle/coupling	The delivery nozzle/coupling should be checked for condition and serviceability. The bonding wire and clip should also be checked for general condition, security and electrical continuity. Maximum 0.5 ohms.
viii)	Bonding Reel	Check for general condition, security and electrical continuity. Maximum 0.5 ohms. Check proper operation of quick release connection.
ix)	Documentation	Completion of these checks should be recorded on the serviceability report.

c) **Three-Monthly Inspection**

A three-monthly check is the major inspection of the system. The following checklist of items to be included will depend on the particular installation and is included as a general guide only. Additional items may be included when considered appropriate.

No.	Items	Activity
i)	All filtration units (e.g. decant line, dispenser and monitor filter	Obtain a fuel sample from each filtration unit and perform fuel quality checks as noted in paragraphs 2.3 and 2.4. Note results of the sample checks on system records. If consistently bad samples are evident on the three-monthly check it could indicate the presence of bacteriological growth in the separator. This will require the following action to be taken: Open the filter vessel and inspect for surfactants, bacteriological presence, mechanical damage and condition of lining (if applicable). Clean out any sediment and carry out a water test on the water separator element.
ii)	Earth bonding check	Carry out a continuity test throughout the system.
iii)	Suction fuel hose and coupling	Carry out the following inspections: a) Check condition of outer protective cover if fitted. b) Check hose for damage and leakage. c) Check end connections for damage and leakage. d) Check correct operation of hose coupling. e) Check end cap present.
iv)	Pump unit	Remove, clean and inspect strainers. If air driven, then remove air line lubricator, regulator and water separator units and service as required.

v)	Hose reel	Ensure reel mechanism operates correctly and grease rewind gears.
vi)	Differential pressure gauge	Check for correct operation and, if the differential pressure limit is exceeded, renew filter element.
vii)	Automatic air eliminator	Prime and check for correct operation of the unit. If a manual unit is fitted, replace with an automatic type.
viii)	Delivery hose	Carry out a visual check over the ENTIRE length of the hose whilst under system pressure. Look for external damage, soft areas, blistering, bulging, leakage and any other signs of weakness. Particular attention should be paid to those sections of the hose within approximately 45 cm (18″) of couplings since these sections are especially prone to deterioration.
ix)	Delivery coupling/nozzle	Carry out the following inspections and tests: a) Check operation to ensure correct lock off and no leakages. b) Remove, clean and visually check cone strainers, replace as necessary. c) Check earth bonding wire assemblies and bonding clips and pins. Renew if required. d) Ensure all dust caps are present and are secured. NOTE: No lubrication except petroleum jelly should be applied to any of the coupling or nozzle parts.
x)	Main earth bonding	Carry out the following inspections and tests: a) Check for correct operation of the rewind mechanism. Adjust and lubricate as necessary. b) Carry out a visual check on earth bonding cable and terminal connections, replace if required. c) Check condition of earth clamp and quick disconnect assembly. d) Carry out continuity check. Maximum 0.5 ohms.
xi)	Documentation	Completion of this inspection should be recorded on the serviceability report.

d) **Six-Monthly Inspection**

Six-monthly checks should be carried out only by an authorised Fuel Inspector. The content of a six-monthly check should include all of the three-monthly checks detailed in paragraph 3.6.1(c) above and, in addition, should include the following items:

No.	Items	Activity
i)	All filtration units (e.g. decant line, dispenser and monitor filter)	Carry out the following inspections to ensure: a) Units have the correct fuel grade identification. b) The connecting pipework has the correct fuel grade identification.
ii)	Electrical pump unit (if applicable)	Carry out the following inspections and tests: a) All electrical circuits to be checked by a qualified electrician. b) Check gearbox oil level is appropriate. c) Lubricate pump bearings. d) Check coupling between motor and pump for wear and signs of misalignment. e) Refer to pump manufacturer's recommended maintenance schedule for additional items.
iii)	Air-driven pump system (if applicable)	Carry out the following inspections and tests: a) Lubricate air motor bearings. b) Lubricate pump bearings. c) Check coupling between motor and pump for wear and signs of misalignment. d) Refer to pump manufacturer's recommended maintenance schedule for additional items.
iv)	Metering unit	Carry out the following inspections and tests: a) Check operation of automatic air eliminator. b) Lubricate the meter register head, drive and calibration gears with petroleum jelly only. c) Clean and inspect strainer element.
v)	Hose reel	Carry out the following inspections and tests: a) Check tension on chain drive and adjust if necessary. b) Lubricate the bearings.
vi)	Delivery hose	Ensure the correct couplings are attached to the hose.
vii)	Documentation	Completion of this inspection should be recorded on the serviceability report.

e) **Annual Inspection**

Annual checks should be carried out by an authorised Fuel Inspector. The content of the annual check includes all the items in both the three-monthly and six-monthly inspections and the following additional items:

No.	Items	Activity
i)	All filtration units (e.g. transfer, water separator and monitor filters)	a) Remove and discard existing coalescer and monitor elements (See Note below). Clean out vessel. Visually check all areas of lining for signs of deterioration. b) Carry out water test on separator element if applicable. NOTE: For onshore installations, filter elements need only be replaced "on condition" or every three years. For offshore installations filter elements should be replaced either annually or, if appropriate, less frequently (e.g. three years) in accordance with the original equipment manufacturer's (OEM) instructions. c) Carry out MEK test if applicable. d) Carry out DfT thickness test on vessel interior linings if applicable (this is only necessary on new or repaired linings). e) Apply pin hole detection test if applicable. NOTE: These need only be carried out to check for correct curing when lining is new or has been repaired. f) Fit new elements. g) Fit new gasket and seals. h) Mark the filter body with the dates of the last filter element change date and the next due date.
ii)	Delivery hose	Ascertain when hose was fitted from system records. Delivery hose should be re-certified every two years or earlier if any defects are found which cannot be repaired. The hose will have a ten year life from date of manufacture. NOTE: Hoses that are unused for a period of more than two years may be unsuitable for aircraft refuelling.
iii)	Fuel delivery meter	The meter should be calibrated in accordance with the manufacturer's recommendation.

4 Filling of Transit Tanks

4.1 The trip examination should be carried out as specified in paragraph 3.4.1(a). The tank should then be dipped to ascertain the quantity of fuel in the tank in order to calculate the volume of fuel required to fill the tank. The following items should then be completed:

a) Draw fuel from transit tank sample line and discard until the samples appear free from water.

b) Carry out fuel quality check as noted in paragraph 2.3.

c) Once satisfied that the fuel is free from water, draw off sufficient fuel to measure its specific gravity with a clean hydrometer. The fuel temperature should also be noted in order to correct the measured specific gravity to a relative density (this is done using a correction graph).

The relative density of the fuel sample taken from the transit tank should be compared with that of the previous recorded relative density after the last tank filling. The relative density of the previous batch of fuel should be taken from the previous release note or from the label from the retained sample. If the difference in relative densities exceeds 0.003 the contents of the transit tank may have been contaminated with some other product and the refilling should not take place.

d) Connect the bonding wire to the transit tank then connect the delivery hose coupling to the transit tank filling point and start the transfer pump to fill the tank. When the meter register head indicates that the required quantity of fuel has been transferred, stop the transfer pump, remove the coupling from the tank and then remove the bonding connection. The dust cap should then be replaced on the filling point.

Leave the tank to settle for ten minutes then a further sample should be drawn from the tank once it has been filled. This sample should be labelled with the tank number, the fuel batch number and date of filling and should then be retained safely until the tank is offered again for refilling. The sample should be subjected to a relative density check following the same process given in paragraph (c) above. The record of this should be within 0.003 of the composite relative density of the bulk tank contents and transit tank residue. This relative density reading should be recorded to allow the fuel remaining in the tank to be checked for possible contamination when the tank next returns from offshore for the next tank filling.

This fuel sample will be required as a proof of fuel quality in the event of an aircraft incident where fuel may be considered to be a causal factor.

e) The tank should then be sealed and a release note completed with all the required particulars; special attention should be paid that the correct grade of fuel is included on this release note.

A copy of the release note should be secured in the tank document container and a further copy retained for reference.

5 Receipt of Transit Tanks Offshore

5.1 Transit tanks transported offshore are often exposed to sea spray and harsh weather conditions on supply vessels and this could potentially cause ingress of water into the fuel. It is strongly recommended that fuel sampling is carried out as soon as the appropriate settling time has elapsed or at least within 24 hours of the tank being placed into a bunded storage area on the installation or vessel. Settling times are one hour per foot depth of fuel in the tank.

5.2 The following procedure should then be followed:

a) Check transit tank seals are still intact.

b) Check transit tank grade marked.

c) Check tank shell for damage, particularly around welded seams.

d) Check release note for the following:

i) correct grade;

ii) quantity;

iii) batch number;

iv) date;

v) certified free from dirt and water; and

vi) signed by authorised product inspector.

e) Take fuel samples from the transit tank and discard until the samples appear free from water.

6 Decanting from Transit Tanks to Static Storage

6.1 Before commencing any transfer of fuel it is necessary to dip the storage tank to ensure that the contents of the transit tank can be accommodated within the intended storage facility.

6.2 The transit tank should have had sufficient time to settle once positioned correctly for the transfer operation. Settling times are one hour per foot depth of fuel in the tank.

6.3 Bulk storage tanks equipped with a floating suction device need at least one hour for settling time and tanks without floating suction should be left for a period in hours approximately equal to the depth of fuel in feet (e.g. six feet depth of fuel should be left to settle for a period of at least six hours).

6.4 The following procedure should then be followed:

a) Connect an earth bonding lead to the transit tank.

b) Carry out checks for fuel quality as described in paragraph 2.3.

c) If the transit tank sample test is not satisfactory, then draining a quantity of fuel off at full flush and then retesting may produce a satisfactory result.

d) Once a satisfactory test has been obtained the transfer hose should be connected to the transit tank discharge point (via a suitable filter, i.e. one micron or less). Open valve.

e) With the transfer pump running obtain a sample from the transfer filter vessel until a satisfactory result is obtained. Stop the pump.

NOTE: Fuel should be pumped (not 'gravity' decanted) through filtration vessels for the elements to be effective.

f) Re-start the transfer pump and open the static tank inlet valve to start the fuel flow. Once fuel transfer has commenced check the coupling connections for any signs of leakage and continue to monitor the fuel flow whilst transfer is taking place.

g) When sufficient fuel has been transferred, shut off the valves and stop the transfer pump.

h) Disconnect the transfer hose followed by the electrical bonding lead and replace any dust caps that were removed at the commencement of the operation.

i) Record fuel quality checks and the transfer of the transit tank contents into the storage tanks and retain the release note on board the installation/vessel.

j) After transfer of fuel into the bulk storage tank and before it is released for use, ensure that the fuel is allowed to settle in accordance with the time periods set out above.

7 Fuelling Direct from Transit Tanks

7.1 Many offshore helicopter fuelling systems are designed to supply aviation fuel direct from the transit tanks into the delivery system.

7.2 In this case the following procedure should be followed:

a) Once the transit tank is correctly positioned for the fuel storage operation and before it is released for use, ensure that the fuel is allowed sufficient time to settle in accordance with the following time periods. Settling times are one hour per foot depth of fuel in the tank.

b) Connect an earth bonding lead to the transit tank.

c) Take fuel samples from the transit tank and discard until the samples appear free from water.

d) Carry out checks for fuel quality as described in paragraph 2.3.

e) If the transit tank sample test is not satisfactory, then draining a quantity of fuel off at full flush and then retesting may produce a satisfactory result.

f) Once a satisfactory test has been obtained the suction hose should be connected to the transit tank discharge point. Open valve.

g) With the delivery pump running obtain a sample from the delivery filter water separator, filter water monitor and hose end until a satisfactory result is obtained from each.

h) Record fuel quality checks and transit tank contents and retain the release note on board the installation/vessel.

8 Long Term Storage of Aviation Fuel

8.1 The long term storage of aviation fuel offshore should be discouraged. Should fuel stocks remain unused offshore for an extended period (e.g. six months after the filling date) then, prior to use, samples should be drawn from the tank and sent onshore for laboratory testing to ensure fuel quality. An alternative course of action is to return the transit tank(s) to an onshore fuel depot for further action.

9 Aircraft Refuelling

9.1 Always ensure before starting any refuelling that the fuel in the storage tank or transit tank is properly settled. Refer to paragraph 6 above for correct settling times.

9.2 Before the commencement of any helicopter refuelling, the HLO should be notified. All passengers should normally be disembarked from the helicopter and should be clear of the helideck before refuelling commences (see also (i) below). The fire team should be in attendance at all times during any refuelling operation. The following procedure should then apply:

a) When the aircraft captain is ready and it has been ascertained how much fuel is required and that the grade of fuel is correct for the particular aircraft, run out the earth bonding lead and attach it to the aircraft. Next, run out the delivery hose on the helideck to the aircraft refuelling point.

b) Take a fuel sample from the overwing nozzle or from the pressure refuelling coupling sample point and carry out a water detection check. For two-pilot operations, this water detection check should be witnessed by the non-handling pilot, who should be satisfied that the fuel water test is acceptable. During single-pilot operations the water detection capsule should be shown to the pilot after the water detection check.

NOTE: Only if there is no pressure refuelling coupling sample point should a sample be drawn from the filter water monitor drain point.

c) If pressure refuelling, first connect the secondary bonding lead to bond the refuelling nozzle to the aircraft, then connect the pressure coupling to the aircraft and remain adjacent to the fuelling point. If gravity refuelling, first connect the secondary bonding lead to bond the refuelling nozzle to the aircraft, then open the tank filler and insert the nozzle and prepare to operate the fuel lever when signalled to do so by the person in charge of refuelling.

d) The nominated person in charge of the refuelling should operate the system pump switches and open any necessary valves to start the flow of fuel only when given clearance by the pilot via the HLO.

e) If any abnormalities are observed during the refuelling the "off" switch should immediately be operated. When refuelling is complete, the pump should be shut down and the nozzle handle released.

f) Remove the refuelling nozzle or disconnect the pressure coupling as appropriate and replace the aircraft filler and nozzle caps. Finally disconnect the secondary bonding lead. A further fuel sample should now be taken, witnessed by the pilot, as in (b) above and a fuel water check should again be carried out. See also paragraph 2.4 for sample retention requirements.

g) Remove the delivery hose from the helideck and carry out a final check that the aircraft filler cap is secure, then disconnect the main bonding lead from the aircraft and check that all equipment is clear from the proximity of the aircraft. The hose should be rewound onto its reel.

h) Enter the fuel quantity onto the daily refuelling sheet and obtain the pilot's signature for the fuel received.

i) If for safety reasons the aircraft captain has decided that the refuelling should be carried out with passengers embarked, the following additional precautions should be undertaken:

   i) Constant communications should be maintained between the aircraft captain and the refuelling crew.

   ii) The passengers should be briefed.

   iii) The emergency exits opposite the refuelling point should be unobstructed and ready for use.

   iv) Passengers' seatbelts should be undone.

   v) A competent person should be positioned ready to supervise disembarkation in the event of an emergency.

10 Quality Control Documentation

10.1 Recording of aviation refuelling system/component manufacture, routine maintenance and rectification, testing, fuel transfer history and aircraft refuelling, etc. should be completed on official company documentation. This documentation is normally provided by the helicopter operators and/or specialist fuel suppliers and system maintainers. As a minimum, the documentation used should comprise:

- Fuel Release Certificate (Note: Tank Certificate details should also be recorded on the Fuel Release Certificate);

- record of transit tank receipt;
- daily and weekly serviceability report;
- daily storage checks;
- differential pressure record;
- hose inspection and nozzle filters test record;
- storage tank checks before and after replenishment;
- fuel system maintenance record;
- tank inspection and cleaning record; and
- fuelling daily log sheet.

Chapter 9 Helicopter Landing Areas on Vessels

1 Vessels Supporting Offshore Mineral Workings and Specific Standards for Landing Areas on Merchant Vessels

1.1 Helidecks on vessels used in support of the offshore oil and gas industry should be designed to comply with the requirements of the preceding chapters of this publication.

1.2 The International Chamber of Shipping (ICS) has published a 'Guide to Helicopter/Ship Operations', updated in 2008, which comprehensively describes physical criteria and procedures on ships having shipboard landing or winching area arrangements. Other than to address the basic design criteria and marking and lighting schemes related to shipboard landing area arrangements, it is not intended to reproduce detail from the ICS document here in CAP 437. However, it is recommended that the 2008 4th edition of the ICS 'Guide' should be referenced in addition to this chapter and, where necessary, in conjunction with Chapter 10 which includes information relating to shipboard winching area arrangements.

1.3 Helicopter landing areas on vessels which comply with the criteria and which have been satisfactorily assessed by the HCA will be included in the HLL published by the HCA. This list will specify the D-value of the helicopter landing area; include pitch, roll and heave category information with derived landing limits; list areas of non-compliance against CAP 437; and detail any specific limitations applied to the landing area. Vessels having ships'-side or midships purpose-built or non-purpose-built landing areas may be subject to specific limitations.

1.4 Helicopter landing areas should have an approved D-value equal to or greater than the 'D' dimension of the helicopter intending to land on it.

1.5 Helicopter landing areas which cannot be positioned so as to provide a full obstacle-free surface for landing and take-off for specific helicopter types will be assessed by the HCA and appropriate limitations will be imposed.

1.6 It should be noted that helicopter operations to small vessels with poor visual cues, such as a stern mounted deck on a small vessel steaming downwind or a bow mounted deck with the landing direction facing forwards or a high mounted deck above the bridge superstructure with the landing direction abeam, may be further limited, especially at night, with respect to stricter limits on the vessel's movement in pitch, roll and heave.

NOTE: Under provisions adopted in 2009 by ICAO for Annex 14 Volume II, for a purpose-built shipboard heliport located in the bow or stern of a vessel, there is acceptance for operations to be conducted with limited touchdown headings to landing areas which provide the minimum 1D dimension along the forward/aft axis but which can only provide a smaller dimension, of not less than 0.83D, across the width axis. The primary purpose of the ICAO provision is to facilitate operations to narrow beam vessels where the stability of the vessel is sensitive to the overall width dimension of the landing area in proportion to the dimension of the beam of the vessel. In recognising the scope of applicability for CAP 437 (see Foreword, paragraph 5) it is not intended to publish this ICAO provision as an option in CAP 437. However, for narrow beam vessels operating to the Maritime and Coastguard Agency's (MCA) Large Commercial Yacht Code (LY2) [Merchant Shipping Notice MSN 1792 (M), Amendment 1], the arrangement is fully described and accepted. The HCA, listed in Annex 5 to LY2 as the Aviation Inspection Body for these vessels, will be able to provide specific guidance and interpretation for the application of this arrangement. Details on how to obtain MSN 1792 (M) are given in Appendix B.

2 Amidships Helicopter Landing Areas – Purpose-Built or Non-Purpose-Built Ship's Centreline

2.1 General

2.1.1 The following special requirements apply to vessels which can only accommodate a helicopter landing area in an obstructed environment amidships. The centre of the landing area will usually be co-located on the centreline of the vessel, but may be offset from the ship's centreline either to the port or starboard side up to the extent that the edge of the landing area is coincidental with the ship's side.

2.2 Size and Obstacle Environment

2.2.1 The reference value D (overall dimension of helicopter) given at Table 1 (Chapter 3) also applies to vessels' landing areas referred to in this Chapter. It should also be noted that amidships landing areas are only considered suitable for single main rotor helicopters.

2.2.2 Forward and aft of the centreline landing area should be two symmetrically located 150° limited obstacle sectors with apexes on the circumference of the 'D' reference circle. Within the area enclosing these two sectors, and to provide 'funnel of approach protection' over the whole of the D-circle, there should be no obstructions above the level of the landing area except those referred to in Chapter 3, paragraph 6.2 which are permitted up to a maximum height of 25 cm above the landing area level.

2.2.3 On the surface of the landing area itself, obstacles should be limited to 2.5 cm to include only essential items such as deck-mounted lighting systems (see Chapter 4, paragraph 3.4 and Appendix E) and landing area nets (see Chapter 3, paragraph 7.3).

NOTE: Such objects may only be present on the landing area provided they do not represent a potential hazard to helicopters. For skid fitted helicopters the presence of nets or other raised fittings on the deck is not recommended as these may induce dynamic rollover in helicopters equipped with skids.

2.2.4 To provide protection from obstructions adjacent to the landing area, an obstacle protection surface should extend both forward and aft of the landing area. This surface should extend at a gradient of 1:5 out to a distance of D as shown in Figure 1.

2.2.5 Where the requirements for the LOS cannot be fully met but the landing area size is acceptable, it may be possible to apply specific operational limitations or restrictions which will enable helicopters up to a maximum D-value of the landing area to operate to the deck.

2.2.6 The structural requirements referred to in Chapter 3 should be applied whether providing a purpose-built amidships helideck above a ship's deck or providing a non-purpose-built landing area arrangement utilising part of the ship's structure, e.g. a large hatch cover. The provision of a landing area net is a requirement except where skid fitted helicopters are routinely used.

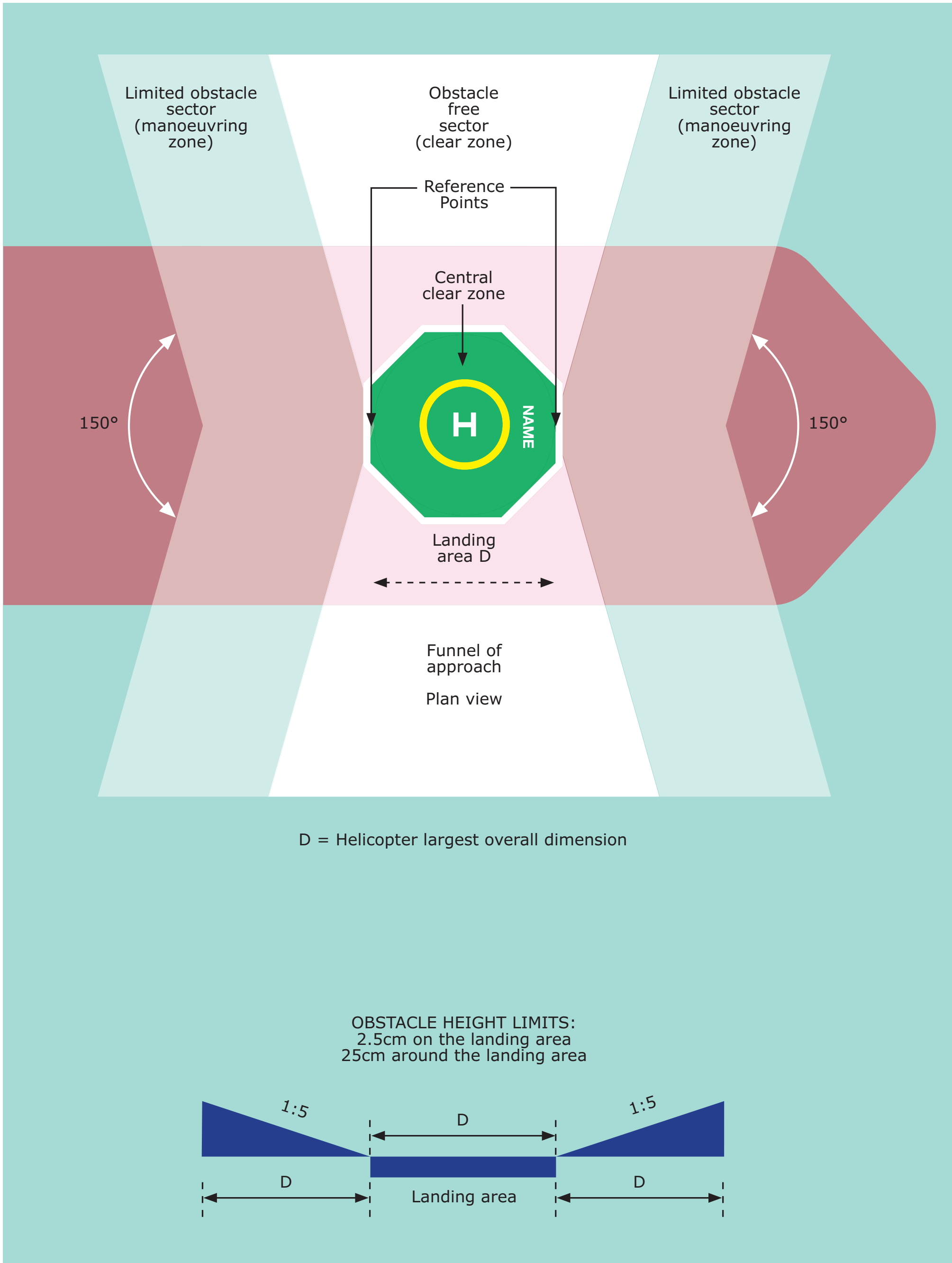


Figure 1 A Purpose-Built or Non-Purpose-Built Midship Centreline Landing Area[1]

3 Helicopter Landing Area Marking and Lighting

3.1 The basic marking and lighting requirements referred to at Chapter 4 will also apply to helicopter landing areas on ships ensuring that for amidships helicopter landing areas the TD/PM circle should be positioned in the centre of the landing area and both the forward and aft 'origins' denoting the LOS should be marked with a black chevron (see Figure 2). In addition, where there is an operational requirement, vessel owners may consider providing the helideck name marking and maximum allowable mass 't' marking both forward *and* aft of the painted helideck identification 'H' marking and TD/PM circle.

1. Figure courtesy of International Chamber of Shipping, Helicopter Ship Guide (2008).

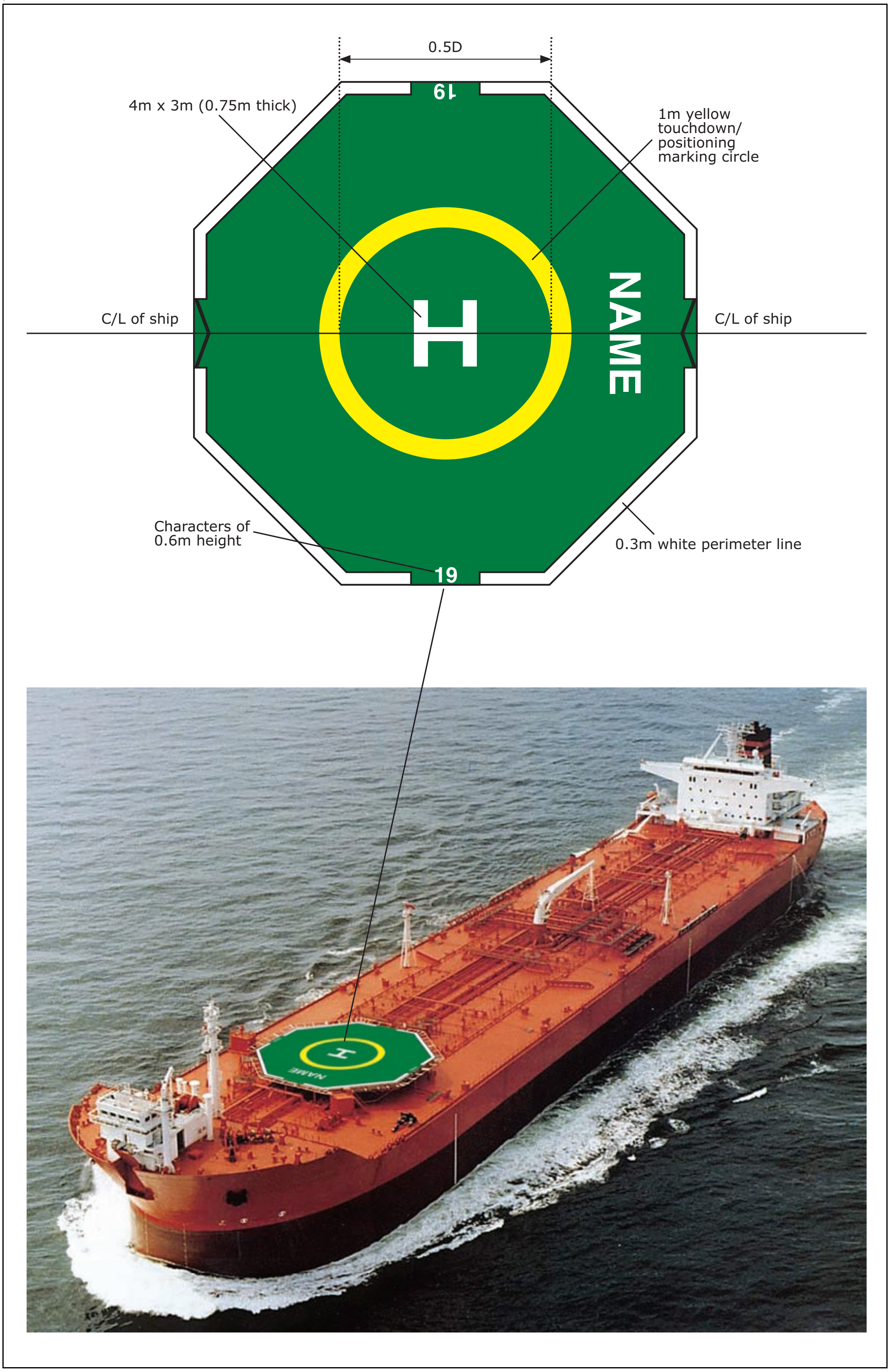


Figure 2 Markings for a Purpose-Built or Non-Purpose-Built Midship Centreline Landing Area[1]

1. Figure courtesy of International Chamber of Shipping, Helicopter Ship Guide (2008).

4 Ship's Side Non-Purpose-Built Landing Area

4.1 A non-purpose-built landing area located on a ship's side should consist of a clear zone and a manoeuvring zone as shown in Figure 3. The clear zone should be capable of containing a circle with a minimum diameter of 1 x D. No objects should be located within the clear zone except aids whose presence is essential for the safe operation of the helicopter, and then only up to a maximum height of 2.5 cm. Such objects should only be present if they do not represent a hazard to helicopters. Where there are immovable fixed objects located in the clear zone, such as a Butterworth lid, these should be marked conspicuously and annotated on the ship's operating area diagram (a system of annotation is described in detail in Appendix F to the ICS Helicopter Ship Guide). In addition, a manoeuvring zone should be established, where possible, on the main deck of the ship. The manoeuvring zone, intended to provide the helicopter with an additional degree of protection to account for rotor overhang beyond the clear zone, should extend beyond the clear zone by a minimum of 0.25D. The manoeuvring zone should only contain obstacles whose presence is essential for the safe operation of the helicopter, and up to a maximum height of 25 cm.

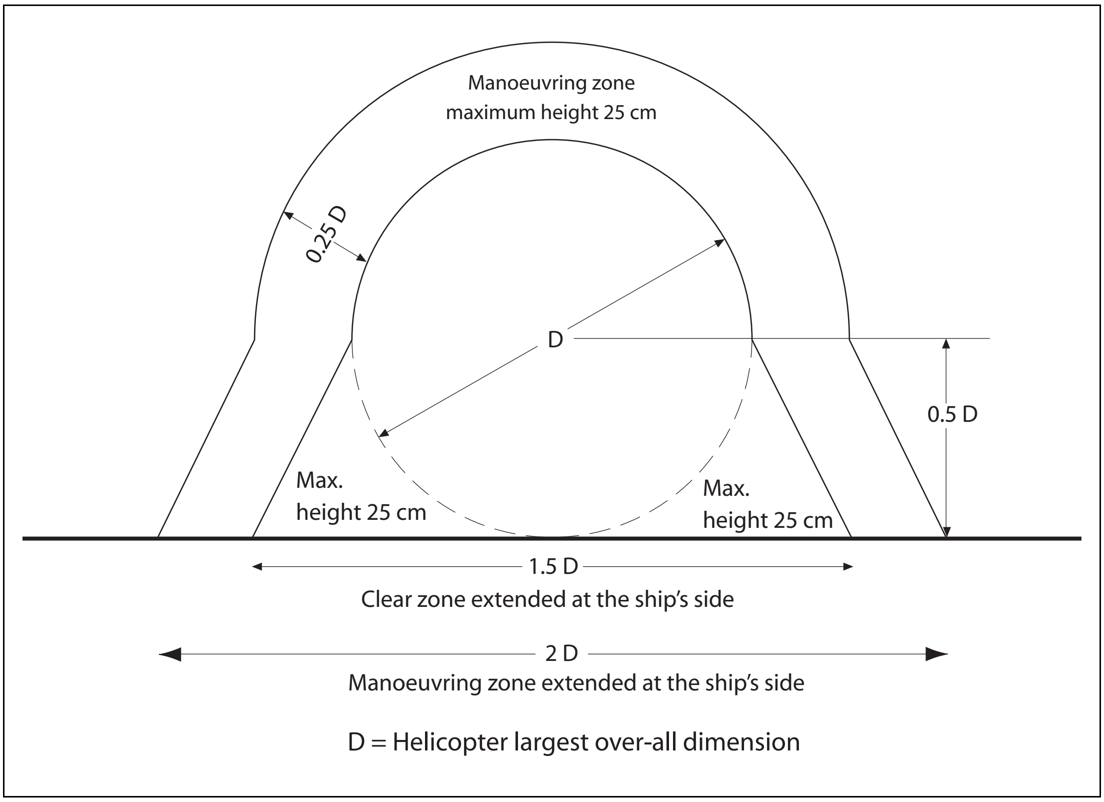


Figure 3 Ship's Side: Non-Purpose-Built Landing Area

4.2 Where the operating area is coincident with the ship's side, and in order to improve operational safety, the clear zone should extend to a distance of 1.5D at the ship's side while the manoeuvring zone should extend to a distance of 2D measured at the ship's side. Within this area, the only obstacles present should be those essential for the safe operation of the helicopter, with a maximum height of 25 cm. Where there are immovable fixed objects such as tank cleaning lines they should be marked conspicuously and annotated on the ship's operating area diagram (see Appendix F in the ICS Helicopter Ship Guide).

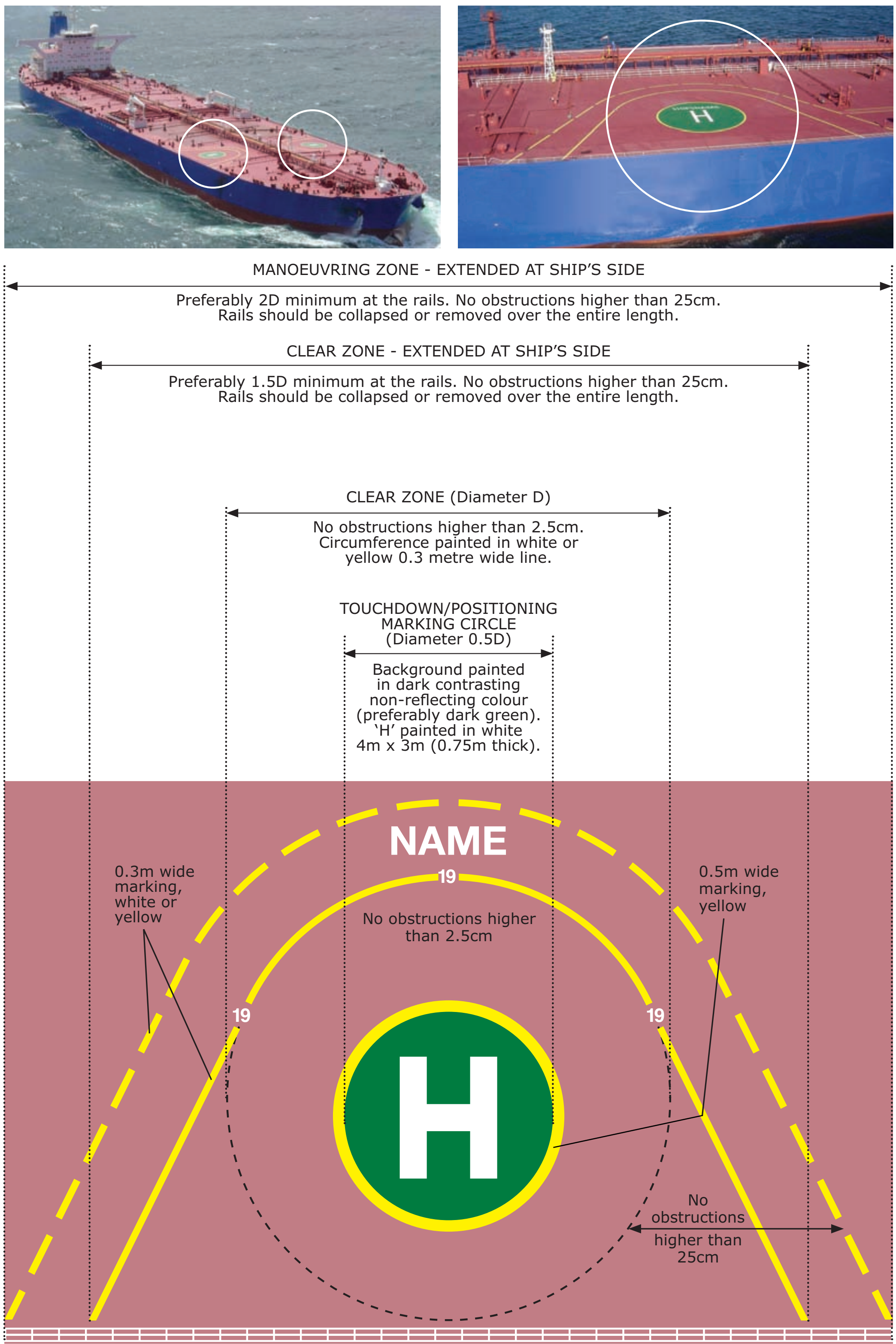
4.3 Any railings located on the ship's side should be removed or stowed horizontally along the entire length of the manoeuvring zone at the ship's side (i.e. over a distance of at least 2D). All aerials, awnings, stanchions and derricks and cranes within the vicinity of the manoeuvring zone should be either lowered or securely stowed. All dominant obstacles within, or adjacent to, the manoeuvring zone should be conspicuously marked and, for night operations, lit (see paragraph 6 and Chapter 4, paragraph 4).

5 Ship's Side Non-Purpose-Built Landing Area Markings

5.1 A TD/PM circle, denoting the touchdown point for the helicopter, should be located centrally within the clear zone. The diameter of the clear zone should be 1 x D (D being the extent of the available operating area), while the inner diameter of the TD/PM should be 0.5D. The TD/PM circle should be at least 0.5 m in width and painted yellow. The area enclosed by the TD/PM circle should be painted in a contrasting colour, preferably dark green or dark grey. A white 'H' should be painted in the centre of the circle, with the cross bar of the 'H' running parallel to the ship's side. The 'H' marking should be 4 m high x 3 m wide, the width of the marking itself being 0.75 m.

5.2 The boundary of the clear zone, capable of enclosing a circle with a minimum diameter of 1 x D and extending to a total distance of 1.5D at the ship's side, should be painted with a continuous 0.3 m wide yellow line. The actual D-value, expressed in metres rounded to the nearest whole number (with 0.5 m rounded down), should also be marked in three locations around the perimeter of the clear zone in a contrasting colour, preferably white. The height of the numbers so marked should be 0.6 m, i.e. twice the width of the line itself.

5.3 The boundary of the manoeuvring zone, located beyond the clear zone and extending to a total distance of 2D at the ship's side, should be marked with a 0.3 m wide broken yellow line with a mark:space ratio of approximately 4:1. Where practical, the name of the ship should be painted in a contrasting colour (preferably white) on the inboard side of the manoeuvring zone in (minimum) 1.2 m high characters (see Figure 4).



Notes: The diameter in metres of the clear zone 'D' to be marked in white figures of 0.6m at each of the points shown, so as to be easily visible to the helicopter pilot. NB: The diameter (in metres) of the clear zone must be equal to or greater than the overall length of a visiting helicopter with rotors running.

Figure 4 Ship's Side Non-Purpose-Built Landing Area Markings[1]

1. Figure courtesy of International Chamber of Shipping, Helicopter Ship Guide (2008).

6 Night Operations

6.1 Details of landing area lighting for purpose-built landing areas are given at Chapter 4, paragraph 3. In addition, Figure 5 shows an example of the overall lighting scheme for night helicopter operations (example shows a non-purpose-built ship's side arrangement).

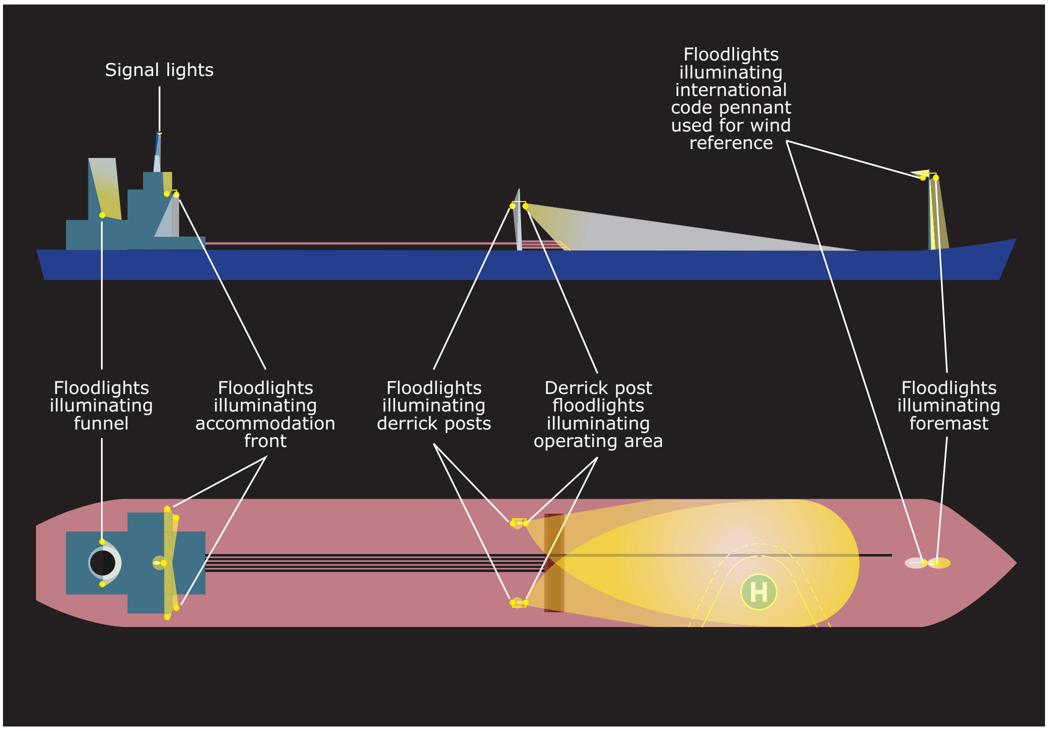


Figure 5 Representative Landing Area Lighting Scheme for a Non-Purpose-Built Ship's Side Arrangement[1]

7 Poop Deck Operations

7.1 Poop deck operations are addressed fully in the ICS Guide.

1. Figure courtesy of International Chamber of Shipping, Helicopter Ship Guide (2008).

Chapter 10 Helicopter Winching Areas on Vessels and on Wind Turbine Platforms

1 Winching Areas on Ships

1.1 Where practicable, the helicopter should always land rather than winch, because safety is enhanced when the time spent hovering is reduced. In both cases the Ship's Master should be fully aware of, and in agreement with, the helicopter pilot's intentions.

1.2 The ICS has published a 'Guide to Helicopter/Ship Operations', updated in 2008, which comprehensively describes physical criteria and procedures applicable for a shipboard winching area operation. It is not intended to reproduce the procedures from the ICS document in detail in this sixth edition of CAP 437 and therefore the ICS Guide may need to be referenced in addition to Chapter 10, paragraph 1.

1.3 Design and Obstacle Restriction

1.3.1 A winching area should be located over an area to which the helicopter can safely hover whilst winching to or from the vessel. Its location should allow the pilot an unimpeded view of the whole of the clear area (zone) whilst facilitating an unobstructed view of the vessel. The winching area should be located so as to minimise aerodynamic and wave motion effects. The area should preferably be clear of accommodation spaces (see also paragraph 1.6) and provide adequate deck area adjacent to the manoeuvring zone to allow for safe access to the winching area from different directions. In selecting a winching area the desirability for keeping the winching height to a minimum should also be borne in mind.

1.3.2 A winching area should provide a manoeuvring zone with a minimum diameter of 2D (twice the overall dimension of the largest helicopter permitted to use the area). Within the manoeuvring zone a clear zone should be centred. This clear zone should be at least 5 m in diameter and should be a solid surface capable of accommodating personnel and/or stores during winching operations. It is accepted that a portion of the manoeuvring zone, outside the clear area, may be located beyond the ship's side but should nonetheless comply with obstruction requirements shown in Figure 1. In the inner portion of the manoeuvring zone no obstructions should be higher than 3 m. In the outer portion of the manoeuvring zone no obstructions should be higher than 6 m.

1.4 Visual Aids

1.4.1 Winching area markings should be located so that their centres coincide with the centre of the clear zone (see Figure 1).

1.4.2 The 5 m minimum diameter clear zone should be painted in a conspicuous colour, preferably yellow, using non-slip paint.

1.4.3 A winching area outer manoeuvring zone marking should consist of a broken circle with a minimum line width of 30 cm and a mark:space ratio of approximately 4:1. The marking should be painted in a conspicuous colour, preferably yellow. The extent of the inner manoeuvring zone may be indicated by painting a thin white line, typically 10 cm thickness.

1.4.4 Within the manoeuvring zone, in a location adjacent to the clear area, 'WINCH ONLY' should be easily visible to the pilot, painted in not less than 2 m characters, in a conspicuous colour.

1.4.5 Where winching operations to vessels are required at night, winching area floodlighting should be provided to illuminate the clear zone and manoeuvring zone areas. Floodlights should be arranged and adequately shielded so as to avoid glare to pilots operating in the hover.

1.4.6 The spectral distribution of winching area floodlights should be such that the surface and obstacle markings can be clearly identified. The floodlighting arrangement should ensure that shadows are kept to a minimum.

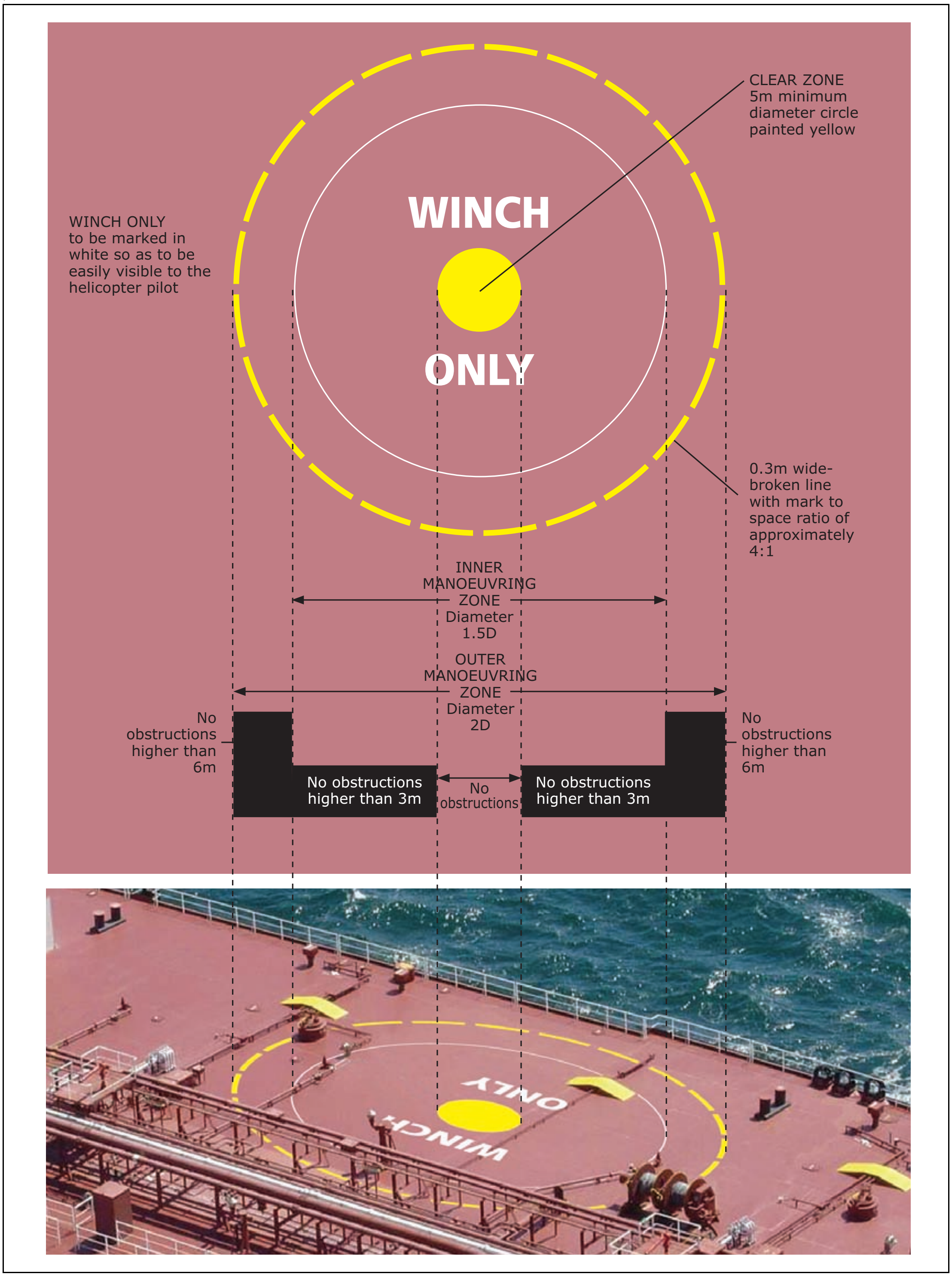


Figure 1 Winching Area Arrangement on a Vessel[1]

1. Figure courtesy of International Chamber of Shipping, Helicopter Ship Guide (2008).

1.5 Obstructions

1.5.1 To reduce the risk of a winching hook or cable becoming fouled, all guard rails, awnings, stanchions, antennae and other obstructions within the vicinity of the manoeuvring zone should, as far as possible, be either removed, lowered or securely stowed.

1.5.2 All dominant obstacles within, or adjacent to, the manoeuvring zone should be conspicuously marked and, for night operations, be adequately illuminated (see paragraphs 1.4.5 and 1.4.6. Also see Chapter 4, paragraph 4).

1.6 Winching Above Accommodation Spaces

1.6.1 Some vessels may only be able to provide winching areas which are situated above accommodation spaces. Due to the constraints of operating above such an area only twin-engined helicopters should be used for such operations and the following procedures adhered to:

a) Personnel should be cleared from all spaces immediately below the helicopter operating area and from those spaces where the only means of escape is through the area immediately below the operating area.

b) Safe means of access to and escape from the operating area should be provided by at least two independent routes.

c) All doors, ports, skylights etc. in the vicinity of the aircraft operating area should be closed. This also applies to deck levels below the operating area.

Fire and rescue personnel should be deployed in a ready state but sheltered from the helicopter operating area.

2 Helicopter Winching Areas on Wind Turbine Platforms

NOTE: CAP 764 provides CAA policy and guidance on wind turbines.

2.1 Platform Design

2.1.1 The winching area platform (clear area) should be square or rectangular and capable of containing a circle having a minimum diameter of 4 m.

2.1.2 In addition to the winching area platform, provision needs to be made for a safety zone to accommodate Helicopter Hoist Operations Passengers (HHOP) at a safe distance away from the winching area during helicopter hoist operations. The minimum safe distance is deemed to be not less than 1.5 m from the inboard edge of the winching (clear) area.

2.1.3 The safety zone should be connected by an access route to the winching area platform and be located inboard of the winching area platform. The safety zone and associated access route should have the same surface characteristics as the winching area platform (see paragraphs 2.1.5, 2.1.6 and 2.1.7) except that the overall size may be reduced, such that the dimensions of the safety zone and access route are not less than 2.5 m (length) x 0.9 m (width).

NOTE: The dimensions of the safety zone may need to be increased according to the maximum number of HHOP that need to be accommodated safely away from the winching (clear) area during helicopter hoist operations.

2.1.4 To differentiate the safety zone from the associated access route and the winching area, it is recommended that the safety zone be painted in a contrasting colour to indicate to HHOP where it is safe to congregate during helicopter hoist operations.

2.1.5 The platform should be constructed so that it generates as little turbulence as possible. The surface of the platform should be in the form of a grating to allow downdraft from the main rotor to penetrate through the platform surface. The incidence regarding the discharge of static electricity from the helicopter should be addressed by ensuring that the platform is capable of grounding the winch wire and aircraft.

2.1.6 The platform deck should be capable of supporting a mass that is approximately five times the weight of an average HHOP.

2.1.7 The surface of the platform, including the safety zone and associated access route, should display suitable friction characteristics to ensure the safe movement of HHOP in all conditions.

2.1.8 The winching area platform and associated access route and safety zone should be completely enclosed by a 1.5 m high railing system to ensure the safety and security of HHOP at all times. The design of the safety rails should ensure that a free flow of air through the structure is not prevented or disrupted whilst also guaranteeing that no possibility exists for the hoist hook to get entangled in the railing or in any other part of the platform structure.

2.1.9 The surface of the platform should be essentially flat during helicopter hoist operations.

2.1.10 The winching area platform should be located to ensure a minimum horizontal distance of not less than 1 x RD measured between the outboard edge of the winching area platform and the plane of rotation of the turbine rotor blades. 1 x RD equates to the largest rotor diameter (overall width) of helicopters that are intended to use the facility.

2.1.11 In addition the winching area platform should be located so that when the hoist is placed over the centre of the winching (clear) area the minimum clearance between the tip-path plane of the main rotor and the plane of rotation of the turbine rotor blades is no less than 4 m for any helicopter that is intended to use the facility. Ideally a minimum rotor tip-to-obstacle clearance of 0.5 RD should be achieved.

2.1.12 During helicopter hoist operations, the nacelle should not turn in azimuth and the turbine blades should be prevented from rotating by the application of the braking system. Experience in other sectors indicates that it is normal practice for the nacelle to be motored 90 degrees out of wind so that the upwind blade is horizontal and points into the prevailing wind. This is considered to be the preferred orientation for helicopter hoist operations; however, the actual orientation of the blades may vary to suit specific operational requirements.

2.2 Obstacle Restriction

2.2.1 Within a horizontal distance of 1.5 m measured back from the railing located on the inboard side of the winching (clear) area, no obstacles are permitted to extend above the top of the 1.5 m railing provided for security of HHOP transiting to and from the safety zone via the associated access route.

2.2.2 Beyond 1.5 m, and out to a distance corresponding to the plane of rotation of the turbine rotor blades, obstacles are permitted up to a height not exceeding 3 m above the surface of the winching area. It is required that only fixed obstacles essential to the safety of the operation are present, e.g. anemometer mast, communications antennae, aeronautical lighting etc.

2.3 Visual Aids

2.3.1 The surface of the winching area (a minimum 4 m square clear area) and the associated access route, being at least 1.5 m in length, should be painted yellow (see Figure 2).

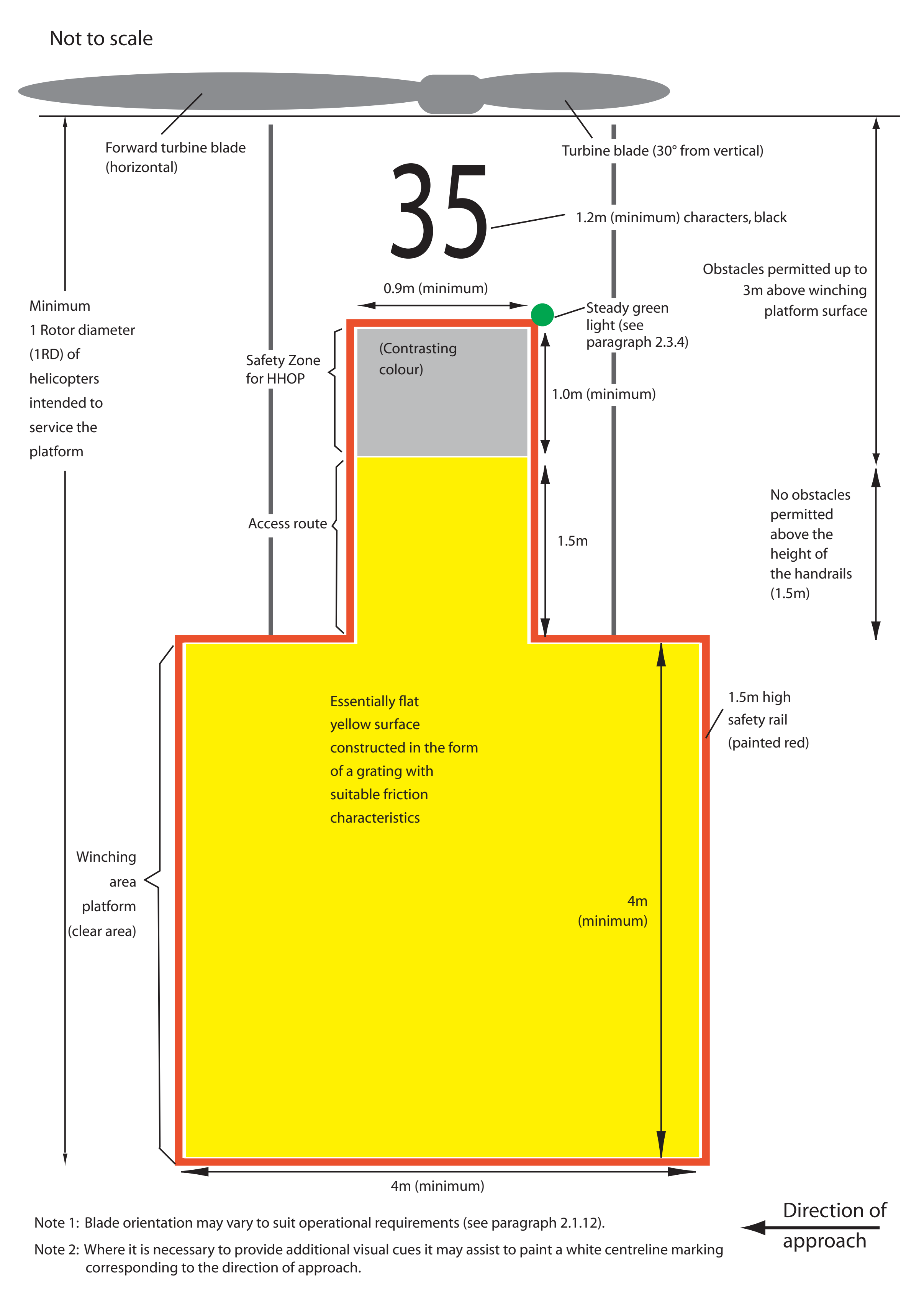


Figure 2 Winching Area, Access Route and Safety Zone

2.3.2 The railings around the entire winching area, safety zone and associated access route should be painted in a conspicuous colour, preferably red.

2.3.3 The wind turbine structure should be clearly identifiable from the air using a simple designator (normally a two-digit number), painted in 1.2 m (minimum) characters in a contrasting colour, preferably black. The turbine designator should be painted on the white nacelle top cover ideally utilising an area adjacent to the turbine rotor blades.

NOTE: The following paragraphs 2.3.4 and 2.3.5 specify the lighting needed to facilitate helicopter hoist operations to wind turbine platforms conducted by day in Visual Meteorological Conditions (VMC) only. These lights are separate and distinct from the requirements of paragraph 2.3.6 which addresses additional lighting, prescribed by the ANO, aimed at 'warning off' other aircraft transiting the generic area.

2.3.4 To indicate that the turbine blades and nacelle are secured in position prior to helicopter hoist operations commencing, a green light should be located in the safety zone, which is capable of being operated remotely and from the platform itself. A low intensity steady green light will indicate to the pilot that it is safe to operate (when the light is extinguished this will indicate that it is **not** safe to operate). The green light should have a minimum intensity of 16 candelas and a maximum intensity of 60 candelas for all angles of azimuth and for all angles of elevation from 0 to 90 degrees but should not be visible below the level of the winching area platform.

2.3.5 Each wind turbine platform to which helicopter hoist operations are to be conducted should be fitted with at least one low intensity steady red obstruction light positioned as close as reasonably practicable to the top of the fixed structure. The red light should conform to the specification for a low intensity obstacle (Group B) light described in *CAP 168 Licensing of Aerodromes*, Chapter 4 and Table 6A.1 (Appendix 6A). It should be visible for all angles of azimuth and have a minimum intensity of 50 candelas for angles of elevation between 0 and 15 degrees, and a minimum intensity of 200 candelas between 5 and 8 degrees, but should not be visible below the level of the winching area platform.

2.3.6 Requirements for lighting of wind turbine generators in United Kingdom territorial waters, aimed at 'warning off' aircraft transiting the generic area, are addressed in Article 220 of the ANO 2009. See also Directorate of Airspace Policy – Policy Statement for The Lighting of Wind Turbine Generators in United Kingdom Territorial Waters.

2.3.7 Obstruction lighting in the vicinity of the winching area that has a potential to cause glare or dazzle to the pilot or to a helicopter hoist operations crew member should be switched off prior to, and during, helicopter hoist operations.

2.4 Further Operational Considerations

2.4.1 For UK operations it is understood to be normal practice for the winch arrangement to be located on the right hand side of the helicopter with the pilot positioned just on the inboard side of the outboard winching (clear area) platform railings (see Figure 3). In this configuration the pilot's view of the platform and turbine blade arrangement should be unimpeded and it is not considered usually necessary to provide any additional visual cues to assist in the maintenance of a safe lateral distance between the helicopter main rotor and the nearest dominant obstacle. Where it is considered necessary to provide additional visual cues, it may assist to paint an aiming marking on the platform surface in a conspicuous colour (preferably white) to indicate the centreline of the winching area (clear area). It is recommended the marking be 30 cm to 50 cm wide and outlined as necessary to improve conspicuity against the yellow background.

2.4.2 Where cross-cockpit helicopter hoist operations are envisaged an aiming point system may need to be established to assist the pilot in determining the position of the helicopter in relation to the winching area platform and to obstacles. This may be achieved by the provision of a sight point marking system or similar markings. Further guidance may be obtained from Flight Operations Inspectorate (Helicopters) Section.

2.4.3 Further specific operational guidance is given in CAP 789. It is strongly recommended that helicopter hoist operators consult this additional guidance.

2.4.4

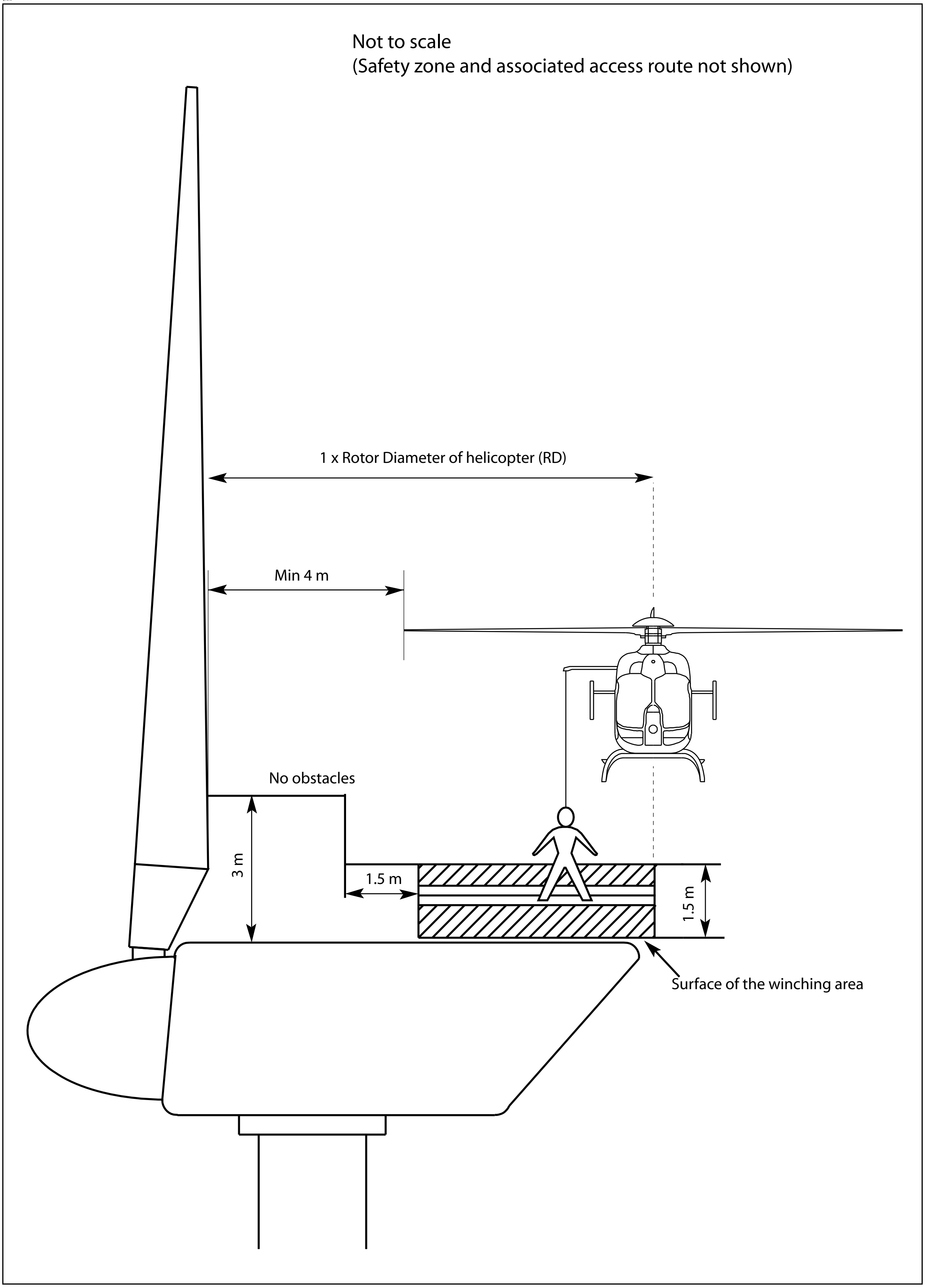


Figure 3 General Arrangement of Surfaces and Sensors

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Appendix A Checklist

The following checklist indicates in general terms the minimum number of helideck physical characteristics which the CAA considers should be examined during periodic surveys to confirm that there has been no alteration or deterioration in condition. For a detailed Helideck and System Inspection Checklist, readers are recommended to refer to UKOOA Guidelines for the Management of Offshore Helideck Operations.

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

b) **Deck Landing Area Conditions:**
   i) Type of surface, condition, friction, contaminant-free;
   ii) Fuel retention;
   iii) Deck landing area net;
   iv) Perimeter safety netting; and
   v) Tie-down points.

c) **Environment:**
   i) Turbine and other exhausts;
   ii) Hot and cold gas emissions;
   iii) Turbulence generators;
   iv) Flares;
   v) Emergency gas release systems; and
   vi) Adjacent fixed/mobile/vessel exhausts, gas emissions, flares, and turbulence generators.

d) **Obstacle Protected Surfaces (Minima):**
   i) Obstacle-free sector (210°);
   ii) Limited obstacle sector (150°);
   iii) Falling 5:1 gradient; and
   iv) Note if i) or iii) above are swung from normal axis.

e) **Visual Aids:**
   i) Deck surface;
   ii) General condition of painted markings;
   iii) Location of H;
   iv) Aiming circle;
   v) Landing Area perimeter line – relationship to Chevron;

vi) D-value marked within perimeter line;

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

viii) Certification marking (exact D-value);

ix) Maximum allowable mass marking;

x) Conspicuity of installation name;

xi) Wind indicator;

xii) Perimeter lighting;

xiii) Floodlighting;

xiv) Obstruction lighting;

xv) Marking of dominant obstacles;

xvi) Shield of installation working lights (helideck light pollution); and

xvii) Status Lights (where required).

f) **Fuel System:**

i) Jet A-1 installation;

ii) Hose; and

iii) Earthing equipment.

g) **Rescue and Firefighting Equipment**

i) Principal agent;

ii) Complementary media;

iii) Rescue equipment; and

iv) Personal protective equipment.

Appendix B Bibliography

1 References

Where a chapter is indicated below it shows where in this CAP the document is primarily referenced.

Chapter	
	Health and Safety Executive
1	A guide to the Integrity, Workplace Environment and Miscellaneous Aspects of the Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996 HSE Books ISBN 0 7176 1164 7
1	A guide to the Offshore Installations (Safety Case) Regulations 2005, Third edition 2006 HSE Books, ISBN 0 7176 6184 9
1	A guide to the Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995 HSE Books ISBN 0 7176 0938 3
4	Operations Notice No. 39: Guidance on identification of offshore installations, June 2008
1	Operations Notice No. 67: Offshore Helideck Design Guidelines, October 2004
3	Offshore Helideck Design Guidelines (available online at www.hse.gov.uk)
1	Prevention of Fire and Explosion, and Emergency Response on Offshore Installations, Approved Code of Practice and Guidance 1995, HSE Books ISBN 0 7176 0874 3
5	Safety Notice 2/2004: Offshore Helidecks - Testing of Helideck Foam Production Systems, April 2004

International Civil Aviation Organization

ICAO Annex 3	Meteorological Service for International Air Navigation
ICAO Annex 14 Volume II	Heliports
ICAO Doc 9261 AN/903	Heliport Manual
ICAO Doc 9284 AN/905	Technical Instruction for the Safe Transport of Dangerous Goods by Air

Other Publications

9 Guide to Helicopter/Ship Operations, International Chamber of Shipping, Fourth Edition, December 2008

8 Helicopter Refuelling Handbook (5th Edition, 2007)

3 IMO (International Maritime Organization) — Mobile Offshore Drilling Units (MODU) Code (2001 consolidated)

3 ISO (International Standards Organisation) ISO 19901-3 — Petroleum and Natural Gas Industries – Specific Requirements for Offshore Structures, Part 3: topsides structure

9 Merchant Shipping Notice MSN 1792 (M) Amendment 1 (UK Maritime and Coastguard Agency) www.mcga.gov.uk

5 Offshore Petroleum Industry Training Organisation (OPITO) Helicopter Landing Officer's Handbook (8th Edition, 2007)

3 Oil & Gas UK — Joint Industry Guidance for Helideck Perimeter Safety Nets – Issue 2, March 2008

3 Review of falling 5-in-1 Gradient Criteria of Offshore Platform Operations.
Dr Douglas G Thomson/Prof Roy Bradley – Final Report March 1997
Dr Douglas G Thomson – Addendum to Final Report – July 1999

4 TNO — Human Factors (Report Ref: TM-02-0003)

3 UKOOA — Guidelines for the Management of Offshore Helideck Operations (Issue 5 – February 2005)

6 UKOOA — Guidelines for Safety Related Telecommunications Systems On Fixed Offshore Installations

6 WMO (World Meteorological Organisation) Publication No. 306 Manual on Codes Volume 1.1, Part A Alphanumeric Codes, Code Table 3700 State of the Sea

Civil Aviation Authority – CAPs and Research Papers

3 CAA Paper 98002 — Friction Characteristics of Helidecks on Offshore Fixed-Manned Installations

3 CAA Paper 99004 — Research on Offshore Helideck Environmental Issues

4 CAA Paper 2004/01 — Enhancing Offshore Helideck Lighting – NAM K14 Trials

4 CAA Paper 2005/01 — Enhancing Offshore Helideck Lighting – Onshore Trials at Longside airfield

4 CAA Paper 2006/03 — Enhancing Offshore Helideck Lighting – Onshore Trials at Norwich Airport

3	CAA Paper 2007/02	Visualisation of Offshore Gas Turbine Exhaust Plumes
4	CAA Paper 2008/01	Specification for an Offshore Helideck Status Light System
3	CAA Paper 2008/02 Study I	Validation of the Helicopter Turbulence Criterion for Operations to Offshore Platforms
3	CAA Paper 2008/02 Study II	A review of 0.9 m/s Vertical Wind Component Criterion for Helicopters Operating to Offshore Installations
3	CAA Paper 2008/03	Helideck Design Considerations: Environmental Effects
6	CAP 413	Radiotelephony Manual
6	CAP 452	Aeronautical Radio Station Operator's Guide
6	CAP 670	Air Traffic Services Safety Requirements
6	CAP 746 (Appendix H)	Meteorological Observations at Aerodromes (Competency of Observers)
7	CAP 748	Aircraft Fuelling and Fuel Installation Management
10	CAP 764	CAA Policy and Guidance on Wind Turbines
10	CAP 789	Requirements and Guidance Material for Operators

2 Sources

British Standards (BS) may be obtained from Her Majesty's Stationery Office, PO Box 276, Nine Elms Lane, London SW8 5DT. Telephone +44 (0) 20 7211 5656 or from any HMSO. Advice on relevant codes (BS, EN and PREN) is available from the CAA at SRG Gatwick.

Civil Aviation Publications (CAPs) and Civil Aviation Authority Papers (CAA Papers) are published on the CAA website at www.caa.co.uk where you may register for e-mail notification of amendments. Please see the inside cover of this CAP for details of availability of paper copy.

HSE Publications from HSE Books, PO Box 1999, Sudbury, Suffolk, CO10 6FS. Telephone +44 (0) 1787 881165. Most documents can be downloaded from HSE's website www.hse.gov.uk.

ICAO Publications are available from Airplan Flight Equipment, 1a Ringway Trading Estate, Shadowmoss Road, Manchester M22 5LH. Telephone +44 (0) 161 499 0023. The ICAO website address is www.icao.int.

International Chamber of Shipping Publications from International Chamber of Shipping, 12 Carthusian Street, London, EC1M 6EZ. Telephone +44 (0) 20 7417 2855. E-mail publications@marisec.org.

Oil & Gas UK Publications from Oil & Gas UK, 2nd Floor, 232-242 Vauxhall Bridge Road, London SW1V 1AU. Telephone +44 (0) 20 7802 2400. Website www.oilandgas.org.uk. E-mail info@oilandgasuk.co.uk.

OPITO Publications from OPITO, Inchbraoch house, South Quay, Ferryden, Montrose, Scotland, DD10 9SL. Telephone +44 (0) 1674 662500.

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Appendix C Interim Guidance issued by CAA in July 2004

Safety Regulation Group

Flight Operations Inspectorate (Helicopters)

20 July 2004

Ref 10A/253/16/3

Dear Sirs

Helideck Lighting – Further Interim Guidance on Standards

1 Introduction

Further to my letter ref 10A/253/16/3 of 17 November 2003, ICAO has now endorsed the changes proposed to the helideck lighting standards contained in Annex 14 Vol.2. UK CAA, recommends that the improvements to helideck lighting systems be introduced in two stages and, in conjunction with other North Sea States, intends to update CAP 437 in the near future adding a recommendation that duty holders implement the first stage, Stage 1, as soon as practical.

The purpose of this letter is to update the interim guidance on offshore helideck lighting standards in respect of Stage 1 pending update of CAP 437, and supersedes the 17 November 2003 letter which should now be discarded. Section 2 describes the background to the initiative, and Sections 3 and 4 cover the associated changes to perimeter lighting and floodlighting respectively.

2 Background

Three main problems exist with current helideck lighting systems:

- the location of the helideck on the platform is often difficult to establish due to the lack of conspicuity of the perimeter lights;
- helideck floodlighting systems frequently present a source of glare and loss of pilots' night vision on deck, and further reduce the conspicuity of helideck perimeter lights during the approach;
- the performance of most helideck floodlighting systems do not meet the current specification for light intensity and distribution and thus illumination of the central landing area is inadequate, leading to the so-called 'black hole' effect.

CAA has consequently been researching improved lighting systems for offshore helidecks for a number of years. Work started in earnest with a series of three dedicated trials on the K14 platform in the southern North Sea. A conference paper describing the trials was presented at the Royal Aeronautical Society in London in March 2001. The full report on the trials has been published as CAA Paper 2004/01, and is available from the publications section of the CAA website at www.caa.co.uk. Since then, CAA has completed two dedicated trials at an onshore site just north of Aberdeen (Longside airfield) and a further four dedicated trials at Norwich airport to refine the system, test new ideas, and evaluate the effect of a landing net on the lighting. These trials are currently being written up and will be published in two separate CAA papers later in 2004.

As a result of this work, a proposal to change the standards and recommended practices in ICAO Annex 14 Vol.2 was made. This has been accepted and became effective for all member states on 12 July 2004 with a compliance date of 01 January 2009. Pending the mandate of the Annex 14 Vol.2 changes, CAA will update CAP 437 by including the associated material as additional information and encouraging the Industry to implement the new standards as soon as practical. CAA has agreed with UK Industry that these changes may be progressed in two stages. The changes proposed for CAP 437 will be implemented in these two stages as follows:

- Stage 1 comprises changing the colour of the perimeter lights from yellow to green with a revision of the associated isocandela diagram, and the deletion of the existing deck level floodlighting, ideally replacing it with the improved system described in Section 4.2. (NB: Changes to the floodlighting should be conducted in consultation with the helicopter operators.)
- Stage 2 comprises (as an alternative to fully compliant floodlighting) the provision of a circle of yellow arrays of segmented point source lighting within the yellow painted aiming circle and a lit (green) heliport identification ‘H’ marking in the centre of the helideck aiming circle. Trials to date indicate that LED lighting is effective for both elements, but ICAO compliant alternatives providing an equivalent level of visual cueing will be acceptable.

For Stage 1, the changes are now finalised and equipment to meet the revised specification is commercially available. It is therefore CAA’s intention, in conjunction with other European States with offshore interests, to incorporate the Stage 1 changes as additional guidance material at the next update of CAP 437, scheduled for Autumn 2004.

As regards Stage 2, further trials are being completed to finalise the detail of the lighting and support the development of equipment suitable for installation on an offshore helideck. The associated changes will be considered for a further update of CAP 437 when this work has been completed.

In the longer term, the introduction of Stage 2 to offshore platforms is an issue that is likely to be raised as a topic for the ‘new’ UKOOA/CAA/Helicopter Operator forum. In particular, identifying a commercially available product and the priority of installing it onto platforms.

3 Perimeter Lights

3.1 General

CAA recommends implementing the new perimeter light specification at the earliest practical opportunity. This can most conveniently be accomplished on new decks or on existing decks during refurbishment where new lights are to be installed. Otherwise, some types of existing light can be modified (see Section 3.3) at reasonable cost to provide a satisfactory interim solution (until 31 December 2008) that represents a significant improvement over the current standard.

3.2 New Lights

Where new lights are to be purchased, it is recommended that these fully meet the new specification in terms of both colour and intensity. It is CAA’s understanding that a number of suppliers have suitable products available.

The colour of the light shall be green as defined in ICAO Annex 14 Vol.1 Appendix 1, paragraph 2.1.1(c), i.e. the chromaticity shall be within the following boundaries:

Yellow boundary x = 0.36 - 0.08y

White boundary x = 0.65y

Blue boundary y = 0.39 - 0.171x

As regards intensity, the following change to Annex 14 Vol.2 has been adopted:

Elevation	Azimuth	Intensity
20º-90º	-180° to +180°	3cd
13º-20º	-180° to +180°	8cd
10º-13º	-180° to +180°	15cd
5º-10º	-180° to +180°	30cd
[1]2º-5º	-180° to +180°	15cd

1. Additional values may be required in the case of installations requiring identification by means of the lights at an elevation of less than 2º.

NB: The above footnote was inserted by ICAO with offshore helidecks specifically in mind; operational data from 270 night approaches to 50 different installations in the North Sea has confirmed the need for the beam to extend down to the horizontal.

CAA recognises that the form of presentation chosen by ICAO is designed to cover TLOF lighting systems for both offshore and onshore environments where specific operational requirements may differ. While fully accepting the ICAO standard in general, with the benefit of extensive research in relation to offshore operations the CAA recommends the enhanced specification for offshore helideck perimeter lights defined in the table below:

Elevation	Azimuth	Intensity
0º - 90º	-180° to +180°	60cd max[1]
>20º - 90º	-180° to +180°	3cd min
>10º - 20º	-180° to +180°	15cd min
0º -10º	-180° to +180°	30cd min

1. NB: A study of helideck lighting performed for the Dutch CAA by TNO Human Factors (report ref. TM-02-C003) has indicated that lighting intensities greater than 60cd can represent a source of glare. The value of 60cd has therefore been adopted as a maximum value.

CAA recommends that any new perimeter lights designed for use offshore meet this enhanced intensity specification which, in any case, is compatible with the ICAO specification.

3.3 Existing Lights

Green filters are available for some existing perimeter lights at modest cost, and could be installed with relatively little effort. While CAA wishes to encourage platform operators to implement the colour change as soon as possible, the following issues need to be considered:

- The colour of the filter must meet the chromaticity defined in ICAO Annex 14 Vol.1 Appendix 1, paragraph 2.1.1(c) - see Section 2.2 above.
- Replacing the existing yellow filter with a green filter will significantly reduce the intensity of the light. **Green filters should not be fitted unless a minimum of 10cd is emitted between 0º and 10º elevation for all angles of azimuth.** Note that not all types of existing perimeter light will be able to meet this requirement.

While this figure is less than the 30cd that will be required under the new specification, it is nevertheless considered to represent a significant improvement on the current standard given the increase in conspicuity conferred by the change of colour and acceptable on an interim basis.

- As a consequence of the lower efficiency of green filters compared to yellow, the temperature inside and on external surface of the light will increase. This may have an adverse effect on lamp life and may invalidate the approval of the light for use in hazardous areas.
- It should be noted that new EU hazardous area certification standards (ATEX 95) for new equipment came into effect for new equipment on 01 July 2003. It is CAA's understanding that these standards are not being applied retrospectively and may not be applicable for all classes of installation and vessel, however changes to existing lights may invalidate their current hazardous area certification necessitating re-approval to the new standards.

4 Floodlights

4.1 General

While the continued use of deck level floodlights is allowed under the new ICAO Annex 14 Vol.2 Phase 2 material, the current standard is difficult to meet and there is presently no practical means available of ensuring initial or continued compliance. It is considered that, by reducing the conspicuity of the pattern formed by the perimeter lights and in potentially presenting a significant source of glare, deck level floodlighting is often counter productive.

Under the newly adopted ICAO Annex 14 Vol.2 material, a lit touchdown marking and/ or heliport identification marking may in future be used in lieu of floodlighting (Stage 2). Currently, CAA does not believe that any products are readily available that are suitable for use in the offshore environment. As an interim measure and where practical therefore, CAA recommends replacing the existing deck level floodlighting with a combination of high-mounted floodlights located within the Limited Obstacle Sector (LOS) and deck level floodlights on the opposite edge of the deck to the LOS. If the existing deck level floodlights are suitable for re-use as high-mounted (or LOS) floodlights, the cost of this modification is expected to be modest.

4.2 Improved Floodlighting System

The main constraining factor in floodlighting helidecks is the 25 cm height limit within the 210° Obstacle Free Sector (OFS). With reference to Chapter 3, Figure 1 in CAP 437, however, obstacles up to a height of 0.05D are permitted at the edge of the helideck within the 150° Limited Obstacle Sector (LOS). Trials conducted by CAA have demonstrated that useful light can be provided by using a minimum of two ORGA SHLF218 halogen units mounted at a height of 0.05D within the LOS, angled downwards by approximately 5° and fitted with louvres to prevent glare, together with two Tranberg TEF 9964 xenon floodlights mounted at deck level opposite the LOS.

NB: The lighting products employed for CAA's trials are stated above in order to provide an indication of suitable beam characteristics. Alternative products with similar beam characteristics are equally acceptable. No product endorsement is either made or intended.

While not fully compliant with the ICAO Annex 14 Vol.2 standard, this system offers the following advantages:

- with properly designed and fitted louvres on the high-mounted halogen floodlights virtually all helideck floodlight glare is eliminated;
- the conspicuity of the pattern formed by the perimeter lights is unaffected by the floodlights, the only exception being a slight degradation in the unusual event of an approach from behind the LOS, i.e. facing the deck level xenon floodlights;
- the LOS floodlights identify the location of the origin of the 210º OFS, and provide the pilot with a heading reference.

This arrangement also provides general lighting for deck handling operations.

As stated above, correct louvre design for the high-mounted floodlights is essential to avoid glare and to minimise the attenuation of the main beam of the floodlights. CAA has included guidance material for the design of louvres for this application as an appendix to the Longside trials report (shortly to be published as a CAA paper). In the meantime, key louvre design parameters to note are:

- maximum intensity at and above minimum pilot eye height is 60cd (see Section 3.2 above);
- minimum pilot eye height (Sikorsky S76 on-deck) is 1.6 m for which the design reference point is to be taken as the centre of the helideck aiming circle.

Lighting equipment manufacturers may contact CAA directly for further information on louvre design pending publication of the Longside trials report.

In summary, pending availability of suitable hardware to implement Stage 2 of the helideck lighting improvement programme (lit yellow aiming circle and lit green 'H'), CAA recommends replacing existing deck level floodlighting systems with a combination of a minimum of two high mounted halogen floodlights supplemented with two xenon floodlights mounted around the helideck perimeter at deck level opposite the LOS high mounted units.

NB1: High intensity xenon floodlights are not recommended for high-mounting within the LOS. The 5º angle of depression will result in reflections from the deck surface (when wet) into the approach path and unacceptable glare in certain approach directions.

NB2: Halogen floodlight units are not recommended for deck level use. Their intensity is unlikely to provide sufficient illumination of the deck surface and the relative lack of close vertical beam control could result in glare in the event of misalignment unless fitted with suitable louvers (which would further reduce the output of the light).

4.3 **Caveats**

For helidecks located on platforms with a sufficiently high level of illumination from cultural lighting, the need for an improved floodlighting system may be reviewed with the helicopter operator(s), i.e. in such circumstances it may be sufficient to just delete or disable the existing deck level floodlighting. This concession assumes that the level of illumination from cultural lighting is also sufficiently high to facilitate deck operations such as movement of passengers and refuelling (where applicable). It is a condition that prior to the removal of floodlights, extended trials of the 'no-floodlight' configuration be conducted and their subsequent removal will be subject to satisfactory reports from crews to indicate the acceptability of operating to the helideck with the re-configured lighting.

For helidecks that are currently obstacle free and/or for minimum sized helidecks (e.g. NUIs), it may not be desirable or practical to fit high-mounted floodlights within the LOS, i.e. to create an obstacle where there is presently none. In the absence of sufficient cultural lighting, CAA recommends that installation owners consider a deck level floodlighting system consisting of not less than 4 deck level xenon floodlights equally spaced around the perimeter of the helideck. In considering this solution, installation owners must ensure that the deck level xenon units do not adversely effect the pilots' judgment by ensuring that they do not present a source of glare or loss of pilots' night vision on the helideck, and do not affect the ability of the pilots to determine the actual location of the helideck on the installation. It is therefore essential that all lights are maintained in correct alignment. It is also desirable to position the lights such that no light is pointing directly away from the prevailing wind. Floodlights located on the upwind (for the prevailing wind direction) side of the deck should ideally be mounted so that the centreline of the floodlight beam is at an angle of 45° to the reciprocal of the prevailing wind direction. This will minimise any glare or disruption to the pattern formed by the green perimeter lights for the majority of approaches. An example of an acceptable floodlighting arrangement is shown at Figure 1.

For NUIs previously fitted with deck mounted halogen systems but now fitted either with the improved floodlighting system recommended in Section 4.2 or the 4 deck level xenon units as described above, it would be desirable to redeploy surplus halogen units to improve illumination of the platform structure below deck level. This will assist to alleviate the 'floating in space' effect often encountered with operations to NUIs which have no other significant sources of cultural lighting.

For helidecks on mobile installations where deletion of the deck level floodlighting is appropriate, it may be desirable to disable the existing floodlighting rather than remove it. Adoption of this solution would facilitate the re-instatement of the deck level floodlighting should the installation move out of the UKCS into a region where strict adherence to the letter of the ICAO requirements for floodlighting is necessary.

Yours faithfully

Kevin P Payne

Flight Operations Inspectorate (Helicopters)

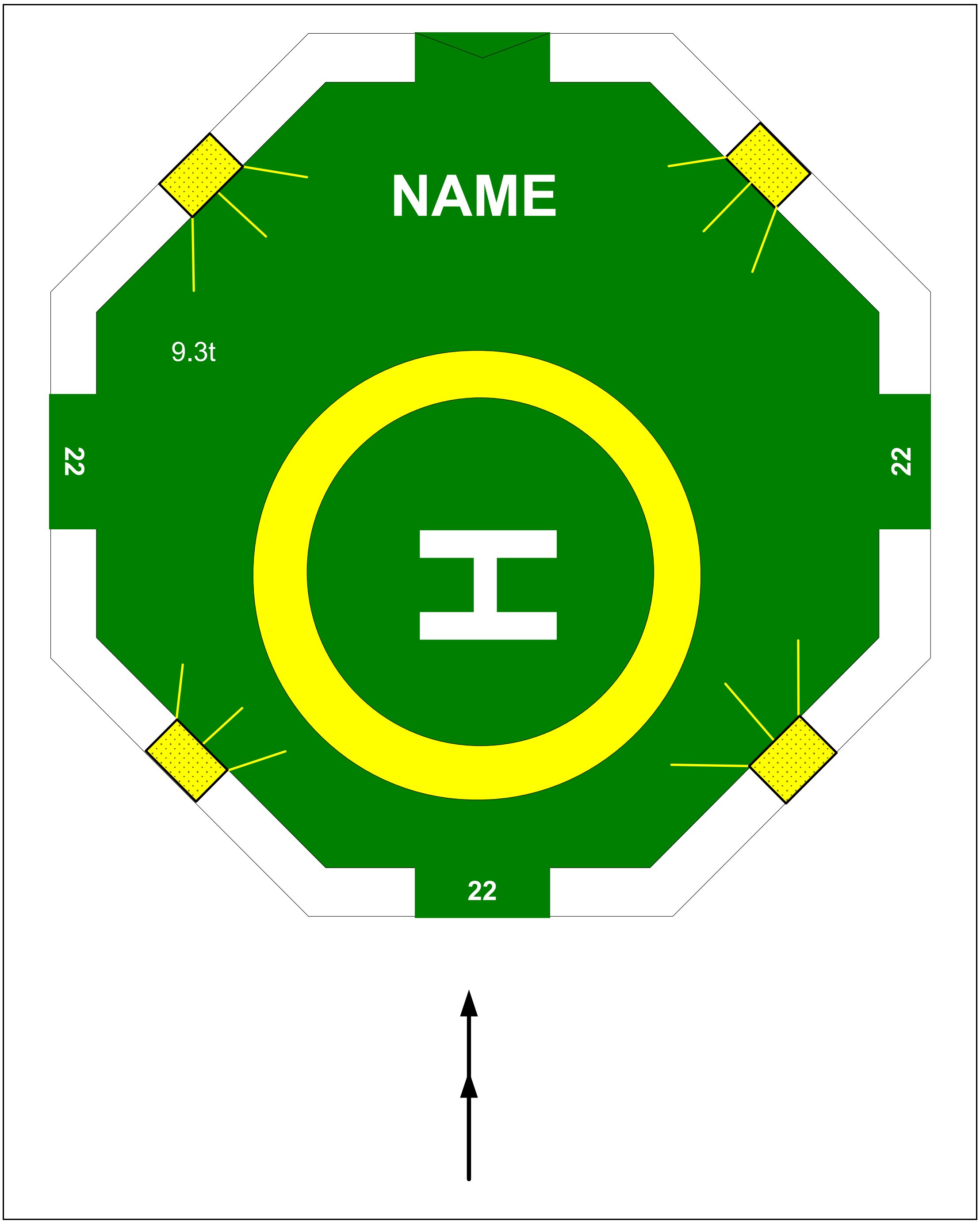

Figure 1 Typical Floodlighting Arrangement

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Appendix D Helideck Lighting – Further Guidance on Preferred Stage 1 Lighting Configurations

Safety Regulation Group

Flight Ops Inspectorate (Helicopters)

Offshore Helicopter Operators
Chief Executive UK Offshore Operators Association
Helideck Certification Agency
Health and Safety Executive
Verification Agencies
British Rig Owners Association
International Maritime Contractors Association
International Association of Drilling Contractors
International Association of Geophysical Contractors

9 March 2006

Ref 10A/253/16/3Q

Dear Sirs

Helideck Lighting – Further Guidance on Preferred Stage 1 Lighting Configurations

1 **Introduction**

I refer to our letter to industry dated 20 July 2004 reference 10A/253/16/3, which was subsequently reproduced in Appendix C of CAP 437 (fifth edition) dated August 2005.

This letter described the background to a series of dedicated CAA helideck lighting trials completed on the Dutch K14 Platform in 1998/9 (and reported in CAA Paper 2004/01) and at Longside airfield near Aberdeen in 2002 (and reported in CAA Paper 2005/01). At the time of publication of our letter, a third series of dedicated trials designed to improve, refine and characterise the helideck lighting systems developed during the early trials was in progress. These trials, completed at Norwich Airport during 2003/4, are being written up and will be published in a CAA Paper in the near future.

One of the primary objectives of the Norwich trials was to evaluate the effectiveness of different floodlighting configurations and technologies in both an elevated position in the Limited Obstacle sector (LOS), and at deck level around the helideck perimeter. The main purpose of the CAA's interim guidance letter of 20 July 2004 was to provide interim guidance on offshore helideck lighting standards in respect of implementing effective Stage 1 interim lighting solutions. Stage 1 comprises changing the colour of the perimeter lights from yellow to green with a revision of the associated iso-candela diagram, and the deletion of the existing deck level floodlighting, ideally replacing it with the improved systems described in detail in the July 2004 letter.

This letter is now presented to update the 'current' best practice guidance given in Section 4 of the previous letter dated 20 July 2004 and effectively reverses the preference for improved floodlighting systems for interim Stage 1 by placing the deck level floodlighting system, consisting of four deck level xenon floodlights equally spaced around the perimeter of the helideck, ahead of the combination system comprising a minimum of two high mounted halogen floodlights supplemented with two xenon floodlights mounted around the helideck perimeter at deck level opposite the LOS high mounted units. The reason for this reversal of preference is explained in the next section.

2 Stage 1 floodlighting evaluation on Exxonmobil Lancelot and Galahad Platforms - Friday 10 February 2006

Following the completion of dedicated lighting trials at Norwich Airport, the two main Stage 1 configurations were implemented on the Exxonmobil Galahad and Lancelot platforms in the southern North Sea. On Friday 10 February 2006, the CAA chartered a Bristow S76 helicopter flown by company pilots to evaluate the two preferred Stage 1 configurations located on the Galahad (a combination of two high halogen floodlights mounted in the LOS and two xenon floodlights mounted around the helideck perimeter at deck level opposite the LOS high mounted units and green perimeter lights) and Lancelot platform (four deck level xenon floodlights equally spaced around the perimeter of the helideck and green perimeter lights). It was apparent to both Bristow pilots and the CAA and HCA observers on board that the visual cues provided by the deck level xenon system on the Lancelot were significantly better than those provided by the combination system on the Galahad platform employing two high mounted halogen floodlights in the LOS.

The evaluation/comparison of representative Stage 1 floodlighting systems on the Lancelot and Galahad will be reported as part of the CAA paper covering the Norwich Airport trials. In the meantime industry is advised that the preferred Stage 1 interim floodlighting solution is a system comprising of four deck level xenon floodlights equally spaced around the perimeter of the helideck. The preferred system is explained in more detail in the next section.

3 Improved Floodlighting System

For helidecks located on platforms with a sufficiently high level of illumination from cultural lighting, the need for an improved floodlighting system may be reviewed with the helicopter operator(s), i.e. in such circumstances it may be sufficient to just delete or disable the existing deck level floodlighting. This concession assumes that the level of illumination from cultural lighting is also sufficiently high to facilitate deck operations such as movement of passengers and refuelling (where applicable). It is a condition that prior to the removal of floodlights, extended trials of the 'no-floodlight' configuration be conducted and their subsequent removal will be subject to satisfactory reports from crews to indicate the acceptability of operating to the helideck with the re-configured lighting.

In the absence of sufficient cultural lighting, the CAA recommends that installation owners consider a deck level floodlighting system consisting of four deck level xenon floodlights equally spaced around the perimeter of the helideck. In considering this solution, installation owners must ensure that the deck level xenon units do not adversely affect the pilots' judgment by ensuring that they do not present a source of glare or loss of pilots' night vision on the helideck, and do not affect the ability of the pilots to determine the actual location of the helideck on the installation. It is therefore essential that all lights are maintained in correct alignment. It is also desirable to position the lights such that no light is pointing directly away from the prevailing wind. Floodlights located on the upwind (for the prevailing wind direction) side of the deck should ideally be mounted so that the centreline of the floodlight beam is at an angle of 45° to the reciprocal of the prevailing wind direction. This will minimise any glare or disruption to the pattern formed by the green perimeter lights for the majority of approaches. An example of an acceptable floodlighting arrangement is shown at Figure 1 of Appendix C.

Offshore duty holders who have already implemented improved Stage 1 floodlighting systems on their platforms by utilising a combination system comprising two or more halogen floodlights mounted in the LOS and two xenon floodlights mounted around the helideck perimeter at deck level opposite the LOS high mounted units need take no further action. However, duty holders who are still considering improvements to existing floodlighting arrangements or are seeking best practice for new build installations should regard a system comprising of four deck level xenon floodlights equally spaced around the perimeter of the helideck as the preferred Stage 1 solution.

Note: For some larger helidecks it may be necessary to consider fitting more than four deck level xenon floodlights, but this should be carefully considered in conjunction with the helicopter operator giving due regard to the issues of glare and loss of definition of the helideck perimeter before further deck level units are procured. The CAA does not recommend more than five or six units even on the largest helidecks.

4 Stage 2 Lighting Update

In our letter of 20 July 2004 we advised, with regard to Stage 2, that further trials were being completed to finalise the detail of the lighting and support the development of equipment suitable for installation on an offshore helideck. Stage 2 comprises (as an alternative to fully compliant floodlighting) the provision of a circle of yellow arrays of segmented point source lighting within the yellow painted aiming circle and a lit (green) heliport identification 'H' marking in the centre of the helideck aiming circle.

Trials at Norwich Airport in 2003/4 (to be reported in a CAA Paper) established the boundaries for the main design parameters for the illumination of the Touchdown Marking Circle and Heliport Identification Marking 'H'. As a result of the Norwich trials it was recommended that an equipment requirements specification should be drawn up for the Touchdown Marking Circle and Heliport Identification Marking 'H'. This document, submitted to lighting manufacturers in July 2005, formed the basis of an invitation to tender (ITT) for the provision of prototype equipment to support offshore in-service trials of the preferred Stage 2 lighting configurations during the winter of 2006/7. In response to the ITT, two manufacturers have been selected to provide prototype systems for a manned fixed platform located in the southern North Sea and a further manned fixed platform located in the northern North Sea. Following these offshore trials of prototype systems it is anticipated that the next update of CAP 437 will define a minimum acceptable specification for this lighting and will remove the existing references to interim floodlighting arrangements.

Yours faithfully

Kevin P Payne

Flight Operations Inspectorate (Helicopters)

CC: International Association of Oil and Gas Producers
Maritime and Coastguard Agency
Offshore Contractors Association
Cogent/Offshore Petroleum Industry Training Organisation
Civil Aviation Authorities of Norway, Denmark, Ireland and Netherlands
Helideck Lighting Manufacturers

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Appendix E Draft Specification for Touchdown/ Positioning Marking and Heliport Identification Marking – "Stage 2 Lighting"

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 stage 2 system is visible and useable at night from ranges in accordance with paragraphs 1.5, 1.6 and 1.7 (below).

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 range of 0.5 NM.

1.7 The Heliport Identification Marking (‘H’) is to be visible at night from a 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 above) should still be achieved even where a correctly fitted 200 mm mesh rope netting of 20 mm thickness covers the lighting.

2 The Perimeter Light Requirement

2.1 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 as stated in Chapter 4, paragraph 3.1.

2.2 Mechanical Constraints

The perimeter lights should not exceed a height of 25 cm above the surface of the helideck.

2.3 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.

2.4 Colour

The colour of the light 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 $x = 0.36 – 0.08y$

White boundary $x = 0.65y$

Blue boundary $y = 0.39 – 0.171x$

3 The Touchdown/Positioning Marking Circle Requirement

3.1 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.

3.2 Mechanical Constraints

3.2.1 The height of the lit TD/PM circle and any associated cabling should be as low as possible and should not exceed 25 mm above the surface of the helideck when fitted. 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.

3.2.2 The overall effect of the lighting strips and cabling on deck friction should be minimised. Wherever practical, the surfaces of the lighting strip should meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.

3.2.3 The TD/PM circle lighting components, fitments and cabling should be able to withstand a pressure of 240 lbs/in^2 (1,654,800 pascals), equivalent to one wheel of a 15-ton helicopter touching down heavily on top of them, without damage.

3.3 Intensity

The light intensity for each of the lighting segments, when viewed broadside on, 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 1	60 cd
>10° to 20°	25% of min intensity >0° to 10°	40 cd
>20° to 90°	5% of min intensity >0° to 10°	10 cd

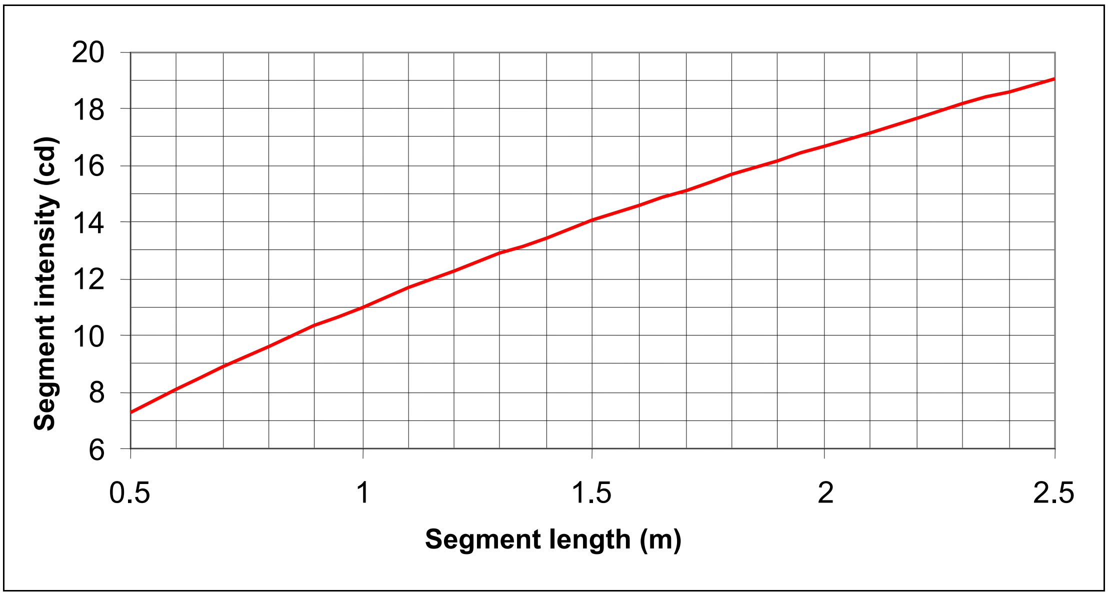

Figure 1 Segment Intensity versus Segment Length

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%).

3.3.1 If a segment is made up of a number of individual lighting elements (e.g. LEDs) then they should be of equal intensity in all angles of azimuth and be equidistantly spaced throughout the segment to aid textural cueing. Minimum spacing shall 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 0° and 10°.

n = the number of lighting elements within the segment.

3.3.2 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. The luminance (B) of the segment should be given by the formula:

B = I / A

where: I = intensity of segment at the 'look down' (elevation) angle.

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

3.4 Colour

The colour of 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 The Heliport Identification Marking ('H') Requirement

4.1 Configuration

The lit Heliport Identification Marking should be superimposed on the 4 m x 3 m white painted 'H' (limb width 0.75 m). The limbs can be lit over the whole surface or be in outline form.

4.1.1 The limbs of a whole surface lit 'H' should be of such dimensions as to leave a 100 mm wide border of the white painted 'H' clearly visible (see Figure 2). The surface colour of the lit 'H' should not detract from the conspicuity of the 'H' in daylight conditions. The mechanical housing should be painted white.

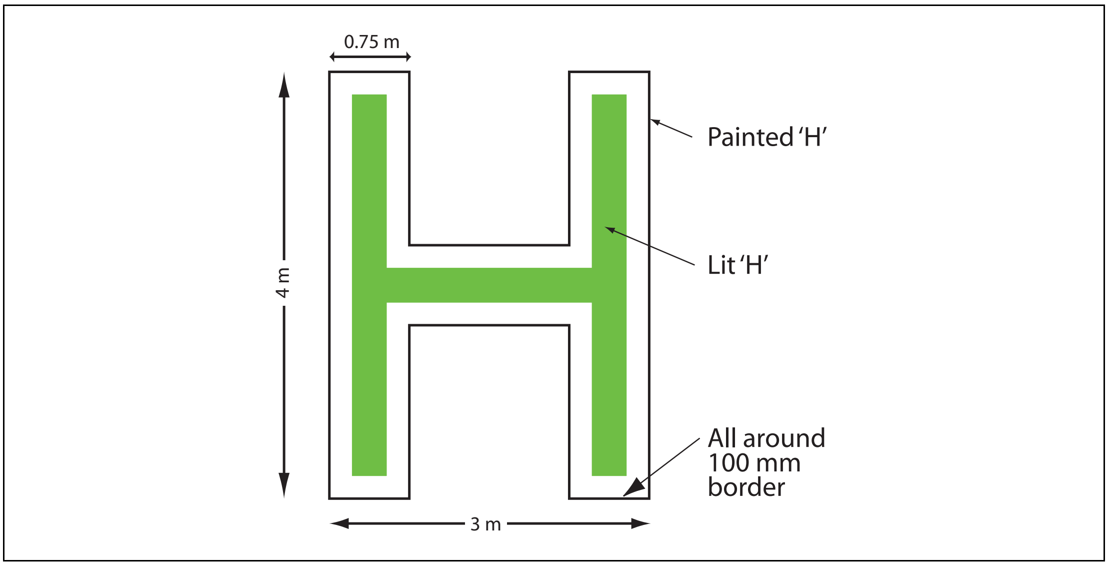

Figure 2 Configuration and Dimensions of Whole-Surface-Lit Heliport Identification Marking 'H'

4.1.2 An outline lit 'H' should comprise lighting strips of between 80 mm and 100 mm wide around the outer edge of the painted 'H' (see Figure 3). Gaps between the lighting strips should not be greater than 10 cm. The mechanical housing should be painted white.

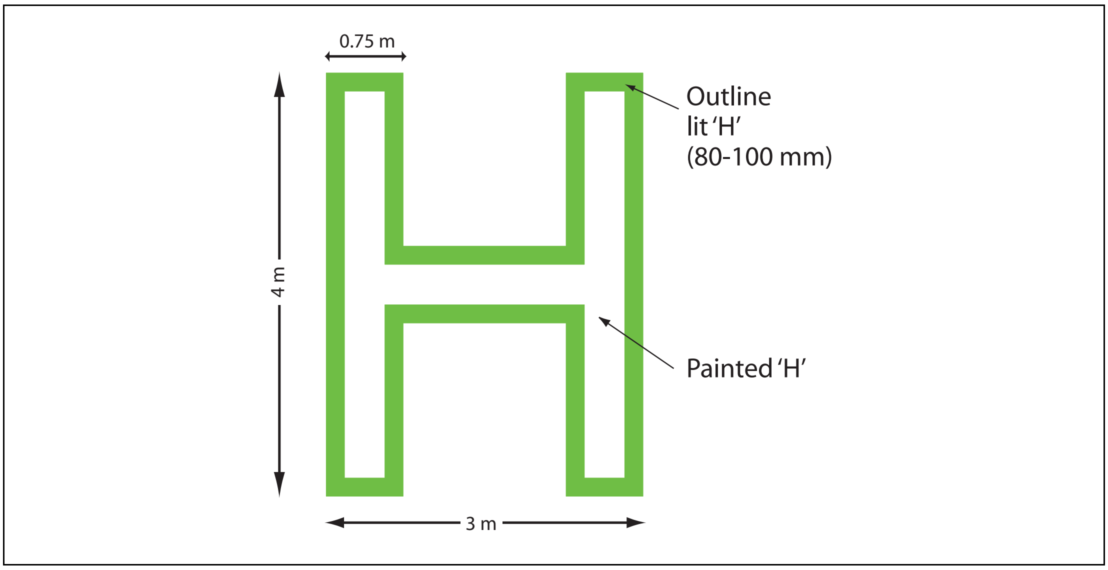

Figure 3 Configuration and Dimensions of Outline-Lit Heliport Identification Marking 'H'

4.2 **Mechanical Constraints**

4.2.1 The height of the lit ‘H’ and any associated cabling should be as low as possible and should not exceed 25 mm above the surface of the helideck when fitted. 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.

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 strip should meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.

4.2.3 The Heliport Identification Marking lighting components, fitments and cabling should be able to withstand a pressure of 240 lbs/in^2 (1,654,800 pascals), equivalent to one wheel of a 15-ton helicopter touching down heavily on top of them, without damage.

4.3 **Intensity**

4.3.1 The intensity of the lighting strip along the 4 m edge of an outline ‘H’ when viewed broadside on is given in Table 4 below.

Table 4 Light Intensity of Lit Heliport Identification Marking ‘H’

Elevation	**Intensity**	
	Min	**Max**
2° to 12°	3.5 cd	60 cd
>12° to 20°	0.5 cd	15 cd
>20° to 90°	0.2 cd	3 cd

The values in Table 4 ensure that the ‘H’ can be detected at the required range in an azimuth approach path normal to the 3 m width.

4.3.2 The ‘H’ should consist of the same lighting element material throughout.

4.3.3 If the outline ‘H’ is made up of individual lighting elements (e.g. LEDs) then they should be of equal intensity in all angles of azimuth and be equidistantly spaced within the limb to aid textural cueing. Minimum spacing shall 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.

4.3.4 If the outline ‘H’ is constructed from 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. 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 segment at the ‘look down’ (elevation) angle.

A = the projected lit area of the segment at the ‘look down’ (elevation) angle.

4.3.5 To achieve textural cueing on a whole surface lit ‘H’, each long limb of the ‘H’ should be divided into a nominal matrix of 5 x 16 equal segments with gaps of no more than 3 cm between each segment. The cross limb should consist of nominally the same sized segments.

4.4 **Colour**

The colour of the landing '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 = 0.36 – 0.08y
White boundary	x = 0.65y
Blue boundary	y = 0.39 – 0.171x

5 Other Considerations

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

5.2 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.

5.3 All lighting components and fitments that are mounted on the surface of the helideck should be able to operate within a temperature range of -35°C to +75°C.

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

5.5 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.

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Appendix F Procedure For Authorising Offshore Helidecks (July 2003)

Safety Regulation Group
Flight Operations Inspectorate (Helicopters)

Ref 10A/253/5

16 July 2003

Dear Sirs

PROCEDURE FOR AUTHORISING OFFSHORE HELIDECKS

This letter restates the legal requirements and related Industry procedure for the authorisation of helidecks on installations and vessels for worldwide use by public transport helicopters registered in the United Kingdom.

Article 34 of the Air Navigation Order (ANO) 2000 requires a public transport operator to reasonably satisfy himself that any place he intends to take-off or land is suitable for purpose.

A United Kingdom registered helicopter, therefore, shall not operate to an offshore helideck unless the operator has satisfied itself that the helideck is suitable for purpose and it is properly described in the helicopter operator's Operations Manual

CAP 437 gives guidance on the arrangements that the CAA will expect an operator to have to discharge this responsibility under article 34. The BHAB procedure for the authorisation of helidecks is designed to enable helicopter operators to ensure that offshore helidecks to which their helicopters fly are suitable for purpose, thus permitting them to discharge that responsibility.

Article 6 of the Air Navigation Order 2000 provides that to hold an air operator's certificate an operator must satisfy the CAA that amongst other things its equipment, organisation and other arrangements are such that it is able to secure the safe operation of aircraft.

When looking at a particular operator, the CAA will therefore have regard to its 'other arrangements'. These arrangements include the manner in which the operator discharges its duty under article 34.

The CAA, in discharging its duty for the grant of an Air Operators Certificate (AOC), will audit the helicopter operators' application of the process on which the operator relies. As part of such an audit, the CAA will review BHAB Helidecks procedures and processes and may accompany an operator when the operator undertakes an audit of BHAB Helidecks procedures or inspects a helideck.

The legal responsibility for acceptance of the safety of landing sites rest with the helicopter operator.

Yours faithfully

Captain B G Hodge
Head of Flight Operations Inspectorate (Helicopters)

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Appendix G Additional Guidance Relating to the Provision of Meteorological Information from Offshore Installations

1 Introduction

1.1 This appendix provides additional guidance on the provision of meteorological information from offshore installations, which is detailed in Chapter 6, paragraph 4.

1.2 The provision of meteorological information for the safety, efficiency and regulation of international air navigation is subject to international standards and recommended practices described in Annex 3 to the Chicago Convention published by ICAO. Requirements for observer training and observing accuracy are set out by the United Nation's World Meteorological Organisation (WMO).

1.3 *CAP 746 Meteorological Observations at Aerodromes* provides the policy and guidance related to the provision of meteorological information at aerodromes in the UK. To ensure compliance with these requirements and to standardise the provision of meteorological information provided, where practicable CAP 746 applies. Specific exceptions are detailed in paragraph 2 below.

2 Contents and Standardisation of the Weather Reports Issued by Each Offshore Installation

2.1 **Wind**

To be reported as per CAP 746 (Chapter 4, paragraph 3).

2.2 **Visibility**

To be reported in metres, as per CAP 746 (Chapter 4, paragraph 5). The visibility reported is the minimum visibility. Visibilities greater than 10 km should be reported as 9999.

2.3 **Lightning**

When lightning is observed, it should be included in the report.

2.4 **Present Weather**

2.4.1 Only the following weather phenomena are required to be reported:

Thunderstorm (No Precipitation)
Thunderstorm with Rain
Thunderstorm with Rain and Snow
Thunderstorm with Snow
Thunderstorm with Hail
Thunderstorm with Heavy Rain
Thunderstorm with Heavy Rain and Snow
Thunderstorm with Heavy Snow
Thunderstorm with Heavy Hail
Thunderstorm in the Vicinity

Drizzle
Heavy Drizzle
Rain
Heavy Rain
Rain and Drizzle
Heavy Rain and Drizzle

Freezing Rain
Heavy Freezing Rain
Freezing Drizzle
Heavy Freezing Drizzle
Snow Grains
Snow
Heavy Snow
Rain and Snow
Heavy Rain and Snow
Ice Pellets

Rain Shower
Heavy Rain Shower
Rain and Snow Shower
Heavy Rain and Snow Shower
Snow Shower
Heavy Snow Shower
Hail Shower
Heavy Hail Shower
Shower in the Vicinity

Fog
Freezing Fog
Fog Patches
Partial Fog
Shallow Fog
Fog in the Vicinity
Haze
Mist
Smoke
Dust
Sea Spray

Squall
Funnel Cloud
Volcanic Ash
Blowing Sand
Sandstorm

NOTES:
1. Guidance on the reporting of these present weather phenomena is as per CAP 746 (Chapter 4, paragraph 7).
2. No coding is required since the report is to be written in plain language.
3. If none of the above is observed then the entry for Present Weather will be Nil.
4. Where appropriate up to three of the above phenomena may be reported.

2.4.2 Reporting of Fog

Due to the small area that a helideck covers, compared to an aerodrome, the following guidance has been provided for the reporting of fog. As each installation has a 500 m exclusion zone it has been decided to use this for the reporting of fog. If there is fog (either within or outside the 500 m zone) and the visibility is <1,000 m in all directions then Fog (or Freezing Fog) should be reported as the Present Weather. If there is fog within the 500 m zone and the visibility is <1,000 m in only some directions then Partial Fog (fog bank) or Fog Patches should be reported as the Present Weather. Shallow Fog will be reported as the Present Weather if it is observed, whether patchy or as a continuous layer, within the 500 m zone below helideck level, and is less than 10 m deep (the visibility above the Shallow Fog will be 1,000 m or more). Where there is no fog within the 500 m zone but fog can be seen within 8 km, the Present Weather should be reported as Fog in the Vicinity with a note in the remarks section indicating Shallow Fog, Partial Fog (fog bank) or Fog Patches. Additionally the remarks section could also include a direction in which the fog is seen, e.g. Partial Fog to East.

2.5 **Cloud**

2.5.1 Cloud amount is reported as:

- Few (FEW);
- Scattered (SCT);
- Broken (BKN); and
- Overcast (OVC);

as per CAP 746 (Chapter 4, paragraph 8). Sky Obscured (VV///) and No Significant Cloud (NSC) should also be reported.

2.5.2 Cumulonimbus (CB) or Towering Cumulus (TCU) should be added to the report when present.

2.5.3 Cloud heights are to be reported in plain language in feet Above Mean Sea Level (AMSL), rounded down to the nearest 100 ft. There is no requirement to report cloud above 5,000 ft unless CB or TCU is present.

2.5.4 A maximum of four cloud groups can be reported.

2.6 **CAVOK (Cloud and Visibility OK)**

To be reported as per CAP 746 (Chapter 4, paragraph 4). When appropriate to do so, CAVOK should be reported as Present Weather.

2.7 **Air Temperature and Dew Point**

To be reported as per CAP 746 (Chapter 4, paragraph 9).

2.8 **QNH and QFE (Atmospheric Pressure)**

To be reported as per CAP 746 (Chapter 4, paragraph 10).

2.9 **Significant Wave Height**

Where sensors are deployed for the measurement of Significant Wave Height the information can be included in the report. The Wave Height should be reported to one decimal place, e.g. 7.6 m.

2.10 **Pitch, Roll and Heave**

Guidance is provided in CAP 437, Chapter 6, paragraph 3.

2.11 **Remarks**

This part of the form can be used to report additional Meteorological-related information that may assist the helicopter crew, e.g. Lightning seen at 12.30, Fog bank to SW, or Heavy Rain shower at 16.20. When a sensor is unavailable and an estimate has been made of the conditions, a note should be recorded in the Remarks section.

2.12 **Missing or Unavailable Information**

Exceptionally, when a sensor is unserviceable and the contingency device is not able to be accessed, or is also unserviceable, the report should be annotated with N/A indicating that the information is not available.

3 Example Offshore Report

3.1 A pre-flight weather report form template is given below that should be used to supply the relevant information. An example report is also provided (see Figure 2).

Location		Vessel Heading	Degrees		
Lat		Long			
Date		Time	UTC		
Wind	degrees	Speed	knots	Gust	knots
Visibility	metres	Lightning Present	Yes / No		
Present Weather					
Cloud amount		Cloud Height	feet		
Cloud amount		Cloud Height	feet		
Cloud amount		Cloud Height	feet		
Cloud amount		Cloud Height	feet		
Air Temperature	°C	Dew Point	°C		
QNH	hPa	QFE	hPa		
Significant Wave Height	metres				
Pitch	degrees up degrees down	Roll	degrees left degrees right	Heave	metres
Remarks					

Figure 1 Offshore Weather Report Form – Template

Location	METOCEAN1	Vessel Heading	319 Degrees
Lat	N 57 01 56	Long	E 01 57 18
Date	16/04/2007	Time	12:50 UTC
Wind	230 200V270 degrees	Speed	18 knots
Gust	32 knots		
Visibility	2000 metres	Lightning Present	Yes
Present Weather	Rain Shower / Thunderstorm in the Vicinity		
Cloud amount	FEW	Cloud Height	800 feet
Cloud amount	SCT	Cloud Height	1200 feet
Cloud amount	BKN	Cloud Height	3000 feet
Cloud amount	BKN CB	Cloud Height	6000 feet
Air Temperature	18°C	Dew Point	12°C
QNH	1009 hPa	QFE	1004 hPa
Significant Wave Height	3.6 metres		
Pitch	2.1 degrees up 1.3 degrees down	Roll	1.2 degrees left 1.3 degrees right
Heave	3.2 metres		
Remarks	Hail Shower at 12:30.		

Figure 2 Offshore Weather Report – Example

4 Definition of an Offshore Meteorological Observer

4.1 **Offshore Meteorological Observer:** any competent person who makes a weather observation or who updates a weather observation which is either provided as a Pre-Flight Weather Report or as a Radio Message to a helicopter en route to a fixed or floating offshore facility. Such a person should be trained and qualified as a Meteorological Observer for Offshore Helicopter Operations.

5 Applicability of Meteorological Equipment to Helideck Categories

5.1 The following categories of helideck should meet the requirements for Meteorological instrumentation given in CAP 437:

- fixed installations (HLL Code A);
- semi-submersible, e.g. semi-submersible crane and lay barges, purpose-built monohull Floating Storage Units (FSUs) and production vessels (HLL Code B); and
- large ships, e.g. drill ships, Floating Production Storage and Offloading units (FPSOs) whether purpose-built or converted oil tankers, non-semi-submersible and lay barges and self-elevating rigs on the move (HLL Code C).

NOTE: Due to less frequent helicopter operations, the weather reports for smaller ships, e.g. Diving Support Vessels (DSVs), support and seismic vessels (HLL Codes D, E and F), are required to contain only wind, pressure, air and dew point temperature information. Similarly, where weather information is being provided by NUIs, the weather report should include (as a minimum) wind, pressure, air and dew point temperature information.

6 Design, Siting and Back-up Requirements for Meteorological Equipment Installed in Offshore Installations

6.1 Wind Speed and Direction

(See CAP 746, Chapter 7, paragraph 3.)

6.1.1 Performance

a) The wind measuring equipment should provide an accurate and representative measurement of wind speed and direction.

b) Wind direction data should be oriented with respect to True North.

c) The wind speed measurement should be to an accuracy of within ±1 kt, or ±10% for wind speeds in excess of 10 kt, of the actual wind speed (whichever is the greater), over the following ranges:

Table 1 Tolerance Values of Sensors and Equipment – Wind Speed

Variable	In-Tolerance Operating Range	Recoverable Range
Wind speed	0 to 100 kt	0 to 130 kt

d) With wind speeds in excess of 2 kt, the wind direction system should be capable of producing an overall accuracy better than ±10°. The sensor should be sampled at a minimum rate of four times every second. Where wind systems measure the gust, the equipment should calculate the three-second gust as a rolling average of the wind speed samples.

e) The equipment should be capable of producing two- and ten-minute rolling averages of the wind speed and direction. The algorithms used for the production of such averages should be defined. The average direction displayed should take regard of the numerical discontinuity at North.

6.1.2 Back-up

A hand-held anemometer may be used as a back-up; any readings that are taken should be taken from the centre of the helideck. The pilot should be advised that a hand-held anemometer has been used to estimate the wind speed and a remark should be added to the offshore weather report form.

6.1.3 Siting

(This is detailed in Chapter 6, paragraph 4.2.1, Assessment of Wind Speed and Direction.)

The aim is to site the wind sensor in such a position to capture the undisturbed flow. It is recommended that the wind sensor be mounted at the highest practical point, e.g. on the drilling derrick or the telecommunications mast. However, it should be noted that regular servicing is required and for that reason the flare stack should not be used. If no suitable mast is available then a specific wind sensor mast should be erected; however, this should not interfere with helicopter operations. If the location is obstructed then a second anemometer should be fitted to cover any compass point that may be obstructed from the primary wind sensor. The height AMSL for each anemometer should be recorded. Ultrasonic sensors should not be fitted in close proximity to electromagnetic sources such as radar transmitters.

6.2 Temperature

(See CAP 746, Chapter 7, paragraph 5.)

6.2.1 Performance

a) The equipment should be capable of measurement to an accuracy better than ±1.0°C for air temperature and dew point, over the following range:

Table 2 Tolerance Values of Sensors and Equipment – Temperature and Humidity

Variable	In-Tolerance Operating Range	Recoverable Range
Temperature	–25°C to +50°C	–30°C to +70°C
Humidity	5 to 100% Relative Humidity condensing	0 to 100% Relative Humidity condensing

NOTE: Dew point should be displayed for temperatures below zero; frost point should not be displayed.

b) Temperature and dew point measurements should be measured to a resolution of 0.1°C. Electronic sensors should be sampled at a minimum rate of once per minute.

6.2.2 Back-up

Alternative sensors should be provided with an accuracy better than ±1.0°C for air temperature and dew point measurement. These sensors should be able to be easily read by the observer in the event of a failure of the main sensor.

6.2.3 Siting

Temperature and humidity sensors should be exposed in an instrument housing (e.g. Stevenson Screen), which provides protection from atmospheric radiation and water droplets either as precipitation or fog. The sensors should be located in an area that is representative of the air around the landing area and away from exhausts of building heating and equipment cooling systems. For this reason it is recommended that the sensors are located as close to the helideck as possible. The most common area is directly below the helideck, since this provides mechanical protection to the Screen itself. The site should be free of obstructions and away from areas where air may be stagnant, e.g. near blast walls or close to the superstructure of the platform.

6.3 **Pressure**

(See CAP 746, Chapter 7, paragraph 4.)

6.3.1 Performance

a) No observing system that determines pressure automatically should be dependent upon a single sensor for pressure measurement. A minimum of two co-located sensors should be used. The pressure sensors should be accurate to within 0.5 hectoPascals of each other.

NOTE: In the event of failure of one or more individual pressure sensors, or where pressure sensors are not accurate to within 0.5 hectoPascals of each other, the system should not provide any pressure reading to the user.

b) Automatic sensors should be sampled at a minimum rate of once per minute in order to detect significant changes.

c) The measurement system should provide a pressure reading to an accuracy of ±0.5 hectoPascals or better over the following range:

Table 3 Tolerance Values of Sensors and Equipment – Pressure

Variable	In-Tolerance Operating Range	Recoverable Range
Pressure	900 to 1050 hPa	850 to 1200 hPa

d) The sensor should provide an output with a minimum system resolution of 0.1 hPa.

6.3.2 Back-up

a) Suitable back-up instrumentation includes:

- precision aneroid barometers; and
- digital precision pressure indicators.

b) Where the pressure is not being determined automatically the observer should ensure that the appropriate height and temperature corrections are applied.

c) Manual atmospheric pressure measuring equipment (as noted above) should be checked daily for signs of sensor drift by comparison with other pressure instrumentation located on the offshore installation. CAP 746, Appendix D, Daily Atmospheric Pressure Equipment QNH Check, provides an example of the type of form that may be used to assist in the monitoring process.

6.3.3 Siting

a) Pressure readings are of critical importance to aviation safety and operations. Great care should be taken to ensure that pressure sensor siting is suitable and provides accurate data.

b) Pressure sensors can accurately measure atmospheric pressure and will provide representative data for the weather report provided the sensors are correctly located and maintained.

c) The equipment should be installed so that the sensor measurements are suitable for the operational purpose and free of external influences.

d) If the equipment is not installed at the same level as the notified helideck elevation, it should be given a correction factor in order to produce values with respect to the reference point. For QNH this is the height above sea level and for QFE the height of helideck above sea level.

e) Where required, the manufacturer's recommended venting method should be employed to isolate the sensor from the internal environment. The pressure sensor should be installed in a safe area, typically the Telecommunications Room, and in close proximity to the Meteorological processing system. In most cases, internal venting of the pressure sensors will be satisfactory. However, if it is determined that internal venting may affect the altimeter setting value to the extent that it is no longer within the accuracy limits given below, outside venting should be used. When the pressure sensor is vented to the outside a vent header (water trap) should be used. The venting interface is designed to avoid and dampen pressure variations and oscillations due to 'pumping' or 'breathing' of the pressure sensor venting equipment.

f) The sensors should also be located in an area free of jarring, vibration and rapid temperature fluctuations (i.e. avoid locations exposed to direct sunlight, draughts from open windows, and locations in the direct path of air currents from heating or cooling systems). Regular inspections of the vent header should be carried out to ensure that the header does not become obstructed by dust etc.

6.4 Visibility

(See CAP 746, Chapter 7, paragraph 7.)

6.4.1 Performance

a) The performance of the measuring system is limited by the range and field of view of the sensor. The equipment should be capable of measurement to the following accuracy limits to a range of 15 km:

Range	**Accuracy**
Up to and including 550 m	Visibility ±50 m
Between 600 m and 1,500 m	Visibility ±10%
Between 1,500 m and 15 km	Visibility ±20%

b) The visibility measuring system should measure to a resolution of 50 m.

c) The sensor(s) should be sampled at a minimum rate of once per minute. An averaging period of 10 minutes for weather reports should be used; however, where a marked discontinuity occurs only those values after the discontinuity should be used for obtaining mean values.

NOTE: A marked discontinuity occurs when there is an abrupt and sustained change in visibility, lasting at least two minutes, which reaches or passes through the following ranges:

10 km or more
5,000 m to 9 km
3,000 m to 4,900 m
2,000 m to 2,900 m
1,500 m to 1,900 m
800 m to 1,400 m
750 m or less

6.4.2 Back-up

The accredited observer should assess the visibility by eye. Where possible, visibility reference points should be provided. Structures illuminated at night should be indicated. When the visibility has been assessed by eye a remark should be included in the weather report form.

6.4.3 Siting

The sensor should be positioned in accordance with the manufacturer's specifications and is normally mounted on a mast. The visibility sensor transmits an infrared beam that measures the refraction caused by suspended particles that obstruct visibility, i.e. mist, fog, haze, dust and smoke. For this reason it is important to avoid any interference such as flares, smoke vents, etc. Areas of the installation that are used for wash-down or are susceptible to sea spray should be avoided. The sensor should be located as far away as practicable from other light sources that might affect the measurement, including direct sunlight or spotlights etc., as these will cause interference. These sensors require routine maintenance, calibration and cleaning; hence they should be positioned in a location that is easily accessible.

6.5 Present Weather Sensor

6.5.1 Performance

a) The sensor should be capable of detecting a precipitation rate greater than or equal to 0.05 mm per hour, within 10 minutes of the precipitation commencing.

b) Where intensity is measured, the sensor should be capable of measuring the range of intensity from 0.00 mm per hour to 100 mm per hour and resolve this to the following resolutions:

Range	**Resolution**
0-10 mm per hour	0.1 mm
10.5 to 50 mm per hour	0.5 mm
51 to 100 mm per hour	1 mm

c) The sensor should be accurate to within ±30% in the range 0.5 to 20 mm per hour.

d) Where the sensor is capable of doing so, it should discriminate between liquid precipitation and frozen precipitation.

6.5.2 Back-up

The accredited observer should assess the present weather manually, assisted by reference material as appropriate. When the present weather has been assessed manually a remark should be included in the offshore weather report form.

6.5.3 Siting

The sensor should be positioned in accordance with the manufacturer's specifications. The sensor should be located as far away as practicable from the shielding effects of obstacles and structures.

6.6 **Cloud**

6.6.1 Performance

a) The performance of the cloud base recorder is limited by the view of the sensor. The equipment should be capable of measurement to the following accuracy limits, from the surface up to 5,000 ft above ground level:

Range	**Accuracy**
Up to and including 300 ft	Cloud height ±30 ft
Above 300 ft	Cloud height ±10%

b) The cloud base recorder should measure to a resolution of 100 ft.

c) The sensor(s) should be sampled at a minimum rate of once per minute.

d) Where appropriate software is utilised, cloud base detection systems may also provide an indication of the cloud amount. A cloud cover algorithm unit calculates the cloud amounts and the heights of different cloud layers, in order to construct an approximation of the entire sky. Such an approximation is limited by the detection system's coverage of the sky and should not be used in the weather report unless validated by the accredited observer.

6.6.2 Back-up

The accredited observer should assess the cloud by eye and estimate the height, assisted by reference material where appropriate. It should be noted that human estimates of cloud height without reference to any form of measuring equipment (particularly at night) may not meet the accuracy requirements stated above, so it is essential that when the cloud height has been assessed manually a remark is included in the offshore weather report form.

6.6.3 Siting

The sensor should be positioned in accordance with the manufacturer's specifications and is normally mounted on a platform or pedestal. The sensor should be located as far away as practicable from other light sources or reflections that might affect the measurement. Most ceilometers are fitted with blowers that prevent precipitation from settling on the lens; however, it is recommended that the sensor is installed in an area free of sea spray and away from any areas that are used routinely for wash-down. The sensor should have a clear view of the sky, uninterrupted by cranes or other structures that may obscure the sensor’s view. The height of the sensor above sea level should be noted to ensure that the necessary correction is applied to all readings. These types of sensors are only suitable for installation in safe areas and should not be installed near to radars or other radio transmitters.

7 **Calibration, Maintenance and Servicing Periods**

7.1 All sensors should be serviced by an engineer on at least an annual basis. Calibration should take place according to the instrument manufacturer's recommendation. Cleaning and routine maintenance should take place according to the instrument manufacturer's guidance; however, due to the harsh offshore environment cleaning routines may have to be increased in certain conditions.

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