Guidelines for the development and operation of off-shore helicopter landing sites, including vessels

**Relevant regulations and other references**
- Regulations 92, 92A and 93 of CAR 1988
- Proposed Parts 133 and 138 of CASR 1998
- Civil Aviation Order (CAO) 29.11
- Aeronautical Information Publication (AIP–AD)
- Annex 14 to the Convention on International Civil Aviation, Aerodromes, Volume II – Heliports
- ICAO Heliport Manual (Doc 9261)

**This CAAP will be of interest to**
- Air Operator’s Certificate (AOC) holders operating to off-shore facilities and vessels
- Operators and regulators of off-shore oil and gas platforms
- Shipping operators and marine port services providers
- Helicopter pilots conducting off-shore operations
- Helideck designs and certifiers

**Why this publication was written**
This Civil Aviation Advisory Publication (CAAP) has been written to provide for future regulation of off-shore helicopter operations under proposed Part 133 of CASR 1998 and to bring the advisory material on the design and siting of helidecks on off-shore platforms and vessels in the previous version (CAAP 92-1 (1)) up-to-date with current standards.

**Status of this CAAP**
This is the first issue of CAAP 92-4. However, some of the material was previously published in CAAP 92-2 (1). A new version of CAAP 92-2 will be published in parallel with this CAAP covering on-shore helicopter landing sites only.

**For further information**
For application and policy advice contact your local CASA regional office (Telephone 131 757).
Table of Contents

Acronyms 3
Definitions 4

PART 1 – Guidance on designing and siting an off-shore helideck 6
1. Introduction 6
2. Helicopter Performance Considerations 6
3. Helicopter Landing Sites – Physical Considerations 8
4. Visual Aids 25
5. Helideck Rescue and Fire Fighting Facilities 36
7. Helicopter Landing Areas on Vessels 47
8. Helicopter Winching Areas on Vessels 55

PART 2 – Related information on off-shore helideck operations 59
1. Visual Aids 59
2. Helideck Rescue and Fire Fighting 59
3. Miscellaneous Operational Standards 61
4. Helicopter Fuelling Facilities – Maintenance and Fuelling Procedures 64
5. Ongoing Conformity – Checklist 78
6. Provision of Meteorological Information from Off-shore Installations 80

APPENDIX A - Specification for helideck lighting scheme comprising: perimeter lights, lit touchdown/positioning marking and lit heliport identification marking 87
APPENDIX A1 - Guidance for helideck floodlighting systems 95
APPENDIX B - Specification for meteorological equipment for helidecks 98
APPENDIX C - References and sources 104
Acronyms

AMSL  Above Mean Sea Level
AOC   Air Operator’s Certificate
APPEA Australian Petroleum Production and Exploration Association
ATSB Australian Transport Safety Bureau
CA/GRO Certified Air/Ground Radio Officer
CFD   Computational Fluid Dynamics
DIFFS Deck Integrated Fire Fighting System(s)
DSV   Diving Support Vessel
FMS   Fixed Monitor System
FOD   Foreign Object Debris/Damage
FPSO  Floating Production Storage and Offloading
FSU   Floating Storage Unit
HDBG  Heliport Design Working Group (of ICAO Aerodromes Panel)
HEMS  Helicopter Emergency Medical Service
HLL   Helideck Limitations List
HLO   Helicopter Landing Officer
HLS   Helicopter Landing Site
IATA  International Air Transport Association
ICAO  International Civil Aviation Organization
ICS   International Chamber of Shipping
IMC   Instrument Meteorological Conditions
IMO   International Maritime Organization
ISO   International Standards Organization
LED   Light Emitting Diode
LFL   Lower Flammable Limit
LOS   Limited Obstacle Sector
MEK   Methyl Ethyl Ketone
MTOW  Maximum Certificated Take-Off Weight
NAA   National Aviation Authority
NDB   Non-Directional Beacon
NOPSEMA The National Off-shore Petroleum Safety and Environmental Management Authority
NUI   Normally Unattended Installation
NVG/NVIS Night Vision Goggles/Night Vision
OFS   Obstacle Free Sector
Definitions

**D-circle** means 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** means 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).

**Helideck** means an area intended for use wholly or partly for the arrival or departure of rotorcraft on:

(a) a ship; or
(b) a floating or fixed off-shore structure

**Helicopter Landing Officer** means a designated person on duty at an off-shore installation responsible for supporting safe helicopter operations to the helideck.

**Heliport** means an area:

(a) intended for use wholly or partly for the arrival or departure of rotorcraft, on:
    (i) land; or
    (ii) a building or other structure on land
(b) that meets the standards for a heliport set out in the International Civil Aviation Organization (ICAO) Annex 14, Aerodromes, Volume II – Heliports (as amended) or an equivalent standard, used by a National Aviation Authority.

**Helicopter Landing Site** means:

(a) an area of land or water, or an area on a structure on land, intended for use wholly or partly for the arrival or departure of helicopters; or
(b) a helideck; or
(c) a heliport.
**Landing Area** means a generic term referring to the load-bearing area primarily intended for the landing or take-off of aircraft. This area, sometimes referred to as the Final Approach and Take-Off (FATO/Touchdown and Lift-Off (TLOF) area, is bounded by the perimeter line and perimeter lighting.

**Limited Obstacle Sector** means the 150° sector within which obstacles may be permitted, provided the height of the obstacles is limited.

**Off-shore Installation** means:
(a) an infrastructure facility within the meaning of section 15 of the *Off-shore Petroleum and Greenhouse Gas Storage Act 2006*; and
(b) a floating facility, structure or installation:
(i) for engaging in any of the activities to which subsection 15 (2) or (3) of that Act applies that is not resting on, fixed to or connected to the seabed; and is not attached or tethered to an infrastructure facility within the meaning of section 15 of that Act.

**Off-shore Installation Operator** means the person, organisation or entity which owns or operates the off-shore installation.

**Obstacle Free Sector** means 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.

**Oil and Gas UK** is the representative body for the UK off-shore oil and gas industry.

**Perimeter D-Marking** means 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.

**Run-Off Area** means an extension to the Landing Area designed to accommodate a parked helicopter; sometimes referred to as the ‘Parking Area’.

**Touchdown/Positioning Marking 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. It should be noted that only correct positioning over the Touchdown/Positioning Marking (TD/PM) Circle will ensure proper clearance with respect to physical obstacles and provision of ground effect and adequate passenger access/egress.

**Universal Communications** means a non-ATS (Air Traffic Services) communication service provided to enhance the value of information normally available about a non-towered aerodrome.
PART 1 – Guidance on designing and siting an off-shore helideck

1. Introduction

1.1 Regulation 92 (1) of the Civil Aviation Regulations 1988 (CAR 1988) requires, in effect, that: an aircraft shall not land at or take-off from any place if, having regard to all the circumstances of the proposed landing or take-off, the aircraft cannot land at, or take-off from, the place safely.

1.2 Regulation 92 (1) of CAR 1988 does not specify the method of determining which ‘circumstances’, other than the prevailing weather conditions, should be considered in any particular case. These matters are the responsibility of the pilot-in-command, shared in some circumstances with the aircraft operator.

1.3 Despite this, due to the unique characteristics of the operating environment and the numbers of persons carried to and from off-shore installations, the oil and gas petroleum industry commonly requires specific standards to be in place to reduce the risks associated with off-shore helideck operations.

1.4 These guidelines, then, set out criteria for the siting and construction of helidecks on off-shore platforms and vessels. Helidecks that conform to these criteria should provide a safe area for the landing and taking-off of helicopters, provided that the pilot-in-command:

- adheres to the relevant specific procedures for the Helicopter Landing Site (HLS);
- adheres to the AOC holder’s standard operating procedures for these landing sites;
- has sound piloting skills; and
- displays sound airmanship.

2. Helicopter Performance Considerations

General Considerations

2.1 This guidance for helicopter landing areas on off-shore installations and vessels results from the need to ensure that helicopters are afforded sufficient space to be able to operate safely in the varying conditions experienced off-shore.

2.2 Helicopter companies conducting off-shore Regular Public Transport (RPT), charter or (in future CASR terminology) Air Transport operations are required to hold an AOC. The AOC is neither granted nor allowed to remain in force unless the holder provides procedures for helicopter crews which safely combine the risk mitigations of sufficient physical space and helicopter performance to manage the risks associated with the operation.

2.3 The helicopter’s performance requirements and handling techniques are contained in the approved Aircraft Flight Manual (AFM) and the operator’s Operations Manual, and pilots are linked to these requirements through the actions of Regulations 138 and 215 of CAR 1988.

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1 Guidance for the use of pontoons will form an attachment to this document at a later time and will pick up many of the engineering and other requirements set out here for Normally Unattended Installation (NUI) helidecks.
Safety Philosophy

2.4 Aircraft performance data is set out in the AFM and/or the Operations Manual which enables flight crew to accommodate 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.

2.5 Operators should recognise the remote possibility of engine failure in flight and provide the flight procedures and performance criteria necessary to minimise the risk to an aircraft and its occupants during the initial stage of take-off, or final stage of landing, and other stages of flight as necessary.

Factors Affecting Performance Capability

2.6 On any given day helicopter performance is a function of many factors including the actual all-up weight; ambient temperature; pressure altitude; effective wind speed component; and operating technique. The requirements for safe flight in consideration of these factors are outlined in the AFM, but are not the principal subject of this CAAP. Helideck builders and operators do, however, need to ensure these matters and the contents of the CAAP are taken into consideration when designing, constructing, modifying or operating their helidecks.

2.7 In the off-shore environment, other factors concerning the physical and airflow characteristics of the helideck and associated or adjacent structures will also combine to affect rotorcraft performance and the safety of operations.

2.8 These factors also need to be taken into account in the determination of potential specific and general limitations to ensure adequate performance is available for the proposed operation and to ensure operational safety risk is kept to a minimum. In many circumstances the period will be zero.

2.9 In certain circumstances, where exposure to a hazard would be unacceptable, it will probably be necessary to reduce helicopter take-off weight (and therefore payload) or even to suspend flying operations until conditions improve.

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2 Relevant helicopter performance classes are defined in proposed Regulation 133.360 of CASR 1998.
3. Helicopter Landing Sites – Physical Considerations

General

3.1 This section provides criteria on the physical characteristics of helicopter landing sites (helidecks) on off-shore installations and vessels. The guidance outlines for each helideck FATO/TLOF area, the maximum size of helicopter in terms of D-value and the weight for which that area is rated with regard to its size and strength. Table 1 below outlines some of the “D-values” associated with common helicopter types used in off-shore operations for information of the reader; however AOC holders and other operators must confirm these values from an approved source before operational use of this information. Where the criteria cannot be met in full for a particular type of helicopter it may be necessary to promulgate operational restrictions in order to compensate for deviations from these criteria. Helicopter operators must have a process which ensures for each helideck, they are aware of any limitations to the helideck and this information incorporated into their operational procedures.

Table 1: D-Value, ‘t’ Value and other Helicopter Type Criteria

<table>
<thead>
<tr>
<th>Type</th>
<th>D-value (metres)</th>
<th>Perimeter ‘D’ marking</th>
<th>Rotor diameter (metres)</th>
<th>Max weight (kg)</th>
<th>‘t’ value</th>
<th>Landing net size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolkow Bo 105D</td>
<td>12.00</td>
<td>12</td>
<td>9.90</td>
<td>2400</td>
<td>2.4t</td>
<td>Not required</td>
</tr>
<tr>
<td>EC 135 T2+</td>
<td>12.20</td>
<td>12</td>
<td>10.20</td>
<td>2910</td>
<td>2.9t</td>
<td>Not required</td>
</tr>
<tr>
<td>Bolkow 117</td>
<td>13.00</td>
<td>13</td>
<td>11.00</td>
<td>3200</td>
<td>3.2t</td>
<td>Not required</td>
</tr>
<tr>
<td>Agusta A109</td>
<td>13.05</td>
<td>13</td>
<td>11.00</td>
<td>2600</td>
<td>2.6t</td>
<td>Small</td>
</tr>
<tr>
<td>Dauphin AS365 N2</td>
<td>13.68</td>
<td>14</td>
<td>11.93</td>
<td>4250</td>
<td>4.3t</td>
<td>Small</td>
</tr>
<tr>
<td>Dauphin AS365 N3</td>
<td>13.73</td>
<td>14</td>
<td>11.94</td>
<td>4300</td>
<td>4.3t</td>
<td>Small</td>
</tr>
<tr>
<td>EC 155B1</td>
<td>14.30</td>
<td>14</td>
<td>12.60</td>
<td>4850</td>
<td>4.9t</td>
<td>Medium</td>
</tr>
<tr>
<td>Sikorsky S76</td>
<td>16</td>
<td>16</td>
<td>13.40</td>
<td>5307</td>
<td>5.3t</td>
<td>Medium</td>
</tr>
<tr>
<td>Agusta/Westland AW 139</td>
<td>16.66</td>
<td>17</td>
<td>13.80</td>
<td>6800</td>
<td>6.8t</td>
<td>Medium</td>
</tr>
<tr>
<td>Bell 412</td>
<td>17.13</td>
<td>17</td>
<td>14.02</td>
<td>5397</td>
<td>5.4t</td>
<td>Not Required</td>
</tr>
<tr>
<td>Bell 212</td>
<td>17.46</td>
<td>17</td>
<td>14.63</td>
<td>5080</td>
<td>5.1t</td>
<td>Not required</td>
</tr>
<tr>
<td>Super Puma AS332L</td>
<td>18.70</td>
<td>19</td>
<td>15.60</td>
<td>8599</td>
<td>8.6t</td>
<td>Medium</td>
</tr>
<tr>
<td>Bell 214ST</td>
<td>18.95</td>
<td>19</td>
<td>15.85</td>
<td>7936</td>
<td>8.0t</td>
<td>Medium</td>
</tr>
<tr>
<td>Super Puma AS332L2</td>
<td>19.50</td>
<td>20</td>
<td>16.20</td>
<td>9300</td>
<td>9.3t</td>
<td>Medium</td>
</tr>
<tr>
<td>EC 225</td>
<td>19.50</td>
<td>20</td>
<td>16.20</td>
<td>11000</td>
<td>11.0t</td>
<td>Medium</td>
</tr>
<tr>
<td>Sikorsky S92A³</td>
<td>20.88</td>
<td>21</td>
<td>17.17</td>
<td>12020</td>
<td>12.0t</td>
<td>Large</td>
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<tr>
<td>Sikorsky S61N</td>
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<td>22</td>
<td>18.90</td>
<td>9298</td>
<td>9.3t</td>
<td>Large</td>
</tr>
<tr>
<td>EH101</td>
<td>22.80</td>
<td>23</td>
<td>18.60</td>
<td>14600</td>
<td>14.6t</td>
<td>Large</td>
</tr>
</tbody>
</table>

1. Landing nets are not recommended where skid-equipped helicopters are to be used.
2. Manufacturer derived data has indicated that the Maximum Certificated Take-Off Weight (MTOW) of the S92A may grow to 12,565 kg. It is understood that structural design considerations for new build S92 helidecks will normally be based on the higher take-off weight (12,565 kg). Where structural design is certified by an independent certifier to be in accordance with this higher weight, helideck operators should display the higher ‘t’ value marking on the helideck.

³ Some Australian installations are included in the Helideck Limitations List at www.helidecks.org
Helideck Design Considerations – Environmental Effects

Introduction

3.2 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, that results 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 blow-down systems. It is almost inevitable that helidecks installed on the cramped topsides of off-shore 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.

3.3 Advice on the design and placement of off-shore helidecks is provided in this document, in relation to certain environmental criteria. 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, any limitations must be notified to helicopter operators prior to any operations to the helideck. Similarly, in accordance with Regulations 92, 218 and 219 of CAR 1988, it is incumbent on the AOC holder and the pilot in command to ensure they are also aware of these limitations prior to operations. These limits are usually specific to particular combinations of wind speed and direction, and either restrict helicopter weight (payload) or prevent flying altogether in certain conditions.

3.4 This process should ensure that operations to and from off-shore helidecks are properly controlled when adverse environmental effects are present as severe operational restrictions may result from poorly designed helidecks, leading to significant commercial penalties for an installation operator or vessel owner. Well designed and ‘helicopter friendly’ helidecks should result in efficient operations and cost savings for the off-shore installation operator.

3.5 For new build helidecks, it is important that helicopter operators are always consulted at the earliest stage of design so that the process for the operator authorising the use of the helideck can be completed in a timely fashion and in a manner which ensures that maximum helicopter operational flexibility. Information from helideck flow assessment studies (see paragraphs 3.10 to 3.12 below) should be made available to the helicopter operators 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.

Design Guidance

3.6 The design guidance in this CAAP is relevant to new build designs for Australian operations, rather than those installations which arrive from overseas. Notwithstanding this, it is strongly recommended that platform designers and off-shore installation operators consult the UK CAA document 2008/03: Helideck Design Considerations – Environmental Effects (UK CAA document 2008/03), which is available in the publications section of the CAA website, at the earliest possible stage of the design process.

DRAFT: October 2012
3.7 The objective of this CAAP and the UK CAA document 2008/03 is to help platform designers create off-shore installation topside designs, and helidecks that are safe for helicopter operations by minimising exposure to environmental effects. If used from ‘day one’ of the off-shore installation design process, this information should prevent or minimise many helideck environmental problems at little or no extra cost to the design or construction of the installation.

Design Criteria

3.8 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.

3.9 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.

3.10 All new-build off-shore helidecks, modifications to existing topside arrangements which may alter 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. Helicopter operators should be informed at the earliest opportunity of any wind conditions for which this criterion is not met as operational restrictions may be necessary.

3.11 The limit on the standard deviation of the vertical airflow velocity of 1.75 m/s is designed 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 helicopter operators routinely monitor pilot workload and that this be used to inform and enhance procedures continually for each platform (see UK CAA Paper 2008/02 – Validation of the Helicopter Turbulence Criterion for Operations to Off-shore Platforms for further technical information).

3.12 Unless there are no significant heat sources on the installation or vessel, off-shore installation operators 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, so that appropriate operational restrictions may be applied.

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4 Installation operators should maintain a record of pilot reports of turbulence in the vicinity of the landing area and ensure that all helicopter operators using the helideck are aware of any turbulence issues. Where there are continuing turbulence issues with a helideck, installation operators should consider structural modifications to the installation or other mitigations.
3.13 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 minimise its effects by making it easier to avoid encountering the plume. Helicopter and installation operators should also monitor the temperature environments around all off-shore platforms. This action is aimed at identifying any ‘problem’ platforms and identifying any new problems and hence limitations caused by changes to platform topsides or resulting from combined operations, as well as identifying any issues related to flight crew training or procedures.

3.14 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 blow-down systems should be assumed to result in excessive gas concentrations. Platform 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.

3.15 The installation of ‘Status Lights’ (paragraph 4.32 of this CAAP) 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.

3.16 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 ‘other’ 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.

3.17 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.

3.18 In respect of permanent multi-platform configurations and ‘temporary’ combined installations 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.\(^5\)

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\(^5\) Additional considerations can be found in *Guidelines for the Management of Aviation Operations*, published by Oil and Gas UK (See Appendix C)
**Structural Design**

3.19 The take-off and landing area should be designed for the heaviest and largest helicopter expected to use the facility (see Table 1 above). Helideck structures should be designed in accordance with relevant International Organization for Standards (ISO) codes for off-shore structures and for floating installations. The maximum size and weight of helicopters for which the helideck has been designed should be stated in the installation/vessel operations manual and certification document.

3.20 Optimal operational flexibility may be gained from considering the potential life and usage of the facility along with likely future developments in helicopter design and technology (e.g. the AW 609 ‘Tilt-rotor’).

3.21 Consideration should also be given in the design to other types of loading such as personnel, other traffic and ice, freight, refuelling equipment, rotor downwash etc. as stated in the relevant ISO codes. It may be assumed that single main rotor helicopters will land on two wheels (or both 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.

3.22 Consideration should be given to the possibility of accommodating an unserviceable helicopter in a designated parking or run-off area (where provided) adjacent to the helideck to allow a relief helicopter to land. If this contingency is designed into the construction/operating philosophy of the installation, weight restrictions may need to be imposed on the relief helicopter for structural integrity reasons. Where a parking or run-off area is provided it is assumed the structural considerations will at least meet the loads criteria applicable for helicopters at rest (see section 5 below).

3.23 Requirements for the structural design of helidecks are comprehensively set out in ISO 19901-3 Petroleum and natural gas industries – Specific requirements for off-shore structures, Part 3: Topsides structure. Useful guidance is also given in the Off-shore Industry Advisory Committee’s publication *Off-shore Helideck Design Guidelines* (see Appendix C of this CAAP).

3.24 Alternative loading criteria equivalent to those recommended here and in sections 4 and 5 of this CAAP 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. In consideration of alternative criteria, it is assumed that a single engine failure represents the worst case in terms of rate of descent on to the helideck among likely survivable emergencies.
Loads – Helicopter Landings

3.25 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 should include:

- **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 Maximum Take-off Weight (MTOW) of the helicopter should be used, distributed as described in paragraph 3.21 of this CAAP above. This should be treated as an imposed load, applied together with the combined effect of the load factors from the following four dot points 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 MTOW should be applied. Normally, the emergency landing case will govern the design of the structure.

- **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 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.

- **Overall superimposed load on the landing platform.** In addition to wheel loads, an allowance of 0.5 kiloNewtons per square metre (kN/m²) should be added over the whole area of the helideck to allow for any appendages that may be present on the deck surface e.g. helideck net, “H” and circle lighting etc.

- **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 MTOW 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.

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

- **Wind loading.** Wind loading should be allowed for in the design of the platform. Where available, the 100-year return period wind actions should be applied in the direction which, together with the imposed lateral loading, will produce the most severe loading condition on each structural element.

- **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 10³ mm² acting in any probable location. Particular attention to detail should be paid to the junction of the supports and the platform deck.

Loads – Helicopters at Rest

3.26 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:

- **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 MTOW 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.
• **Overall superimposed load.** To allow for personnel, freight, refuelling equipment and other traffic and ice, rotor downwash etc., an allowance of 2.0 kN/m$^2$ should be added to the whole area of the helideck.

• **Dead load and wind load.** The values for these loads are the same as given in the fifth and sixth dot points in paragraph 3.25 above and should be considered to act simultaneously in combination with the first two points above. Consideration should also be given to the additional wind loading from any parked or secured helicopter.

• **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.

### Location and Size of Obstacle Protected Surfaces

3.27 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 200 ft above sea level, the regularity of helicopter operations may be adversely affected in low cloud base conditions.

3.28 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 above, for D values). Due to the actual shape of most off-shore helidecks the D-circle will be ‘hypothetical’ but the helideck shape should be capable of accommodating such a circle within its physical boundaries.

3.29 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 cm for any helideck where the D-value is greater than 16 m or by more than 5 cm for any helideck where the D-value is 16 m or less:

- the guttering (associated with the requirements in paragraph 3.44 of this CAAP);
- the lighting required by Section 4 of this CAAP;
- the foam monitors (where provided); and
- those handrails and other items (e.g. an exit sign) associated with the landing area, which are incapable of complete retraction or lowering for helicopter operations.

3.30 Objects whose function requires that they be located on the surface of the landing area such as landing nets and lighting systems should not protrude above 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.

3.31 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 on Page 16. Acceptance of the ‘swung’ criteria will normally only be applicable to existing installations (Normal practice is to swing the 180° falling 5:1 gradient by a corresponding amount to indicate, and align with, the swung OFS.)
3.32 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 coincident. No objects above 25 cm (or 5 cm where the D-value of the helideck is 16 m or less) 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). The exact point of origin of the LOS is assumed to be at the periphery of the D-circle.

3.33 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.

3.34 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. Note that where the D-value is 16 m or less, objects in the first segment of the LOS are restricted to 5 cm.
3.35 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.

3.36 While application of the criteria in paragraph 3.28 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 engine 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. 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, over). All objects that are underneath anticipated final approach and take-off paths should be assessed.

3.37 A falling 5:1 Gradient is defined as: 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.

3.38 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 sensors 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.

3.39 It has been 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.

3.40 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 helicopter operators 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.
3.41 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 needed to accommodate the one-engine inoperative capability of the helicopter type to be used, it may be necessary to impose operating restrictions on one or all of the helidecks affected. More information on the management and control of combined operations can be found in Oil and Gas UK’s Guidelines for the Management of Aviation Operations (see Appendix C for references).

Figure 2: Obstacle Free Areas – Below Landing Area Level (for all types of helicopters)
3.42 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 operators and crews to be kept informed of all temporary infringements.

Surface

3.43 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 3.49). It is important that adequate friction exists in all directions and in worst case conditions, i.e. when the deck is wet. Over-painting friction surfaces on such designs with other than non-slip material will likely compromise the surface friction. Aluminium helidecks are unlikely to meet the minimum friction requirement without a non-slip coating or other means.

3.44 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.

3.45 Note that where a helideck is constructed in the form of a grating, for example where a passive fire-retarding system is selected (see Section 6), the design of the helideck should ensure that ground effect is not reduced.

3.46 Tautly-stretched rope netting should be considered 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.

3.47 Provided assessment indicates no reduction in safety, 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 off-shore. 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, below, may be modified.
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 6.4 above.

3.48 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>
<thead>
<tr>
<th>Table 2: Helicopter Deck Netting</th>
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<tbody>
<tr>
<td>Small</td>
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<tr>
<td>Medium</td>
</tr>
<tr>
<td>Large</td>
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</tbody>
</table>

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

3.49 For fixed normally attended installations, 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 an acceptable test method, a helideck landing net may not be required. The installation operator should ensure thereafter that the helideck is kept free from oil, grease, ice, excessive surface water or any other contaminant (particularly guano) that could degrade surface friction. Assurance should be provided to helicopter operators 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.

3.50 The criteria for removal and the frequency of subsequent testing should be approved by an independent certifying body. Friction testing periodicity can be determined using a simple trend analysis as described in UK CAA Paper 98002. Table 3, below, indicates typical frequencies of inspection for given ranges of friction values.

<table>
<thead>
<tr>
<th>Table 3: Friction Requirements for no or removal of Landing Area Net</th>
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</thead>
<tbody>
<tr>
<td>Average surface friction value</td>
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<tr>
<td>0.85 and above (Recognised Friction Surface)</td>
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<tr>
<td>0.7 to 0.84</td>
</tr>
<tr>
<td>0.65 to 0.69</td>
</tr>
<tr>
<td>Less than 0.651</td>
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</tbody>
</table>

Source: UK CAA Paper 98002 (see reference in Appendix C)

3.51 The helideck friction test method should involve a friction measuring device that employs the braked wheel technique, is able to control the wetness of the deck during testing, includes electronic data collection, storage and processing, and allows the whole of the deck surface to be covered to a resolution of not less than 1m². The minimum average surface friction value of 0.65 should be achieved across the area inside the touchdown/positioning marking, outside the touchdown/positioning marking and on the paint markings themselves.

3.52 Approval to remove landing nets on 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.
3.53 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 helicopter operators for specific installations.

3.54 Experience has shown that the removal of existing 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 this reason 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.

**Helicopter Tie-Down Points**

3.55 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.
3.56 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 bar diameter of the tie-down point should match the strop hook dimension of the tie-down strops carried in most off-shore helicopters (22 mm). Advice on recommended safe working load requirements for strop/ring arrangements for specific helicopter types can be obtained from the helicopter operator.

3.57 An example of a suitable tie-down configuration is shown at Figure 3 above. The helicopter operator should provide guidance on the configuration of the tie-down points for specific helicopter types, but note:

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.
Perimeter Safety Net

3.58 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 m 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°.

3.59 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. Perimeter nets may incorporate a hinge arrangement to facilitate the removal of sacrificial panels for testing.

Access Points

3.60 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 off-shore 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.

3.61 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.

3.62 The need to preserve, in so far as possible, an unobstructed falling 5:1 gradient (see paragraphs 3.36 and 3.42 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.

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6 It is not within the scope or purpose of this CAAP to provide detailed guidance for the design, fabrication and testing of helideck perimeter nets. Specific issues on this subject are addressed in Oil and Gas UK’s Guidelines for the Management of Aviation Operations (see reference in Appendix C). However, perimeter nets that extend up to 2 metres in the horizontal plane, measured from the edge of the landing area, are unlikely to attract operational limitations.
3.63 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 route referred to in paragraph 3.61 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 to 2.0 metres of the edge of the landing area).

3.64 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.

3.65 Where handrails associated with helideck access/escape points exceed the height limitations given at paragraph 3.29 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 (usually indicated by the crew switching off the helicopter anti-collision light), the handrails may be raised and locked in position. The handrails should be retracted, collapsed or removed again prior to the helicopter taking off.

**Winching (Hoist) Operations**

3.66 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, it is recommended that a helicopter landing area (helideck) should be provided. In Australia winching is classified as an aerial work operation, and as such, should not be adopted as a normal method of personnel transfer in current RPT, charter or future Air Transport operations. However, if winching operations are required for other purposes, they should be conducted in accordance with procedures agreed with helicopter operators and contained within the helicopter operator’s Operations Manual consistent with relevant regulations and Civil Aviation Order (CAO). Requirements for winching operations should be discussed with the specific helicopter operator well in advance. Winching area design arrangements are described in more detail in Section 9 of this CAAP.

**Normally Unattended Installations (NUIs)**

3.67 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 continuously 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. NUls 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.

3.68 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 3.49 to 3.52 above), permanent removal of the landing net on NUls is not normally a viable option unless effective preventative measures are in place.
4. Visual Aids

General

4.1 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.

4.2 The approved radio call-sign 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.

4.3 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. See Appendix C for reference to guidance on the identification of off-shore installations.

4.4 The installation identification 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 fitted).

4.5 Helideck perimeter line marking and lighting serve to identify the limits of the Landing Area (see Definitions on page 4) for day and night operations respectively.

4.6 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 primary 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.

4.7 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.
Helideck Landing Area Markings

4.8 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 4 below). Non-slip materials should be used (see paragraph 3.43 of this CAAP).

Figure 4: Helideck Markings (Single Main Rotor Helicopters)

4.9 The origin of the 210° OFS for approach and take-off as specified in Section 3 of this CAAP 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 5, over. 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. Where the OFS is swung in accordance with the provision of paragraph 3.31 of this CAAP this should be reflected in the alignment of the chevron. The purpose of the chevron is to provide visual guidance to the Helicopter Landing Officer (HLO) so that he or she 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.

4.9.1 Aluminium helidecks are in use throughout the off-shore industry. Some of these are a natural light grey colour and may present painting difficulties. In such cases the legibility of the helideck markings may need to be enhanced by, for example, overlaying white markings on a painted black background. Additionally, the appearance of the yellow TD/PM Circle may be enhanced by outlining the deck marking with a thin black line (typically 10 cm wide).
4.10 The actual D-value of the helideck (paragraph 3.28 of this CAAP) 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 requirement of 210°, the 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. New build helidecks should always comply in full with the requirement to provide a minimum 210° OFS.

4.11 The helideck D-value should also be marked around the perimeter of the helideck in characters no less than 90 cm high, in the manner shown in Figures 4 and 5, above, in a colour contrasting with the helideck surface (preferably white, and avoid black or grey for night use)\(^7\). The D-value should be expressed to the nearest whole number with 0.5 rounded down (see Table 3 in Section 3).

\(^7\) 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. For helidecks where the actual D-value is less than 15 m, the height of the numbers may be reduced from 90 cm to no less than 60 cm.
4.12 A maximum allowable weight 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 weight in tonnes. 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 weight marking should be well separated from the installation identification marking (see paragraph 4.4) in order to avoid possible confusion on recognition. Refer also to Figure 4 above and Table 1 in Section 3.

4.13 A TD/PM circle should be provided (see Figures 4, above, and 6 below). 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 m. The centre of the marking should be concentric with the centre of the D-circle.

4.14 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\(^8\).

\(^8\) Some existing helidecks may have the TD/PM Circle offset by more than 0.1D. Operators of these installations should consider whether, for the safety of deck personnel, flight crew and passengers, the circle should be moved back towards the OFS in line with this paragraph.
4.15 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 7.

![Diagram](image)

**Figure 7**: Dimensions of heliport identification marking ‘H’ (to be painted white)

4.16 Where the OFS has been swung in accordance with paragraph 3.31, the positioning of the TD/PM and ‘H’ should comply with the normal un-swung criteria. However, the ‘H’ should be orientated so that the bar is parallel to the bisector of the swung sector.

4.17 Prohibited landing heading sector(s) 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. 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 8 and 9. When positioning over the TD/PM helicopters manoeuvre so as to keep the aircraft nose clear of the hatched prohibited sector at all times.
4.18 The position of the ‘H’ and the orientation of the prohibited landing heading segment will depend on the obstacle. For narrow objects, such as a lamp post, a minimum practical size should be established to allow for a margin for safety for different flying accuracies and conditions.
4.19 For certain operational or technical reasons an installation operator 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 10. The standard signal is the large enough to just cover the ‘H’ inside the TD/PM.

![Figure 10: Landing on Installation/Vessel Prohibited Signal](image)

4.20 Colours should conform to the following Australian Standard AS 2700-1996

a) **RED**  
   AS 2700: R13 (Signal Red)

b) **YELLOW**  
   AS 2700: Y14 (Golden Yellow)

c) **GREEN**  
   AS 2700: G35 (Lime Green)

d) **WHITE**  
   AS 2700: N14 (White)

**Lighting**

4.21 The helideck lighting scheme is intended to provide effective visual cues for a pilot throughout the approach and landing manoeuvre at night. Starting with the initial acquisition of the helideck, the lighting needs to enable a pilot to easily locate the position of the helideck, on the installation at long range on an often well-lit off-shore structure. The lighting should then guide the helicopter to a point above the landing area and then provide visual cues to assist with the touchdown.

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9 The paragraphs in the lighting section should be read in conjunction with Appendix A to this CAAP which contains the specification for the full helideck lighting scheme, comprising perimeter lights, lit touchdown/positioning marking and lit heliport identification “H” marking.

**DRAFT**: October 2012
4.22 The specification has an in-built assumption that the performance of the helideck lighting system will not be diminished by the presence of any other lighting due to the relative intensity, configuration or colour of other lighting sources on the installation or vessel. Where other non-aeronautical ground lights have the potential to cause confusion or to diminish or prevent the clear interpretation of helideck lighting systems, it will be necessary for an installation or vessel operator to extinguish, screen or otherwise modify these lights to ensure that the effectiveness of the helideck lighting system is not compromised. This will include, but may not be limited to, an assessment of the effect of general installation lighting on the performance of the helideck lighting scheme. It is recommended that installation and vessel operators shield high intensity light sources (e.g. by fitting screens or louvres) from helicopters approaching and landing, and maintain good colour contrast between the helideck lighting and surrounding installation lighting. Particular attention should be paid to the areas of the installation adjacent to the helideck.

4.23 The specification contained in Appendix A to this CAAP includes a facility to increase the intensity of some elements of the helideck lighting by up to two times to compensate for installations or vessels with high levels of background lighting. Any adjustment above the nominal values specified should be carried out in conjunction with the helicopter operator as a once-off exercise following installation of the lighting, and subsequently if required following changes to the lighting environment at the installation or vessel. The intensity of the helideck lighting should not be routinely adjusted, and should not be adjusted without the involvement and agreement of the helicopter operator.

4.24 The periphery of the landing area should be delineated by omni-directional green perimeter lights visible from on or above the landing area; however the pattern formed by the lights should not be visible to the pilot from below the elevation of the landing area. Perimeter lights should be mounted above the level of the helideck but should not exceed the height limitations specified in, paragraph 3.2 of Appendix A to this CAAP. 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 4.8 above). 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. 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. For example, where a run-off area is provided there may be a need to move the helicopter itself to and from the landing area onto the adjacent run-off (parking) area. Care should be taken to select flush fitting lights that will meet the iso-candela requirements stated Table A2 in Appendix A to this CAAP.

4.25 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 circle, 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 (see paragraphs 3.32 to 3.34) from the perimeter marking and coincident lighting, adequate main rotor to obstruction separation should be achieved for the worst-case helicopter intending to operate to the helideck.
4.26 In order to aid the visual task of final approach and hover and landing it is important that the helideck is adequately illuminated for use at night. In the past this has typically been achieved by providing systems of 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, however, that deck level lighting systems can adversely affect the visual cueing environment by reducing the visibility of helideck perimeter lights during the approach, and by causing glare and loss of pilots’ night vision during the hover and landing. Furthermore, flooding systems often fail to provide adequate illumination of the centre of the landing area leading to the so called ‘black-hole effect’. Even well designed and maintained flooding systems do not provide effective visual cueing until within relatively close range of the helideck due to the scale of the visual cues involved.

4.27 Effective visual cues can be provided by means of a lit touchdown/positioning marking circle and a lit heliport identification ‘H’ marking. This scheme, described in detail in Sections 4 and 5 of Appendix A to this CAAP, has been demonstrated to provide the visual cues required by the pilot earlier on in the approach, much more effectively than flooding and without the disadvantages associated with floodlights such as glare. All operators of off-shore helidecks should consider the safety benefits of upgrading their existing facilities to meet the specification described in Appendix A.

4.28 This lighting specification has been developed to be compatible with helicopters having wheeled undercarriages. Although compliant with the International Civil Aviation Organization (ICAO) maximum obstacle height of 2.5 cm and likely to be able to withstand the point loading presented by (typically) lighter skidded aircraft, compatibility should be considered before operating skidded helicopters to helidecks fitted with the new lighting.

4.29 Note, however, that at the time of publication of this guidance material, the durability of this lighting specification has not been fully established and ‘teething’ problems cannot be ruled out. A temporary source of alternative helideck lighting may therefore be desirable in the event that significant reliability problems occur. There is also the possibility of guano rendering the new lighting ineffective on some NUIs. It may, then, be desirable to retain compliant floodlighting as a back-up on some installations (see Appendix A1 to this CAAP).

4.30 The system described above assures that effective visual cueing will be provided for the acquisition, approach, hover and landing task. However, existing floodlighting may be retained for the purpose of providing a source of illumination for on-deck operations, such as refuelling and passenger handling and, where required, for lighting the installation name on the helideck surface. Unless otherwise instructed by aircrew, floodlights should not be used during the acquisition, approach to hover, landing and take-off phases. In addition particular care should be taken to maintain correct alignment to ensure that floodlights do not cause dazzle or glare to pilots at the controls of a helicopter while on the helideck. All floodlights should be capable of being switched on and off at the pilot’s request and accessible to, and controlled by, the HLO.

4.31 For some decks, especially NUIs, it may be beneficial to improve depth perception by redeploying floodlighting to the main structure or ‘legs’ of the platform.
**Visual Warning Lights**

4.32  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. See Appendix C for a reference which provides a specification for the status light system summarised below.

4.33  **Status Lights**

- 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 Annex 14, Aerodromes Volume I, Aerodrome Design and Operations, Appendix I – Colours for aeronautical ground lights, markings, signs and panels.
- 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.
- A means of resetting the system which, in the case of NUIs, does 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, but 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.

4.34 Manufacturers are reminded that the minimum intensity specification stated above is considered acceptable to meet current operational requirements, which specify a minimum meteorological visibility of 1500 m for instrument approach-based arrivals. Development of off-shore approach aids which permit lower minima (e.g. differential GPS) will require a higher intensity.

4.35 The installation’s emergency power supply 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.

Obstacles – Marking and Lighting

4.36 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, or more than six metres wide. The colour should be chosen to contrast with the background to the maximum extent. Paint colours should conform to the references at paragraph 4.20 above.

4.37 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.

4.38 Omni-directional low intensity steady red obstruction lights conforming to the specifications for low intensity obstacle lights which conform to Chapter 9 of the Manual of Standards to Part 139 of CASR 1998, 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 helicopter operator if possible.

4.39 An omni-directional low intensity steady red obstruction light should be fitted also to the highest point of the installation. The light should conform to the specifications for a low intensity obstacle light described in Chapter 9 of the Part 139 MOS, but have a minimum peak intensity of 200 cd 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.

4.40 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 omni-directional low intensity steady red lights of the same intensity and characteristics as described in the previous paragraph. 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 4.37, above, 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.
4.41 Any ancillary structure within 1 km of the landing area, and which is significantly higher than it, should be similarly fitted with red lights.

4.42 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.

4.43 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, and it should be fed from a UPS system.

5. **Helideck Rescue and Fire Fighting Facilities**

**Introduction**

5.1 This Section sets out guidance regarding provision of equipment, extinguishing media, personnel, training, and emergency procedures for off-shore helidecks on installations and vessels.

**Key Design Characteristics – Principal Agent**

5.2 A key aspect in the successful design for providing an efficient, integrated helideck rescue and fire fighting (RFF) 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.

5.3 Delivery of fire fighting media to the landing area at the appropriate application rate should be achieved in the quickest possible time. 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 is for the system 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 that may exist at the installation site. A fire is deemed to be ‘under control’ at the point when it becomes possible for the occupants of the helicopter to be rescued by trained fire-fighters.

5.4 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 an 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 monitor(s) 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 5.10 below.

5.5 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. The effects of condensation on stored equipment should be considered.
5.6 The minimum capacity of the foam production system will depend on the D-value of the helideck, the foam application rate, 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.

5.7 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. It is recommended that foam concentrates compatible with seawater and meeting at least ICAO Performance Level ‘B’ are used. Level B foams should be applied at a minimum application rate of six litres per square metre per minute\(^{10}\). See Appendix C to this CAAP for a reference to the relevant ICAO document.

5.7.1 Calculation of Application Rate: For a helideck with a D-value of 22.2m. Application rate = \(6 \times \pi \times r^2\) \((6.0 \times 3.142 \times 11.1 \times 11.1) = 2322\) litres per minute.

5.8 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 to be reasonable.

5.8.1 Calculation of Minimum Operational Stocks: Using the 22.2 metre example 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. Sufficient reserve foam stocks to allow for replenishment as a result of operation of the system during an incident or following training or testing should be held.

5.9 Low expansion foam concentrates can generally be applied in either aspirated or un-aspirated form. It should be recognised that whilst un-aspirated foam may provide a quick knockdown of any fuel fire, aspirated 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.

5.10 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 branch pipes 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 branch pipe capable of applying water in the form of a jet or spray pattern for cooling, or for specific fire fighting tactics.

\(^{10}\) If Level C foams are available the application rate may be reduced to 3.75 litres per square metre per minute.
5.11 Where a Deck Integrated Fire Fighting System (DIFFS) capable of delivering foam and/or seawater in a spray pattern to the whole of the landing area 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 ‘Complementary Media’ below).

5.12 DIFFSs 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 likely to be encountered at the site. A DIFFS should be capable of supplying Performance Level B or Level C foam solution to bring under control a fire associated with a crashed helicopter within the time constraints stated in paragraph 5.3, above, achieving an average (theoretical) application rate over the entire landing area (based on the D-circle) of six litres per square metre per minute for Level B foams and 3.75 litres per square metre per minute for Level C foams, for a duration, which at least meets the minimum requirements stated in paragraph 5.8 above.

5.13 The precise number and lay out of pop-up nozzles will be dependent on the specific helideck design, particularly the dimensions of the critical area. However, nozzles should not be located adjacent to helideck egress points as this may hamper quick access to the helideck by rescue crews and/or impede occupants of the helicopter escaping to a safe place beyond the helideck. Notwithstanding this, the number and lay out of nozzles should be sufficient to provide an effective spray distribution of foam over the entire landing area with a suitable overlap of the horizontal spray component from each nozzle assuming calm wind conditions. It is recognised in meeting the objective for the average (theoretical) application rate specified in paragraph 5.12, above, for Performance Level B or C foams, there may be some areas of the helideck, particularly where the spray pattern of nozzles significantly overlap, where the average (theoretical) application rate is exceeded in practice. Conversely for other areas of the helideck the application rate in practice may fall below the average (theoretical) application rate specified in 5.12. This is acceptable provided that the actual application rate achieved for any portion of the landing area does not fall below two-thirds of the rates specified in 5.12 for the critical area calculation.

5.14 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 Performance Level B foam DIFFS in paragraphs 5.12 and 5.13 above.

5.15 In a similar way to where an FMS is provided, 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. Any local damage to the helideck, nozzles and distribution system, caused by a helicopter crash, should not hinder the system’s overall ability to deal effectively with a fire situation. To this end a DIFFS supplier should be able to verify that the system remains fit for purpose, in being able to bring a helideck fire associated with a crashed helicopter “under control” within 30 seconds measured from the time the system is producing foam at the required application rate for the range of weather conditions prevalent at the site.

5.16 If lifesaving 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 landing area, and the location of the storage facilities should be clearly indicated.
**Complementary Media**

5.17 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, avionics bays, transmission areas, hydraulics) may require the provision of more than one type of agent. Dry powder and gaseous agents are generally considered acceptable for this task. The complementary agents selected should comply with the appropriate specifications of the ISO. Systems should be capable of delivering the agents through equipment which will ensure its effective application.

5.18 The use of dry powder as the primary complementary agent is recommended. 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 and the discharge rate of the agent should be selected for optimum effectiveness of the agent. Containers of sufficient capacity to allow continuous and sufficient application of the agent should be provided.

5.19 It is also recommended that a gaseous agent is used in addition to the use of dry powder as the primary complementary agent. Therefore, in addition to the dry powder specified above, 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. The discharge rate of the agent should be selected for optimum effectiveness of the agent. Due regard should be paid to the requirement to deliver gaseous agents to the seat of the fire at the recommended discharge rate. All complementary agents could be adversely affected during application and training courses should take this into account.

5.20 Off-shore helicopters should 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 and 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.

5.21 Other Considerations

- All applicators should be fitted with a mechanism which allows them to be hand controlled.
- Dry chemical powder should be of the ‘foam compatible’ type.
- The complementary agents should be sited so that they are readily available at all times.
- Space for 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 provided.
- Complementary agents should be subject to annual visual inspection by a competent person and pressure testing in accordance with manufacturers’ recommendations.

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11 Halon extinguishing agents are no longer specified for new installations. Gaseous agents, including CO₂, have replaced them. The effectiveness of CO₂ is accepted as being half that of halon.
 normally unattended installations (nui)

5.22 In the case of NUIs, serious consideration should be given to the selection and provision of foam as the principal agent. For an NUI, where helideck RFF equipment may be unattended during certain helicopter movements, the pressurised discharge of foam through a manually operated fixed monitor system is not recommended. For installations which are at times unattended, the effective delivery of foam to the whole of the landing area is probably best achieved by means of a DIFFS (see paragraphs 5.11 to 5.14).

5.23 For NUIs, operators 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.

5.24 DIFFS on NUIs should be integrated with platform safety systems such that pop-up nozzles are activated automatically in the event of an impact of a helicopter on the helideck where a fire results. The overall design of a DIFFS should incorporate a method of fire detection and be configured to avoid spurious activation. It should be capable of manual override by the HLO and from the mother installation or from 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 paragraphs 5.11 to 5.14 should also apply for a DIFFS located on an NUI.

Rescue Equipment

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

5.26 It is strongly recommended that the design provides for at least the following equipment set-out in Table 5 below. Sizes of equipment are not detailed but should be appropriate to the types of helicopter expected to use the facility. A suitable storage area should be provided.

Table 5: Rescue Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Helicopter RFF Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>H1/H2</td>
</tr>
<tr>
<td>Adjustable wrench</td>
<td>1</td>
</tr>
<tr>
<td>Rescue axe, large (non-wedge or aircraft type)</td>
<td>1</td>
</tr>
<tr>
<td>Cutters, bolt</td>
<td>1</td>
</tr>
<tr>
<td>Crowbar, large</td>
<td>1</td>
</tr>
<tr>
<td>Hook, grab or salving</td>
<td>1</td>
</tr>
<tr>
<td>Hacksaw (heavy duty) and six spare blades</td>
<td>1</td>
</tr>
<tr>
<td>Blanket, fire resistant</td>
<td>1</td>
</tr>
<tr>
<td>Ladder (two-piece)*</td>
<td>1</td>
</tr>
<tr>
<td>Life line (5 cm circumference x 15 m in length) plus rescue harness</td>
<td>1</td>
</tr>
<tr>
<td>Pliers, side cutting (tin snips)</td>
<td>1</td>
</tr>
<tr>
<td>Set of assorted screwdrivers</td>
<td>1</td>
</tr>
<tr>
<td>Harness knife and sheath**</td>
<td>**</td>
</tr>
<tr>
<td>Gloves, fire resistant**</td>
<td>**</td>
</tr>
<tr>
<td>Self-contained breathing apparatus</td>
<td>2</td>
</tr>
</tbody>
</table>

* For access to casualties in an aircraft on its side. ** This equipment is required for each helideck crew member.
5.27 It is recommended that provision be made for at least two, positive pressure, self-contained breathing apparatus (SCBA) sets complete with ancillary equipment and two reserve cylinders. These should be appropriately stored and readily available close to the helideck for fast deployment by the helideck crew.


**General**

6.1 The contents of this chapter are intended as general advice/best practice guidance for the design and construction requirements for helicopter fuelling systems for use on off-shore installations and vessels. Fire safety requirements for equipment in the vicinity of helicopter fuelling operations are contained in Appendix 1 to CAO 20.9.

**Product Identification**

6.2 It is essential to ensure at all times that aviation fuel delivered to helicopters from off-shore 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. The correct identification markings should initially be applied during system manufacture and routinely checked for clarity during subsequent maintenance inspections.

**Fuelling System Description**

6.3 Off-shore fuelling systems vary according to the particular application for which they are designed. Nevertheless, the elements of all off-shore fuelling systems are basically the same and generally include:

- transit tanks;
- static storage facilities and, if installed, a sample reclaim tank (see paragraph 6.4);
- a pumping system; and
- a delivery system.

6.4 In some systems built-in static storage tanks are not provided. In these cases delivery of fuel directly to the aircraft from transit tanks is acceptable and sample reclaim tanks should not be used.

**General Design Considerations**

6.5 When preparing a layout design for aviation fuelling systems on off-shore installations and vessels it is important to make provisions for suitable segregation and bunding of the areas set aside for the tanks 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).
Transit Tanks

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

6.7 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.

6.8 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.

6.9 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.

6.10 Tanks should normally be equipped with the following:

- **Access Plate.** A 450 mm or greater plate to allow physical access to the interior of the tank.
- **Inspection Hatch.** If the manhole position and/or cover type is unsuitable for inspecting the lower end of the tank, a 150 mm hatch should be fitted to enable inspection.
- **Dipstick Connection.** A suitable captive dipstick to determine the tank contents.
- **Emergency Pressure Relief.** A stainless steel 63.5 mm 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.
- **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 diameter but preferably 25.4 mm 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.
- **Outlet/Fill Connection.** The outlet/fill connection should be a flanged fitting with a 76 mm internal valve terminating to a 63.5 mm self-sealing coupler complete with captive dust cap. The draw-off point for the tank outlet should be at least 150 mm higher than the lowest point of the tank.
- **Document Container.** A suitably robust container should be positioned close to the fill/discharge point to hold the tank and fuel certification documents.
- **Tank Barrel and Frame External Surface Finishes.** The tank barrel and frame should be suitably primed and then finished in yellow (AS 2700-Y14). Where the barrel is fabricated from stainless steel it may remain unpainted. All component parts (e.g. tank, frame) 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.
- **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.

**Static Storage Tanks**

6.11 Where static storage tanks are provided they should be constructed to suitable standards. Acceptable standards include American Society of Mechanical Engineers (AMSE) VIII and British Standard (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.

6.12 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.

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

6.14 Sample lines should be a minimum of 20 mm diameter and preferably 25 mm diameter. The sample point accessibility should be as described dot point five in 6.10 above.

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

6.16 Static tanks should be equipped with the following:

- **Access Plate.** A 450 mm or greater plate, which should be hinged to assist easy opening, to allow physical access to the interior of the tank.
- **Inspection Hatch.** A 150 mm sample hatch to allow for a visual inspection of the low end of the tank, or for the taking of samples.
- **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.
- **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.
- **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 higher than the lowest point of the tank or by means of floating suction.
- **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.
- **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.
- **Tank Shell Outer Surface Finish.** The static storage tank shell should be suitably primed and then finished in yellow (AS 2700-Y14). Where the tank shell is fabricated from stainless steel it may remain unpainted. 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.
- **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.

**Sample Reclaim Tank**

6.17 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.

6.18 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.

**Delivery System**

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

- **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 pump(s)\(^{12}\).

- **Pump and Aircraft Bonding Safety Systems.** The pumping system should be equipped with an automatically switched, flashing pump-running warning beacon that is visible from the helideck to clearly show that the fuel delivery pumps are running. Ideally, the flashing beacon should be coloured amber to distinguish it from other helideck lighting and to ensure it is visible against the general installation lighting. The colour red should not be used. In addition, there should be an automatic interlock (e.g. an earth proving unit) that prevents the pump from running and the pump-running warning flashing until such time as there is positive earth bonding established between the aircraft and the refuelling system. For operational reasons, it should be possible to run the system by earthing the interlock to something other than an aircraft in order to draw daily samples and carry out maintenance activities. The system should be robustly designed to prevent inadvertent disconnection during operation whilst at the same time ensuring ‘breakaway device’ integrity is maintained as temperamental operation may be a contributing factor to intentional by-pass of aircraft bonding during refuelling operations. In the event of an earth bonding fault occurring, the system should be designed such that ‘steady-state’ enunciator lights are extinguished at the dispensing cabinet (e.g. at the control panel) and a manual intervention is required prior to re-starting the pump.

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\(^{12}\) Hand pumps should not be incorporated in refuelling system design and should be removed from existing systems where fitted. Lack of use over long periods of time may result in deterioration of the hand pumps internal components, causing them to become a potential source of system contamination.
Although one side of the earth loop will be connected to the control circuit, the electrical resistance between the end connection of the second side of the loop and the system pipework should not be more than 0.5 ohms. The selected length of cable provided should be consistent with easily reaching the helicopter refuelling points when the aircraft is correctly positioned on the helideck. In the case of existing delivery systems an automatic ‘earth proving’ interlock should be installed, where it is practicable to do so; where this is not possible, an earth bonding cable should be fitted as detailed under ‘Bonding Cable’ below\(^\text{13}\).

- **Flow Meter.** The flow meter should be of the positive displacement type with a read-out in litres, positioned upstream of the filter water monitor or combined three-stage filter vessel and sized to suit the flow rate. System designs should take fully into consideration flow meter manufacturers’ recommendations including the installation of strainers and air eliminators when appropriate, especially when placed before a combined three-stage filter vessel. In the case of existing flow meter systems installed downstream from the filter water monitor, consideration should be given to relocating the flow meter upstream, where it is practicable to do so. Alternatively, suitable controls (e.g. sample points) and procedures should be put in place to ensure that the system can be routinely monitored for entrained particulate matter.

- **Filtration.** System filtration should either consist of a two-vessel design, where first and second stage filtration takes place within a filter water separator vessel and third stage filtration takes place within a fuel monitor vessel, or alternatively a single vessel design may be used in the form of a combined three-stage filter vessel. Vessels should meet the following criteria:
  - **Filter Water Separator.** Filter water separators should be fitted with an automatic air eliminator and pressure relief valve and sized to suit the discharge rate and pressure of the delivery system. Such filters should provide protection down to 1 micron particle size or better. A differential pressure gauge with calibrated reading should be fitted in order to provide a means of monitoring element condition during operation. Filter units should be fitted with a sample line at the lowest point of the vessel 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 nominal bore but, in general, the larger the diameter of the sample line, the better. Where practicable to do so, existing filter vessels/systems should be upgraded to meet these requirements.
  - **Fuel Monitor.** A fuel monitor should be fitted with an automatic air eliminator and be sized to suit the discharge rate and pressure of the delivery system. The elements should be Energy Institute (EI) 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. A differential pressure gauge with calibrated reading should be fitted in order to provide a means of monitoring element condition during operation. Filter units should be fitted with a sample line at the lowest point of the vessel to enable contaminants to be drained from the unit.

\(^{13}\) Regardless of the status of the automatic ‘earth proving’ interlock that prevents the pump from running and the pump-running warning beacon flashing, the flight crew/HLO remain responsible for ensuring that the bonding cable has been disconnected from the aircraft and properly stowed prior to clearance for flight.
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 nominal bore but, in general, the larger the diameter of the sample line, the better.

- **Combined Three-Stage Filter Vessel.** Combined three-stage filter vessels should incorporate first-stage coalescer elements, second-stage separator elements and third-stage monitor elements within a single vessel and should be sited adjacent to or within the dispensing cabinet. Vessels should be fitted with an automatic air eliminator and pressure relief valve and sized to suit the discharge rate and pressure of the delivery system. Units should be EI 1581 approved and such filters should provide protection down to 1 micron particle size or better. Third-stage monitor elements should be EI 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. Dual differential pressure gauges with calibrated readings should be fitted in order to provide a means of monitoring element condition during operation. One gauge should be set up to measure first-stage element condition with the other set up to measure third-stage element condition. The differential pressure generated across the second-stage element is insignificant and can therefore be measured combined with either first-stage or third-stage, depending on the vessel design. Filter units should be fitted with a sample line at the lowest point of the vessel 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 nominal bore but, in general, the larger the diameter of the sample line, the better.

- **Delivery Hose.** The delivery hose should be an approved semi-conducting type to ISO 1825:2011 Type C, Grade 2, 38 mm 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.

- **Bonding Cable.** Where it is not practicable to fit an aircraft bonding safety system to existing refuelling systems, 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 device’ 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.
• **Fuelling Nozzle.** Fuel delivery to the aircraft may be either by gravity (over-wing) or pressure (under-wing) refuelling. It is operationally advantageous to have the ability to refuel by either means to suit the aircraft type using the helideck:
  - **Gravity** – The nozzle should be 38 mm spout diameter fitted with 100 mesh strainer. Suitable types include the EMCO G180-GRTB fuelling nozzle.
  - **Pressure** – For pressure refuelling the coupling should be 64 mm with 100 mesh strainer and quick disconnect. A Carter or Avery Hardoll pressure nozzle with regulator/surge control (maximum 240 kilopascals) should be used.
  - **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.

- **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.

### 7. Helicopter Landing Areas on Vessels

**Vessels Supporting Off-shore Mineral Workings and Specific Standards for Landing Areas on Merchant Vessels**

7.1 Helidecks on vessels used in support of the off-shore oil and gas industry should be designed to comply with the requirements of the preceding sections of this publication.

7.2 The International Chamber of Shipping (ICS) has published the *Guide to Helicopter/Ship Operations* that comprehensively describes physical criteria and procedures on ships having shipboard landing or winching area arrangements. It is not intended to reproduce the ICS document in detail here. However, it is recommended that the latest edition of the ICS guide should be referenced in addition to this Section and, where necessary, in conjunction with Section 8, below, which includes information relating to shipboard winching area arrangements.

7.3 Helicopter landing areas on vessels which comply with the criteria should have a helideck manual. This should specify the D-value of the helicopter landing area; include pitch, roll and heave category information with helicopter operator derived landing limits; list any areas of non-conformity with this CAAP and detail any specific limitations applied to the landing area. Vessels landing areas may be subject to specific limitations.

7.4 Helicopter landing areas on vessels should always have an approved D-value equal to or greater than the ‘D’ dimension of the helicopter intending to land on it.

7.5 Helicopter landing areas which cannot be positioned so as to provide a full 210° obstacle-free sector surface for landing and take-off should be assessed against specific criteria described in this Section and appropriate limitations should be imposed.
7.6 It should be noted that helicopter operations to small vessels with poor visual cues, such as a bow deck or a deck mounted above the bridge superstructure with the landing direction facing forwards (bow deck) or abeam (high deck), will have stricter landing limits imposed at night, with respect to the vessel’s movement in pitch, roll and helideck inclination.

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

General

7.7 The following special guidance 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.

Size and Obstacle Environment

7.8 The reference D-value given in Table 1 in Section 3 also applies to vessels’ landing areas referred to in this section. It should also be noted that amidships landing areas are only considered suitable for single main rotor helicopters.

7.9 Forward and aft of the 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 – 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, paragraph 3.29; a maximum height of 25 cm above the landing area level for any shipboard helideck where the D-value is greater than 16 m, or 5 cm above landing area level for any helideck where the D-value is 16 m or less.

7.10 On the surface of the landing area itself, objects such as deck-mounted lighting systems and landing area nets should be limited to 2.5 cm above the landing area level. 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.

7.11 To provide protection from obstructions, 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 11 below.

7.12 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.

7.13 The structural requirements referred to in Section 3, above, should be applied whether providing a purpose-built amidships helideck above a ship’s deck or providing a non-purpose-built landing area on part of the ship’s structure, such as a large hatch cover.
Figure 11: A purpose-built or non-purpose-built mid-ship centreline landing area

**Note:** Where the D-value is 16 m or less the obstacle height limitation around the landing area is restricted to 5 cm.

**Source:** International Chamber of Shipping, Helicopter Ship Guide (2008).
Helicopter Landing Area Marking and Lighting

7.14 The basic marking and lighting requirements referred to in Section 4, above, and Appendix A to this CAAP will also apply to helicopter landing areas on ships ensuring that for amidships helicopter landing areas the TD/PM circle should always 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 4 above). In addition, where there is an operational requirement, vessel owners may consider providing the helideck name marking and maximum allowable weight ‘t’ marking both forward and aft of the painted helideck identification ‘H’ marking and TD/PM circle.
Figure 12: Markings for a purpose-built or non-purpose-built mid-ship centreline landing area

Side Located Non-Purpose-Built Landing Areas

7.15 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 13 below. 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.

7.16 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. However, where the D circle accommodated is 16 m or less, obstacles contained in the manoeuvring zone should not exceed a height of 5 cm.

![Figure 13: Side Located Non-Purpose-Built Landing Area](image)

In order to improve operational safety where the operating area is coincident with the ship’s side, the clear zone should extend to a distance of 1.5D, 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 restrictions as with the manoeuvring area). 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 to the ICS Helicopter Ship Guide).
7.18 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 8.22, below, and Section 4 above).

Side Located Non-Purpose-Built Landing Area Markings

7.19 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. 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.

7.20 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 0.9 m.

7.21 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 14).
NOTE: Amend character heights “19” from 0.6m to 0.9m.

Figure 14: Ship’s side non-purpose-built landing area markings
Night Operations

7.22 Details of landing area lighting for purpose-built landing areas are given in Section 4, above, and Appendix A. In addition, Figure 15 shows an example of the overall lighting scheme for night helicopter operations for a non-purpose-built ship’s side arrangement.

![Diagram of landing area lighting](image)

**Figure 15: Representative Landing Area Lighting Scheme for a Non-Purpose-Built Ship's Side Arrangement**


8. **Helicopter Winching Areas on Vessels**

Winching Areas on Vessels

8.1 Where practicable and safe to do so, the helicopter should always land rather than hoist because safety is enhanced when the time spent hovering is reduced. In both cases the vessel’s master should be fully aware of, and in agreement with, the helicopter pilot’s intentions.

8.2 The ICS has published a *Guide to Helicopter/Ship Operations*, that comprehensively describes physical criteria and procedures applicable for a shipboard winching area operation (see reference in Appendix C to this CAAP). It is not intended to reproduce the procedures from the ICS document in detail in this CAAP and therefore the ICS Guide should be consulted.
Design and Obstacle Restriction

8.3 A winching area should be located over an area to which the helicopter can safely hover whilst hoisting to or from the vessel. Its location should allow the pilot an unimpeded view of the whole of the clear 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 paragraph 9.13 below) 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.

8.4 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 hoisting 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 16 below. 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.

Visual Aids

8.5 Winching area markings should be located so that their centres coincide with the centre of the clear zone (see Figure 16, over).

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

8.7 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.

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

8.9 Where 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.

8.10 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 16: Winching Area Arrangement on a Vessel

Obstructions

8.11 To reduce the risk of a hoist 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.

8.12 All dominant obstacles within, or adjacent to, the manoeuvring zone should be conspicuously marked and, for night operations, be adequately illuminated.

Hoisting Above Accommodation Spaces

8.13 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 it is recommended that only twin-engined helicopters be used for such operations and the following procedures adhered to:

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

8.14 Fire and rescue personnel should be deployed in a ready state but sheltered from the helicopter operating area.
PART 2 – Related information on off-shore helideck operations

1. Visual Aids

1.1 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.

2. Helideck Rescue and Fire Fighting

2.1 This section contains guidance on the provision of equipment, extinguishing media, personnel, training, and emergency procedures for off-shore helidecks on installations and vessels.

Use and Maintenance of Foam Equipment

2.2 Mixing different (either in make or strength) concentrates in the same tank 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.

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

2.4 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 while ensuring compliance with any relevant pollution regulations.

The Management of Extinguishing Media Stocks

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

2.6 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.

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

2.8 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.

Personnel Levels

2.9 The facility should have sufficient trained fire-fighting personnel immediately available whenever aircraft movements are taking place. It is generally recommended that on oil and gas infrastructure facilities a minimum of five suitable personnel should be available for helicopter landings. 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 Oil and Gas UK Guidelines for the Management of Off-shore Helideck Operations (see reference in Appendix C).

Personal Protective Equipment (PPE)

2.10 All responding rescue and fire fighting personnel should be provided with appropriate Personal Protective Equipment (PPE) to allow them to carry out their duties in an effective manner.

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

2.12 For the selection of appropriate PPE, account should be taken of the relevant national or State Occupational Health and Safety (OH&S) regulatory authority’s requirements for equipment to be suitable and safe for intended use, maintained in a safe condition and, where appropriate, inspected to ensure it remains fit for purpose. In addition equipment should only be used by personnel who have received adequate information, instruction and training. PPE should be accompanied by suitable safety measures, including protective devices, markings and warnings. Appropriate PPE should be determined through a process of risk assessment.

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

Training

2.14 If they are to utilise the provided equipment effectively, 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. CASA (and the UK CAA) recommend that personnel attend an established helicopter fire-fighting course.

2.15 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.

2.16 At least one person should be trained in Dangerous Goods handling, even if such goods are not routinely carried in helicopter operations. Awareness of Dangerous Goods issues is vital.
Emergency Procedures

2.17 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.

3. Miscellaneous Operational Standards

Installation/Vessel Helideck Operations Manual and General Requirements

3.1 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 helideck 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 any non-compliance. Non-conformities should also be listed.

3.2 The height of the landing area above water level should be also taken into account when deciding on any operational limitations to be applied to specific helidecks. Landing area height above water level is to be included in the helideck Operations Manual and in information supplied helicopter operators for the purpose of authorising operations to the helideck.

Wind Direction (Vessels)

3.3 The ability of a vessel to manoeuvre may be helpful in providing an acceptable wind direction in relation to the helideck location, and information provided should include whether the installation or vessel is normally fixed at anchor, single point moored, or semi- or fully manoeuvrable.

Helideck Movement

3.4 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 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 presented in UK CAA Paper 2008/03 Helideck Design Considerations – Environmental Effects (see full reference in Appendix C). It is strongly recommended that mobile installation and vessel designers consult this paper at the earliest possible stage of the design process\textsuperscript{14}.

\textsuperscript{14} Some helidecks are fitted with self-levelling equipment, in which case installation operators should establish procedures to ensure the equipment continues to operate within specification.
3.5 In situations where certification or approvals are issued, the helideck approval will normally be related to the helicopter operator’s Operations Manual limitations regarding the movement of the helideck in pitch and roll, helideck inclination, Significant Heave Rate (SHR) and vessel heading. It is necessary for details of these motions to be recorded and displayed by the vessel’s Helideck Motion System (HMS) and reported as part of the overall Off-shore Weather Report, (see Section 6 below), prior to, and during, all helicopter movements. A colour indication may be displayed on the HMS to indicate whether the deck is “in limits” for approach to land (GREEN = deck safe for landing) or whether “out of limits” for approach to land (RED = Nil landing).

3.6 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’; helideck inclination is the angle measured in degrees between the absolute horizon and the plane of the helideck. SHR (SHR being 2 x Root Mean Square heave rate measured over a 20 minute period) should be reported in metres per second. Values of pitch and roll, helideck inclination and SHR should be reported to one decimal place.

3.7 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 reported values are only related to the true vertical and do not relate to any ‘false’ datum (e.g. a ‘list’) created, for example, by anchor patterns or displacement.

3.8 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 should request it (for example, yaw and heading information).

**Standard Report Example:**

- **Actual 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 helideck inclination is 2.8°. The Significant Heave Rate recorded over the preceding 20 minute period is 1.1 metres per second.

- **Report:** “Roll 1.6° left and 3.6° right; pitch 2.1° up and 2.3° down; maximum helideck inclination 2.8°; Significant Heave Rate 1.1 metres per second”.

3.9 The measure of heave rate recommended (SHR) requires electronic motion-sensing equipment to generate it. SHR provides a simpler, less ambiguous and more representative measure of heave rate than Maximum Average Heave Rate. It is not considered acceptable to base helideck motion reports to pilots on visual estimations. It is therefore strongly recommended that all moving helidecks are equipped with electronic motion-sensing systems which will produce accurate pitch and roll, helideck inclination and SHR information to cater for current weather reporting requirements.

3.10 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 intended that future requirements will introduce additional measuring and reporting criteria in the form of a Motion Severity Index (MSI) and a Wind Severity Index (WSI).
Location in Respect to Other Landing Areas in the Vicinity

3.11 Mobile installations and support vessels with helidecks may be positioned adjacent to other installations so that mutual interference/overlaps 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.

3.12 Where there is conflict 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, 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.

Control of Movement in the Vicinity of Landing Areas

3.13 Whenever a helicopter is stationary on board an off-shore 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.

3.14 The practical implementation of the paragraph 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.

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

3.16 Installation/vessel safety notices placed near the helideck access should advise personnel not to approach the helicopter when the aircraft’s anti-collision lights are on.

3.17 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 are taking place crane work ceases, and jibs, ‘A’ frames, etc. are positioned clear of the obstacle protected surfaces and flight paths.

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

Helicopter Operations – Ground Operation of Aircraft Engines and Radar Equipment

3.19 Installation and helicopter operators should refer to subsections 5 and 6 of CAO 20.9 for precautions to be observed when starting and running helicopter engines and operating aircraft radar equipment on and in the vicinity of the helideck.
Helicopter Operations – Support Equipment

3.20 Provision should be made for equipment needed for use in connection with helicopter operations including:
- chocks and tie-down strops/ropes (strops are preferable);
- heavy-duty, calibrated, accurate scales for passenger baggage and freight weighing;
- a suitable power source for starting helicopters if helicopter shut-down is seen as an operational requirement; and
- equipment for clearing the helicopter landing area of snow and ice and other contaminants.

3.21 Chocks should be compatible with helicopter undercarriage/wheel configurations. Helicopter operating experience off-shore 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.

3.22 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 helicopter operators.

3.23 Off-shore Radio Operators, HLOs, Helideck Assistants and other persons who operate VHF aeronautical radio equipment are required to hold a CASA Aircraft Radiotelephone Operator Certificate of Proficiency. Further information can be found in Part 8 of the Civil Aviation Regulations 1988.

3.24 Off-shore fixed installations, mobile installations and vessels which have aeronautical radio equipment and/or aeronautical Non-Directional Radio Beacons (NDBs) installed on them and are required to gain approval from Airservices Australia before operating the equipment (www.airservicesaustralia.com). Regulation 173.265 of CASR 1998 is relevant in respect of designing instrument approaches using such equipment.

4. Helicopter Fuelling Facilities – Maintenance and Fuelling Procedures

General

4.1 This section gives general advice and best practice guidance on the necessary requirements for fuelling system maintenance and the fuelling of helicopters on off-shore 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.

4.2 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.

4.3 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.
Fuel Quality Sampling

4.4 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.

Fuel Sample Containers

4.5 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).

4.6 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.

4.7 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 may 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.

4.8 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.

Fuel Sampling

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

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

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

- Samples should be drawn at full flush into scrupulously clean clear glass sample jars (four litre capacity).
- 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.)
- Free water will appear as droplets on the sides, or bulk water on the bottom, of the sample jar.
- Suspended water will appear as a cloud or haze.
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.

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. The use of water-finding paper is no longer recommended as it no longer meets the IATA specification.

**Fuel Sample Retention**

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

4.14 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.

4.15 The following matrix summarises the minimum recommended fuel sampling and retention requirements for off-shore helicopter operations.

<table>
<thead>
<tr>
<th>No.</th>
<th>Sample</th>
<th>Reason for Sampling and When Taken</th>
<th>Sample Retention Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transit tanks.</td>
<td>Filling onshore.</td>
<td>Until transit tank is returned onshore.</td>
</tr>
<tr>
<td>2</td>
<td>Transit tanks.</td>
<td>Within 24 hours of placement in a bunded storage area and weekly thereafter until tank becomes next on-line.</td>
<td>24 hours.</td>
</tr>
<tr>
<td>3</td>
<td>Transfer filters.</td>
<td>Prior to fuel transfer or weekly, whichever occurs first.</td>
<td>When a satisfactory result has been obtained, samples can be discarded.</td>
</tr>
<tr>
<td>4</td>
<td>Transit tanks.</td>
<td>Prior to decanting to bulk storage tank or daily when on-line or next in-line.</td>
<td>24 hours.</td>
</tr>
<tr>
<td>5</td>
<td>Static storage tank.</td>
<td>Daily - prior to system use.</td>
<td>48 hours.</td>
</tr>
<tr>
<td>6</td>
<td>Delivery filter separator and filter monitor.</td>
<td>Daily - prior to system use.</td>
<td>When a satisfactory result has been obtained, samples can be discarded.</td>
</tr>
<tr>
<td>7</td>
<td>Delivery hose end.</td>
<td>Daily - prior to system use.</td>
<td>When a satisfactory result has been obtained, samples can be discarded.</td>
</tr>
<tr>
<td>8</td>
<td>Delivery hose end (or filter monitor if a pressure refuel is being performed).</td>
<td>Before aircraft refuelling. This sample to be checked by the pilot.</td>
<td>When a satisfactory result has been obtained and the flight crew have seen the evidence, samples can be discarded.</td>
</tr>
<tr>
<td>9</td>
<td>Delivery hose end (or filter monitor if a pressure refuel is being performed).</td>
<td>After aircraft refuelling.</td>
<td>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.</td>
</tr>
</tbody>
</table>
### Decanting from Sample Reclaim Tanks

4.16 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.

4.17 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.

4.18 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.

### Recommended Maintenance Schedules

4.19 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.

4.20 Responsible bodies within the off-shore 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.

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

#### Transit Tanks

4.22 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:

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

b) *Weekly Inspection*

Each transit tank whether it is full or empty, onshore or off-shore, should be given a weekly inspection similar to the trip inspection, 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 sub-section 4.39 below).

c) *Six-Monthly Inspection*

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

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

Static Storage Tanks

4.23 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.

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

4.25 The inspection should include the following:

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

Delivery Systems

4.26 The off-shore 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 off-shore fuelling personnel to ensure satisfactory fuel quality.
### a) Daily Checks

The following checks should be carried out each day:

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Micro-filter and/or filter/water separator and filter monitor</td>
<td>Drain the fuel from the sump until it is clear. The sample taken should be checked and retained as noted in paragraphs 4.4 and 4.5 above. 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.</td>
</tr>
<tr>
<td>ii)</td>
<td>Transit tank/storage tank</td>
<td>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 4.4 and 4.5.</td>
</tr>
<tr>
<td>iii)</td>
<td>Floating suction</td>
<td>The assembly should be checked for buoyancy and freedom of movement.</td>
</tr>
<tr>
<td>iv)</td>
<td>Delivery hose end</td>
<td>A sample should be drawn from the hose end and checked for quality as noted in paragraphs 4.4 and 4.5.</td>
</tr>
<tr>
<td>v)</td>
<td>Complete documentation</td>
<td>Daily checks should be recorded on the 'Daily Storage Check' pro forma.</td>
</tr>
</tbody>
</table>

### b) Weekly Checks

In addition to the daily checks specified in above, the following checks should be carried out each week:

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>Differential pressure gauge</td>
<td>Under full flow conditions during refuelling the differential pressure gauge reading should be noted and recorded on the filter record sheets.</td>
</tr>
<tr>
<td>ii)</td>
<td>Entire system</td>
<td>The system should be checked for leaks and general appearance including the transit tank checks detailed in paragraph 4.22 (b) above.</td>
</tr>
<tr>
<td>iii)</td>
<td>Tank top fittings</td>
<td>Should be checked to see all are in place, clean and watertight.</td>
</tr>
<tr>
<td>iv)</td>
<td>Inlet and outlet couplings</td>
<td>Check caps are in place.</td>
</tr>
<tr>
<td>v)</td>
<td>Hose end strainers</td>
<td>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 and seated.</td>
</tr>
<tr>
<td>vi)</td>
<td>Aviation delivery hose</td>
<td>The hose should be checked visually whilst subjected to system pump pressure. This particular check should be recorded on the hose inspection record.</td>
</tr>
<tr>
<td>vii)</td>
<td>Delivery nozzle/coupling</td>
<td>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.</td>
</tr>
<tr>
<td>viii)</td>
<td>Bonding Reel</td>
<td>Check for general condition, security and electrical continuity. Maximum 0.5 ohms. Check proper operation of quick release connection.</td>
</tr>
<tr>
<td>ix)</td>
<td>Documentation</td>
<td>Completion of these checks should be recorded on the serviceability report.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>i)</td>
<td>All filtration units (e.g. decant line, dispenser and monitor filter.)</td>
<td>Obtain a fuel sample from each filtration unit and perform fuel quality checks as noted in paragraphs 4.9 to 4.15. 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.</td>
</tr>
<tr>
<td>ii)</td>
<td>Earth bonding check</td>
<td>Carry out a continuity test throughout the system.</td>
</tr>
</tbody>
</table>
| 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 the 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 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 under paragraph (c) above, and in addition should include the following items:

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 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:

<table>
<thead>
<tr>
<th>No.</th>
<th>Items</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 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 off-shore 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 | Ascertained 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. |

Filling of Transit Tanks

4.27 The trip examination should be carried out as specified in paragraph 4.22 (a) above. 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:

- Draw fuel from transit tank sample line and discard until the samples appear free from water.
- Carry out fuel quality check as noted in paragraphs 4.9 to 4.12.
- 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.
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 the paragraph 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 off-shore 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.

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.

Receipt of Transit Tanks Off-shore

4.28 Transit tanks transported off-shore 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 on hour per foot depth of fuel in the tank.

4.29 The following procedure should then be followed:

- Check transit tank seals are still intact.
- Check transit tank grade marked.
- Check tank shell for damage, particularly around welded seams.
- Check release note for the following:
  - correct grade;
  - quantity;
  - batch number;
  - date;
  - certified free from dirt and water; and
  - signed by authorised product inspector.
- Take fuel samples from the transit tank and discard until the samples appear free from water.
Decanting from Transit Tanks to Static Storage

4.30 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.

4.31 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.

4.32 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 of three hours for every metre in depth of fuel (e.g. a two metre depth of fuel should be left to settle for a period of at least six hours).

4.33 The following procedure should then be followed:

- Connect an earth bonding lead to the transit tank.
- Carry out checks for fuel quality as described in paragraphs 4.9 to 4.12.
- 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.
- 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.
- 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.

- 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.
- When sufficient fuel has been transferred, shut off the valves and stop the transfer pump.
- Disconnect the transfer hose followed by the electrical bonding lead and replace any dust caps that were removed at the commencement of the operation.
- 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.
- 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.

Fuelling Direct from Transit Tanks

4.34 Many off-shore helicopter fuelling systems are designed to supply aviation fuel direct from the transit tanks into the delivery system.

4.35 In this case the following procedure should be followed:

- 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.
- Connect an earth bonding lead to the transit tank.
- Take fuel samples from the transit tank and discard until the samples appear free from water.
- Carry out checks for fuel quality as described in paragraphs 4.9 to 4.12.

DRAFT: October 2012
• 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.
• Once a satisfactory test has been obtained the suction hose should be connected to the transit tank discharge point. Open valve.
• 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.
• Record fuel quality checks and transit tank contents and retain the release note on board the installation/vessel.

Long Term Storage of Aviation Fuel

4.36 The long term storage of aviation fuel off-shore should be discouraged. Should fuel stocks remain unused off-shore 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.

Aircraft Refuelling

4.37 Always ensure before starting any refuelling that the fuel in the storage tank or transit tank is properly settled. Refer to paragraphs 4.30 to 4.33 above, for correct settling times.

4.38 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 the last dot point, over). The fire team should be in attendance at all times during any refuelling operation. The following procedure should then apply:

• 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.

• Take a fuel sample from the over-wing 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.

• 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.

• 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.

15 This general advice on aircraft refuelling should be read in conjunction with the current regulatory requirements in Civil Aviation Orders 20.9 and 20.10. Future regulations will be contained in Subpart 91D of CASR 1998 when implemented.
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.

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, and a fuel water check should again be carried out. See paragraph 4.15 for sample retention requirements.

Remove the delivery hose from the helideck and carry out a final check that the aircraft filler cap is secure, and 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.

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

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:
- Constant communications should be maintained between the aircraft captain and the refuelling crew.
- The passengers should be briefed.
- The emergency exits opposite the refuelling point should be unobstructed and ready for use.
- Passengers’ seatbelts should be undone.
- A competent person should be positioned ready to supervise disembarkation in the event of an emergency.
- Provision should be made for safe and rapid evacuation as directed by competent persons. The area beneath the emergency exits should be kept clear.

Quality Control Documentation

4.39 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;
- those 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.
5. **Ongoing Conformity – Checklist**

5.1 The following checklist indicates in general terms the minimum number of helideck physical characteristics which should be examined during periodic surveys to confirm that there has been no alteration or deterioration in condition.

- **The physical characteristics of the helideck:**
  - Dimensions as measured;
  - Declared D-value;
  - Deck shape; and
  - Scale drawings of deck arrangement.

- **The preservation of obstacle-protected surfaces is the most basic safeguard for all flights. These surfaces are:**
  - The minimum 210° Obstacle Free Sector (OFS) surface;
  - The 150° Limited Obstacle Sector (LOS) surface; and
  - The minimum 180° falling 5:1 gradient surface with respect to significant obstacles. If one or more of these surfaces is infringed due, for example, to the proximity of an adjacent installation or vessel, an assessment should be made to determine any possible negative effect which may lead to operating restrictions.

- **Marking and lighting:**
  - Adequate helideck perimeter lighting;
  - Adequate helideck touchdown marking lighting (“H” and TD/PM Circle lighting) and/or floodlighting;
  - Status lights (for day and night operations);
  - Helideck markings;
  - Dominant obstacle paint schemes and lighting; and
  - General installation lighting levels including floodlighting. Where inadequate helideck lighting exists the Helideck Limitation List (HLL) should be annotated ‘daylight only operations’.

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

- **Environment:**
  - Foreign object damage;
  - Air quality degradation due to exhaust emissions, hot and cold vented gas emissions and physical turbulence generators;

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16 For a detailed Helideck and System Inspection Checklist, readers should refer to UKOOA *Guidelines for the Management of Off-shore Helideck Operations* (See Appendix C).
○ Bird control;
○ Any adjacent helideck/installation environmental effects may need to be included in any air quality assessment; and
○ Flares.
- Rescue and Fire Fighting:
  ○ Primary and complementary media types, quantities, capacity and systems;
  ○ Personal Protective Equipment (PPE); and
  ○ Crash box.
- Communications and navigation:
  ○ Aeronautical radio(s);
  ○ Radio/telephone (R/T) call sign to match helideck name and side identification which should be simple and unique;
  ○ Non-Directional Beacon (NDB) or equivalent (as appropriate); and
  ○ Radio log.
- Fuelling facilities:
  ○ In accordance with relevant national guidance and regulations.
- Additional operational and handling equipment:
  ○ Windsock;
  ○ Meteorological information (recorded by an automated means);
  ○ Helideck Motion System recording and reporting (where applicable);
  ○ Passenger briefing system;
  ○ Chocks;
  ○ Tie-downs; and
  ○ Weighing scales for passengers, baggage and freight.
- Personnel:
  ○ Trained helicopter staff (e.g. Helicopter Landing Officer, Helideck Assistant and firefighters).
- Other:
  ○ As appropriate.
6. **Provision of Meteorological Information from Off-shore Installations**

**Introduction**

6.1 This section provides guidance on the provision of meteorological information from off-shore installations. Accurate, timely and complete meteorological observations are necessary to support safe and efficient helicopter operations.

6.2 The provision of meteorological information for the safety, efficiency and regulation of international air navigation is subject to the Standards and Recommended Practices in Annex 3, Meteorological Services for International Air Navigation, to the Chicago Convention. Requirements for observer training and observing accuracy are set out by the United Nation's World Meteorological Organization (WMO).

**Provision of meteorological information**

6.3 Each installation should have a meteorological observer to provide helicopter operators and pilots with relevant meteorological information in the form of weather reports.

6.4 It is recommended that personnel who carry out meteorological observations on off-shore installations undergo formal meteorological observer training, relevant to the area of operation, and should complete refresher training every two years to ensure they remain familiar with any changes to meteorological observing practices and procedures.

6.5 Whilst all meteorological information must be used at the discretion of the Pilot in Command. Information from non-authorised observation sources can only be used to assist with gaining an overall picture of the meteorological environment associated with the helideck. This should not though be used for flight or performance planning or control and conduct of a flight unless confirmed from an authorised source – refer to Regulation 120 of CAR 1988.

6.6 If an operator wishes to ensure their reports are authorised, there are a number of aviation based processes which can also be used to form basis of obtaining information from qualified observers, such as the Certified Air/Ground Radio Operator (CA/GRO) process outlined in the AIP at AIP GEN 3.4. CA/GRO holders can give reports on weather conditions and operational information to pilots for locations, which are recognised as qualified observations and which can be used to reduce landing, circling and alternate minima in accordance with AIP-ENR 1.5 paragraph 5.3.1 (QNH sources).

6.7 Also available to operators is the Universal Communications (UNICOM) facility, which is a non-ATS communications service, which is provided to enhance the value of information normally available about a non-towered aerodrome or HLS. UNICOM weather reports are limited to simple factual statements about weather and they are not qualified to make weather observations unless properly authorised under Regulation 120 of CAR 1988.

6.8 An operator with several facilities located in close proximity may wish to utilise the CA/GRO or the UNICOM process to assist with the efficient flow of information in their operation over a number of landing sites.
Automated equipment contingency

6.9 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 automated sensors.

6.10 Where an installation is within ten nautical miles of another installation that is equipped with an automated means of ascertaining the required meteorological information, 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.

Pre-Flight Weather Reports

6.11 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;
- QNH and QFE;
- Significant Heave Rate (SHR);
- Pitch and roll; and
- Helideck inclination.

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

- significant wave height.

Note: These reports supplement but do not replace any required aeronautical authorised weather report or forecast required for the flight.

Radio Messages

6.13 As with helideck movements, 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 (see paragraph 6.16 below). 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 should request it.
Calibration of Meteorological Equipment Sensors

6.14 Calibration of meteorological equipment sensors used to provide the data listed in Appendix B to this CAAP should be periodically calibrated in accordance with the manufacturers’ recommendations in order to demonstrate continuing adequacy for purpose.

Retention of Meteorological Information

6.15 Records of all meteorological reports should be retained for a period of at least 30 days.

Format of weather reports

6.16 Aeronautical Information Publication – General (AIP-GEN) 3.5 provides information and guidance related to the provision of meteorological information. Operators of installations should ensure compliance with these requirements. Specific details and exceptions are set-out below, along with an example form and report.

Wind

6.17 To be reported in knots as per AIP-GEN 3.5.12.6.

Assessment of Wind Speed and Direction

6.18 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.

Visibility

6.19 To be reported in metres as per AIP-GEN 3.5.12.7. The visibility reported is the minimum visibility. Visibilities greater than 10 km should be reported as 9999.

Lightning

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

Present Weather

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

- Thunderstorm (No Precipitation)
- Thunderstorm with Rain
- Thunderstorm with Hail
- Thunderstorm with Heavy Rain
- Thunderstorm with Heavy Hail
- Thunderstorm in the Vicinity
- Drizzle
- Heavy Drizzle
- Rain
6.22 Guidance on the reporting of these present weather phenomena is at AIP-GEN 3.5.12.10. No coding is required since the report is to be written in plain language, with up to three of the above phenomena included. If none of the above is observed then ‘Present Weather’ will be ‘Nil’.

**Reporting of Fog**

6.23 Due to the small area that a helideck covers, compared to an aerodrome, the following guidance has been provided for the reporting of fog. If there is fog around or in the vicinity of the installation and the visibility is less than one kilometre in all directions, then Fog (or Freezing Fog) should be reported as the Present Weather. If there is fog within 500 m and the visibility is less than one kilometre in only some directions then Partial Fog (fog bank) or Fog Patches should be reported as the Present Weather.
6.24 Shallow Fog will be reported as the Present Weather if it is observed, whether patchy or as a continuous layer, within 500 m below helideck level, and is less than 10 m deep (the visibility above the Shallow Fog will be greater than one kilometre). Where there is no fog within 500 m 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).

**Cloud**

6.25 Cloud amount is reported as per AIP-GEN 3.5.12.12:

- Few (FEW);
- Scattered (SCT);
- Broken (BKN);
- Overcast (OVC);
- ‘Nil Cloud’ and Sky Obscured (coded, VV///) should also be reported as appropriate;
- Cumulonimbus (CB) or Towering Cumulus (TCU) should be added to the report when present;
- 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;
- A maximum of four cloud groups can be reported; and
- CAVOK (Cloud and Visibility OK) is to be reported as per AIP-GEN 3.5.12.13. When appropriate to do so, CAVOK should be reported as ‘Present Weather’.

**Air Temperature and Dew Point**

6.26 These measurements should be reported as per AIP-GEN 3.5.12.16.

**QNH and QFE (Atmospheric Pressure)**

6.27 These measurements should be reported as per AIP-GEN 3.5.12.17.

**Significant Wave Height**

6.28 Where sensors are deployed for the measurement of Significant Wave Height the information can be included in the report. Wave Height should be reported to one decimal place.

**Pitch, Roll and Heave**

6.29 See guidance in paragraphs 3.4 to 3.10 of this Part.

**Remarks**

6.30 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 to this effect should be recorded in the Remarks section.
Missing or Unavailable Information

6.31 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.

Example Off-shore Report

6.32 A pre-flight weather report form template and example is set-out below. Such a form should be used to supply the relevant information (see Figure 17 below).
### Off-shore Weather Report Form - Template and Sample Report

<table>
<thead>
<tr>
<th>Location</th>
<th>METOCEAN1</th>
<th>Vessel Heading</th>
<th>319 Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lat</td>
<td>N</td>
<td>57</td>
<td>01</td>
</tr>
<tr>
<td>Long</td>
<td>E</td>
<td>01</td>
<td>57</td>
</tr>
<tr>
<td>Date</td>
<td>16/04/2007</td>
<td>Time</td>
<td>12:50 UTC</td>
</tr>
<tr>
<td>Wind</td>
<td>230-200V270 degrees</td>
<td>Speed</td>
<td>18 knots</td>
</tr>
<tr>
<td>Gust</td>
<td>32 knots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visibility</td>
<td>2000 metres</td>
<td>Lightning</td>
<td>Present</td>
</tr>
<tr>
<td>Present Weather</td>
<td>Rain Shower / Thunderstorm in the Vicinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud amount</td>
<td>FEW</td>
<td>Cloud Height</td>
<td>800 feet</td>
</tr>
<tr>
<td></td>
<td>SCT</td>
<td></td>
<td>1200 feet</td>
</tr>
<tr>
<td></td>
<td>BKN</td>
<td></td>
<td>3000 feet</td>
</tr>
<tr>
<td></td>
<td>BKN C8</td>
<td></td>
<td>6000 feet</td>
</tr>
<tr>
<td>Air Temperature</td>
<td>18°C</td>
<td>Dew Point</td>
<td>12°C</td>
</tr>
<tr>
<td>QNH</td>
<td>1009 hPa</td>
<td>QFE</td>
<td>1004 hPa</td>
</tr>
<tr>
<td>Significant Wave Height</td>
<td>3.6 metres</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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
APPENDIX A

Specification for helideck lighting scheme comprising: perimeter lights, lit touchdown/positioning marking and lit heliport identification marking

1. Overall Operational Requirement

1.1 The whole lighting configuration should be visible over a range of 360° in azimuth. Although on some off-shore 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 configuration should be compatible with the normal range of helicopter vertical approach paths from a range of 2 nautical miles.

1.3 The purpose of the lighting configuration is to aid the helicopter pilot to perform the necessary visual tasks during approach and landing as stated in Table A1.

<table>
<thead>
<tr>
<th>Phase of Approach</th>
<th>Visual Task</th>
<th>Visual Cues/ Aids</th>
<th>Desired Range (NM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helideck Location and Identification</td>
<td>Search within platform structure.</td>
<td>Shape of helideck, Colour of helideck, Luminance of Helideck perimeter lighting.</td>
<td>1.5 (5000m), 0.77 (1500m)</td>
</tr>
<tr>
<td>Final Approach</td>
<td>Detect helicopter position in three axes.</td>
<td>Apparent size / shape and change of size / shape of helideck, Orientation and change of orientation of known features/ markings/ lights.</td>
<td>1.0 (5000m), 0.5 (1500m)</td>
</tr>
<tr>
<td>Hover and Landing</td>
<td>Detect helicopter attitude position and rate of change of position in three axes (six degrees of freedom).</td>
<td>Known features/ markings/ lights, Helideck texture.</td>
<td>50 metres (5000m), 50 metres (1500m)</td>
</tr>
</tbody>
</table>

Table A1: Visual Tasks during Approach and Landing

1.4 The minimum intensities of the lighting configuration should be adequate to ensure that, for a minimum meteorological visibility of 1500 m and an illuminance threshold of $10^{-6}$ lux, each feature of the system is visible and useable at night from ranges in accordance with 1.5, 1.6 and 1.7 (below).
1.5 The Perimeter Lights are to be visible at night from a minimum range of 0.77 NM.

1.6 The Touchdown/Positioning Marking (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 200mm mesh rope netting covers the lighting.

1.9 The design of the Perimeter Lights, TD/PM circle and ‘H’ should be such that the luminance of the Perimeter Lights is equal to or greater than that of the TD/PM circle segments, and the luminance of the TD/PM circle segments equal to or greater than that of the ‘H’.

1.10 The design of the TD/PM circle and ‘H’ should include a facility to increase their intensity by up to two times the figures given in this specification to permit a once-off (tamper proof) adjustment at installation. The purpose of this facility is to ensure adequate performance at installations with high levels of background lighting.

2. Definitions

2.1 The following definitions apply.

**Lighting Element**

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

**Segment**

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

**Sub-Section**

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

3. The Perimeter Light Requirement

**Configuration**

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

**Mechanical Constraints**

3.2 For any helideck where the D-value is greater than 16 m the perimeter lights should not exceed a height of 25 cm above the surface of the helideck. Where a helideck has a D-value of 16 m or less the perimeter lights should not exceed a height of 5 cm above the surface of the helideck.
**Light Intensity**

3.3 The minimum light intensity profile is given in Table A2 below:

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Azimuth</th>
<th>Intensity (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° to 10°</td>
<td>-180° to +180°</td>
<td>30 cd</td>
</tr>
<tr>
<td>&gt;10° to 20°</td>
<td>-180° to +180°</td>
<td>15 cd</td>
</tr>
<tr>
<td>&gt; 20° to 90°</td>
<td>-180° to +180°</td>
<td>3 cd</td>
</tr>
</tbody>
</table>

Table A2: Minimum Light Intensity Profile for Perimeter Lights

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

**Colour**

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

- **Yellow boundary**: \( x = 0.360 - 0.080y \)
- **White boundary**: \( x = 0.650y \)
- **Blue boundary**: \( y = 0.39 - 0.171x \)

**Serviceability**

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

**4. The Touchdown/Positioning Marking Circle Requirement**

**Configuration**

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

**Mechanical Constraints**

4.2 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.

4.3 The overall effect of the lighting segments and cabling on deck friction should be minimised. Wherever practical, the surfaces of the lighting segments should meet the minimum deck friction limit coefficient (\( \mu \)) of 0.65, e.g. on non-illuminated surfaces.
4.4 The TD/PM circle lighting components, fitments and cabling should be able to withstand a pressure of 1,655 kilopascals, equivalent to one wheel of a 15-tonne helicopter touching down heavily on top of them, without damage.

**Intensity**

4.5 The light intensity for each of the lighting segments, when viewed at angles of azimuth over the range +80° to -80° from the normal to the longitudinal axis of the strip (see Figure 18 below), should be as defined in Table A3.

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Intensity</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;0° to 10°</td>
<td>As a function of segment length as defined in Figure 19.</td>
<td>60 cd</td>
<td></td>
</tr>
<tr>
<td>&gt;10° to 20°</td>
<td>25% of min intensity &gt;0° to 10°</td>
<td>45 cd</td>
<td></td>
</tr>
<tr>
<td>&gt;20° to 90°</td>
<td>5% of min intensity &gt;0° to 10°</td>
<td>15 cd</td>
<td></td>
</tr>
</tbody>
</table>

Table A3: Light Intensity for TD/PM Circle Lighting Segments

4.6 For the remaining angles of azimuth on either side of the longitudinal axis of the segment, the maximum intensity should be as defined in Table A3.

4.7 Note that the intensity of each lighting segment should be nominally symmetrical about its longitudinal axis and also that the design of the TD/PM circle should be such that the luminance of the TD/PM circle segments is equal to or greater than those of the ‘H’.
4.8 If a segment is made up of a number of individual lighting elements (e.g. LED’s) then they should be of the same nominal performance (i.e., within manufacturing tolerances) and be equidistantly spaced throughout the segment to aid textural cueing. Minimum spacing should be 3 cm and maximum spacing 10 cm. The minimum intensity of each lighting element ‘i’ is given by the formula:

\[ i = \frac{I}{n} \]

where: \( I \) = required minimum intensity of segment at the ‘look down’ (elevation) angle and: \( n \) = the number of lighting elements within the segment.

4.9 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.

**Colour**

4.10 The colour of the light emitted by the TD/PM circle should be yellow, as defined in Annex 14, Appendix 1 to Volume 1, Aerodromes, to the Chicago Convention, whose chromaticity is within the following boundaries:

- Red boundary \( y = 0.382 \)
- White boundary \( y = 0.790 - 0.667x \)
- Green boundary \( y = x - 0.120 \)

**Serviceability**

4.11 The TD/PM circle is considered serviceable provided that at least 90% of the segments are serviceable. A TD/PM circle segment is considered serviceable provided that at least 90% of the lighting elements are serviceable.
Night Vision Goggles/Night Vision Imaging Systems (NVG/NVIS) compatibility

4.12 If a lighting system or elements of a lighting system used for a particular helideck are shown to be incompatible with NVG/NVIS operations (such as some LED systems), then this information should be noted in the helideck’s limitations list and potential NVIS operators (such as local HEMS operations) advised accordingly. If Helicopter Emergency Medical Service (HEMS) recovery operations are envisaged from a particular facility, these operators should make themselves aware of these limitations and any operational consequences this presents should be addressed prior to night operations to the helideck.

5. The Heliport Identification Marking Requirement

Configuration

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

![Figure 20: Configuration and Dimensions of Heliport Identification Marking ‘H’](image)

5.2 An outline lit ‘H’ should comprise sub-sections of between 80 mm and 100 mm wide around the outer edge of the painted ‘H’ (see Figure 20). There are no restrictions on the length of the sub-sections, but the gaps between them should not be greater than 10 cm. The mechanical housing should be coloured white.

Mechanical Constraints

5.3 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.

5.4 The overall effect of the lighting sub-sections and cabling on deck friction should be minimised. Wherever practical, the surfaces of the lighting sub-sections should meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.
5.5 The ‘H’ lighting components, fitments and cabling should be able to withstand a pressure of 1,655 kilopascals, equivalent to one wheel of a 15-tonne helicopter touching down heavily on top of them without damage.

**Intensity**

5.6 The intensity of the lighting along the 4 m edge of an outline ‘H’ over all angles of azimuth is given in Table A4 below:

<table>
<thead>
<tr>
<th>Elevation</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2° to 12°</td>
<td>3.5 cd</td>
</tr>
<tr>
<td>&gt;12° to 20°</td>
<td>0.5 cd</td>
</tr>
<tr>
<td>&gt;20° to 90°</td>
<td>0.2 cd</td>
</tr>
</tbody>
</table>

Table A4: Light Intensity of the 4 m Edge of the ‘H’

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

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

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

\[
i = \frac{I}{n}
\]

where:  
- I = intensity of the segment between 20 and 120.
- n = the number of lighting elements within the segment.

5.10 If the ‘H’ is constructed from a continuous light element (e.g., ELP panels or fibre optic cables or panels), the luminance (B) of the 4 m edge of the outline ‘H’ is given by the formula:

\[
B = \frac{I}{A}
\]

where:  
- I = intensity of the limb (see Table A4).
- A = the projected lit area at the ‘look down’ (elevation) angle.

**Colour**

5.11 The colour of the ‘H’ should be green, as defined in Annex 14, paragraph 2.1.1(c) of Appendix 1, Aerodromes, Volume 1 to the Chicago Convention, whose chromaticity is within the following boundaries:

<table>
<thead>
<tr>
<th>Boundary</th>
<th>Equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>x = 0.360 – 0.080y</td>
</tr>
<tr>
<td>White</td>
<td>x = 0.650y</td>
</tr>
<tr>
<td>Blue</td>
<td>y = 0.39 – 0.171x</td>
</tr>
</tbody>
</table>
Serviceability

5.12 The ‘H’ is considered serviceable provided that at least 90% of the subsections are serviceable. An ‘H’ subsection is considered serviceable provided that at least 90% of the lighting elements are serviceable.

6. Other Considerations

6.1 All lighting components and fitments should meet safety regulations relevant to a helideck environment such as explosion proofing (Zone 1 or 2 as appropriate) and flammability.

6.2 All lighting components and fitments installed on the surface of the helideck should be resistant to attack by fluids such as fuel, hydraulic fluid, and those used for cleaning and firefighting. In addition they should be resistant to UV light, rain, sea spray, guano and ice.

6.3 All lighting components and fitments that are mounted on the surface of the helideck should be able to operate within a temperature range appropriate for the local ambient conditions.

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

6.5 All cabling should utilise low smoke/toxicity, flame retardant cable. Any through-the-deck cable routing and connections should use sealed glands, type approved for helideck use.

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

6.7 Provision should be included in the design of the system to allow for the drainage of the helideck, in particular, the area inside the TD/PM Circle.
APPENDIX A1

Guidance for helideck floodlighting systems

1. Introduction

1.1 Paragraphs 4.21 to 4.42 in Section 4 of Part 1 set out the best practice requirements for helideck lighting systems consisting of green perimeter lighting, a lit TD/PM Circle and a lit heliport identification ‘H’ marking. Nonetheless, floodlighting systems conforming to the good practice guidance contained in this appendix being retained for the purpose of providing a source of illumination for on-deck operations, such as refuelling and passenger handling and, where required, for lighting the installation name on the helideck.

1.2 At the time of publication of this CAAP the durability of the new lit TD/PM Circle and lit heliport identification ‘H’ marking lighting has not been fully established and ‘teething’ problems cannot be ruled out. An alternative source of helideck lighting may therefore be desirable in the event that significant reliability problems occur. Hence it may be desirable also to retain floodlighting, compliant with the good practice guidance contained in this Appendix, as a temporary back-up.

2. General Considerations for Helideck Floodlighting

2.1 The whole of the landing area should be adequately illuminated if intended for night use. Experience has shown that floodlighting systems, even when properly aligned, can adversely affect the visual cueing environment by reducing the visibility 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 good practice guidance on suitable arrangements is provided below.

2.2 Although the modified floodlighting schemes described will provide useful illumination of the landing area without significantly affecting the visibility 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 Circle and ‘H’. These modified floodlighting solutions should therefore be regarded as temporary arrangements only. It is essential that interim floodlighting solutions are considered in collaboration with helicopter operators who may wish to fly a non-revenue approach to a helideck at night before confirming the final configuration.
2.3 The floodlighting should be arranged so as not to dazzle pilots 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.

Note: 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 other competent person.

3. Improved Floodlighting System

3.1 For helidecks located on platforms with a sufficiently high level of illumination from cultural lighting, the need for an improved floodlighting system may be unnecessary. In such circumstances it may be sufficient just to 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 are conducted with operators and their subsequent removal will be subject to satisfactory reports from air crews to indicate the acceptability of operating to the helideck with the re-configured lighting.

3.2 In the absence of sufficient cultural lighting, it is recommended that installation owners consider a deck level floodlighting system consisting of four deck-level xenon floodlights (or equivalent) equally spaced around the perimeter of the helideck. In considering this solution, installation owners should ensure that the deck-level xenon units 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 location of the helideck on the installation. It is therefore essential that all lights are maintained in correct alignment.

3.3 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 21 below.

Note: For some larger helidecks it may be necessary to consider fitting more than four deck-level xenon floodlights (or equivalent), but this should be carefully considered in conjunction with helicopter operators, giving due regard to the issues of glare and loss of definition of the helideck perimeter before further deck-level units are procured. CASA does not recommend more than five or six units even on the largest helidecks.
Figure 21: Typical Floodlighting Arrangement
1. **General**

1.1 The following categories of helideck should meet the requirements for Meteorological Instrumentation in this section/appendix:

- Fixed Installations;
- Semi-submersible, e.g. semi sub crane and lay barges, purpose-built mono-hull Floating Storage Units (FSUs) and production vessels; and
- Large ships, for example, drill ships, Floating Production Storage and Off-loading units – whether purpose built or converted oil tankers – non semi-submersible and lay barges and self-elevating rigs.

1.2 However, for installations, platforms and smaller ships with less frequent helicopter operations (i.e. less than 12 landings annually), the weather reports are required to contain only wind, pressure, air and dew point temperature information. Similarly where weather information is being provided from NUIs, the weather report need include (as a minimum) wind, pressure and air and dew point temperature information.

1.3 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.

2. **Design, Siting and Back-up Requirements for Meteorological Equipment Installed in Off-shore Installations**

- **Wind Speed and Direction**

2.1 Performance:

- The wind measuring equipment should provide an accurate and representative measurement of wind speed and direction.
- Wind direction data should be oriented with respect to True North.
- The wind speed measurement should be to an accuracy of within ± 1 knot, or ± 10% for wind speeds in excess of 10 kt, of the actual wind speed (whichever is the greater), over the following ranges:

<table>
<thead>
<tr>
<th>Variable</th>
<th>In-Tolerance Operating Range</th>
<th>Recoverable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind speed</td>
<td>0 to 100 kt</td>
<td>0 to 130 kt</td>
</tr>
</tbody>
</table>
Table B1: Tolerance Values of Sensors and Equipment – Wind Speed

- 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 3-second gust as a rolling average of the wind speed samples.
- 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.

Back-up

2.2 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 added to the off-shore weather report form.

Siting

2.3 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.

2.4 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.

Temperature

2.5 Performance:
- The equipment should be capable of measurement to an accuracy better than ± 1.0° Celsius for air temperature and dew point, over the following range:

<table>
<thead>
<tr>
<th>Variable</th>
<th>In Tolerance Operating Range</th>
<th>Recoverable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-25° C to +50° C</td>
<td>-30° C to +70° C</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 to 100% Relative Humidity condensing</td>
<td>0 to 100% Relative Humidity condensing</td>
</tr>
</tbody>
</table>

Table B2: Tolerance Values of Sensors and Equipment – Temperature and Humidity

Note: Dew point should be displayed for temperatures below zero; frost point should not be displayed.
- Temperature and dew point measurements should be measured to a resolution of 0.1° C. Electronic sensors should be sampled at a minimum of once per minute.
Back-up

2.6 Alternative sensors should be provided with 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.

Siting

2.7 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.

Pressure

2.8 Performance:

- No observing system that determines pressure automatically should be dependent upon a single sensor for pressure measurement. A minimum of 2 co-located sensors should be used. The pressure sensors should be accurate to within 0.5 hectopascals (hpa) 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.

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

- The measurement system should provide a pressure reading to an accuracy of ±0.5 hectopascals, or better over the following range:

<table>
<thead>
<tr>
<th>Variable</th>
<th>In Tolerance Operating Range</th>
<th>Recoverable Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>900 to 1050 hPa</td>
<td>850 to 1200 hPa</td>
</tr>
</tbody>
</table>

**Table B3: Tolerance Values of Sensors and Equipment – Pressure**

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

Back-up

2.9 Suitable back up instrumentation includes:

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

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

2.11 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 off-shore installation (UK CAP 746 Appendix D, *Daily Atmospheric Pressure Equipment QNH Check*, provides an example form that may be useful in the monitoring process.)
Siting

2.12 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.

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

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

2.15 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 QFE the height of helideck above sea level.

2.16 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.

2.17 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, drafts 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.

Visibility

2.18 Performance:

- 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:

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 600m</td>
<td>Visibility ± 50 m</td>
</tr>
<tr>
<td>Between 600 m and 1500 m</td>
<td>Visibility ± 10%</td>
</tr>
<tr>
<td>Between 1500 m and 15 km</td>
<td>Visibility ± 20%</td>
</tr>
</tbody>
</table>

- The visibility measuring system should measure to a resolution of 50 m

- The sensor(s) should be sampled at a minimum 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 and which reaches or passes through the following ranges:

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 km or more</td>
<td></td>
</tr>
<tr>
<td>5000 m to 9 km</td>
<td></td>
</tr>
<tr>
<td>3000 m to 4900 m</td>
<td></td>
</tr>
<tr>
<td>2000 m to 2900 m</td>
<td></td>
</tr>
<tr>
<td>1500 m to 1900 m</td>
<td></td>
</tr>
<tr>
<td>800 m to 1400 m</td>
<td></td>
</tr>
<tr>
<td>750 m or less</td>
<td></td>
</tr>
</tbody>
</table>

Back-up

2.19 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.

Siting

2.20 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 susceptible to sea spray should be avoided. The sensor should be located as far as practicable from other light sources that might affect the measurement including direct sunlight or spotlights etc. as this will cause interference. These sensors are only suitable for safe areas. These sensors require routine maintenance, calibration and cleaning; hence it should be positioned in a location that is easily accessible.

Present Weather Sensor

2.21 Performance:

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

<table>
<thead>
<tr>
<th>Range</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10 mm per hour</td>
<td>0.1 mm</td>
</tr>
<tr>
<td>10.5 to 50 mm per hour</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>51 to 100 mm per hour</td>
<td>1 mm</td>
</tr>
</tbody>
</table>

- The sensor should be accurate to within ±30% in the range 0.5 to 20 mm per hour.
- Where the sensor is capable of doing so, the sensor should discriminate between liquid precipitation and frozen precipitation.
Back up

2.22 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 off-shore weather report form.

Siting

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

Cloud

2.24 Performance:

- 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 5000 feet above ground level:

<table>
<thead>
<tr>
<th>Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and including 300 ft</td>
<td>Cloud height ± 30 feet</td>
</tr>
<tr>
<td>Above 300 ft</td>
<td>Cloud height ± 10%</td>
</tr>
</tbody>
</table>

- The cloud base recorder should measure to a resolution of 100 feet.
- The sensor(s) should be sampled at a minimum of once per minute.
- 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.

Back-up

2.25 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 off-shore weather report form.

Siting

2.26 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 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.
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