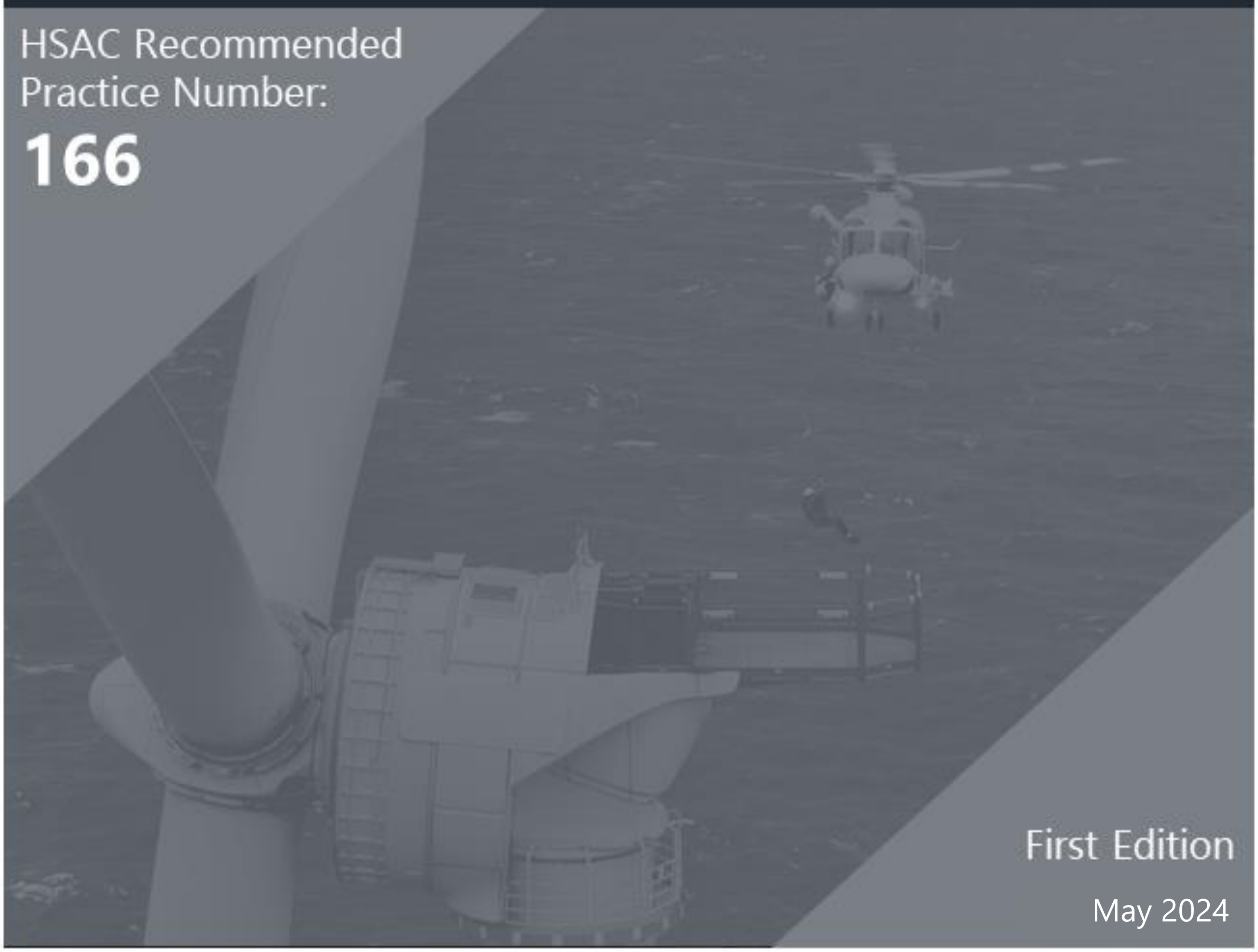
Helicopter Safety
Advisory Conference
Safety Through Cooperation - Since 1978

Aviation Support to Offshore Wind Farms



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Recommended Practices (RP) are published under the direction of the Helicopter Safety Advisory Conference (HSAC). RPs are a medium for discussion of aviation operational safety pertinent to the transmission of product, energy exploration and production industry in the United States. RPs are not intended to replace individual engineering or corporate judgment or to replace instruction in company manuals or government regulations. Adoption of this HSAC RP as a company internal standard is the responsibility of each individual company and is highly recommended. In this HSAC RP the word 'shall' is used to indicate high value safety practices not an imperative command. Companies choosing to adopt practices recommended in this document should be aware that substitution of "shall" to "should" would diminish the effectiveness of the practice. HSAC encourages and welcomes suggestions for subject matter relating to this document intended to improve or update practices contained within.

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Enquiries regarding the content of this publication shall be addressed to HSAC Helideck Committee Chairman. For contact details, see HSAC Website (*http://www.hsac.org/membership-contacts*)

The latest version of this document is available in electronic format at: *http://www.hsac.org/library*

1 TABLE OF CONTENTS

1.1 Table of Tables

1.2 Table of Figures

2 PURPOSE

This Recommended Practice (RP) was created to promote safety by establishing a single, industry-accepted recommended practice for offshore wind aviation support accepted amongst companies in the American offshore renewable sector.

3 SCOPE

The scope of this document intends to cover all aspects of flight operations in support of offshore renewable energy, in particular, offshore wind farms. It is intended to provide guidance on flight operations to, within, and in the vicinity of wind turbine generators (WTGs), met masts, offshore substations, etc. It will also provide guidance for operations at supporting assets such as helidecks and heli-hoist platforms on vessels, sub-stations, terminals, airports, and heliports.

Future editions will discuss air operator standards and requirements in greater detail. Many standards and specifications delineated in this document have been gathered from documents already in use, and best practices, in relation with regulatory requirements, have been considered in the constructing of this document.

4 RECOMMENDED PRACTICE

This Recommended Practice provides standard information that is considered “best practices” for aviation operations in support of offshore renewable energies. The information herein is the result of review of a number of already existing, and proven documents, as well as hazard identification with corresponding risk assessment.

The Helicopter Safety Advisory Conference (HSAC) does not exercise regulatory authority; therefore, these practices are advisory in nature only. These recommended practices were assembled and agreed upon by a number of persons representing companies across the energy industry and are intended to create safe standards across the industry and in lieu of regulatory requirements.

This document is intended to be the start of a much larger, more comprehensive Recommended Practice that will cover other aspects of aviation support to the offshore wind industry and, the renewable industry at large. Additional sections of this document will be added as they are created and will change the edition number of this document.

5 REFERENCES

The following publications, recommended practices, and industry best practices have been taken into account / reviewed in the development of these guidelines and in some cases are cited herein. The most recent edition of the documents listed shall be used, unless otherwise specified.

Table 1: References

Organization	Reference #	Title
American Petroleum Institute (API)	**API RP 2A**	Planning, Designing, and Constructing Fixed Offshore Platforms
United Kingdom Civil Aviation Authority (UK CAA)	**CAP 437**	Standards for offshore helicopter landing areas
	CAP 764	Policy and Guidelines on Wind Turbines
Federal Aviation Administration (FAA)	**FAA AC 70/7460-1M**	Obstruction Marking and Lighting
	FAA AC 150/5345-43	Specification for Obstruction Lighting Equipment
Federal Maritime and Hydrographic Agency (BSH) Germany	**Standard offshore aviation (SOLF) for the German exclusive economic zone**	Parts 3, 4 and 5
G+ Global Offshore Wind / Energy Institute		Good Practice Guidelines for Safe Helicopter Operations in Support of the Global Offshore Wind Industry, Sections A & B
Helicopter Safety Advisory Conference (HSAC)	**HSAC RP 161**	Recommended Practice for New Build Helideck Design Guidelines
	HSAC RP 162	Recommended Practice for Assessment, Upgrades, Modification, Replacement and Marking of Existing Helidecks
	HSAC RP 163	Inspection, Maintenance and Operation of Offshore Helidecks
	HSAC RP 164	Helideck Information Plates
	HSAC RP 165	Guidelines for Offshore Helicopter Operations
	HSAC RP 191	Offshore Helideck Incident Bowtie
	HSAC Table Helicopter Design Criteria	Helicopter size and loading criteria (weight, dimensions, etc.) for helidecks is on the HSAC Web Site noted above under "Documents Library"
HeliOffshore	**Wind Farm Recommended Practice (WinReP)**	Recommended Practice for Wind Farm Operations

Organization	Reference #	Title
International Civil Aviation Organization (ICAO)	**ICAO Annex 14 Vol II**	Heliports
	DOC 9261	Heliport Manual
International Chamber of Shipping (ICS)	**ICS Guide**	ICS Guide to Helicopter / Ship Operations

6 TERMS, DEFINITIONS, AND ABBREVIATIONS

The following terms and associated definitions are used in this document. Additional detailed guidance is provided later in the document.

6.1 Terms and Definitions

Table 2: Terms and Definitions

Term	**Definition**
Air operator	An organization transporting passengers and cargo via aircraft for hire
D-value	The largest overall dimension of the helicopter when rotor(s) are turning, 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 rearward extension of the helicopter structure.
Design helicopter	The helicopter type used in design of the hoist area having the largest set dimensions and the maximum take-off weight/mass (MTOW/MTOM) of the range of helicopters for which the helideck is being designed.
Downwash or Rotor Downwash	Rotor downwash is a common phenomenon that occurs during helicopter hover in close proximity to the ground or some other surface. It has the potential to cause significant damage to nearby vehicles and objects, as well as people.
Offshore Facility	Offshore platforms, vessels, ships, and support systems such as oil and gas handling facilities, living quarters, offices, shops, cranes, electrical supply equipment and systems, fuel and water storage and piping, heliport, marine docking installations, communication facilities, navigation aids, and other similar facilities necessary in the conduct of offshore operations.
Feathering (of the turbine)	Adjusting the blade angle so they do not produce force that would cause the rotor to spin
Hazard	Any operational or technical situation, equipment, procedure, etc. with potential to cause damage or which presents a dangerous situation.
Helicopter Hoist Operations	The transfer of trained personnel and small equipment using a hoist fitted to the side of the aircraft, operated by trained technical crew members (helicopter hoist operators) in the cabin
Hoisting / Winching	The transfer of personnel or loads by means of a hoist cable to or from an aircraft in stable hover flight. It is recognized that the term winching is also used synonymously in the industry.
Inspection	An activity that is predominantly visual in nature, in which the condition of items are compared to a known standard.
Manned Facility	An offshore facility that is normally manned.

Term	Definition
Maximum Take Off Mass (Weight)	A maximum allowed helicopter mass (weight) on the helideck (TLOF) based on dynamic loads incurred during take-off and landings. MTOM is used interchangeably in many documents as MTOW and is depicted in either pounds (lbs.) or metric tons (t).
Met mast	Mast structure placed in (future) wind farm location with equipment to measure meteorologic conditions
Medevac	The evacuation of patients or casualties to the hospital in a helicopter or airplane.
Nacelle	A nacelle is a cover that houses all of the power generating components in a wind turbine, located at the top of the wind turbine generator.
Normally Unattended Installation (NUI)	An offshore facility that is normally unmanned
Nose Cone Heading	When the WTG nacelle is rotated so that the blades are at 90 degrees off the wind with the wind blowing on to the left side of the nacelle. This is usually done to facilitate a hoist-capable helicopter accessing the hoist platform safely, with the relative wind bearing on the aircraft's nose, and clear of the wind turbine blades.
Offshore Wind Farm	A group of energy-producing wind turbine generators placed offshore
Offshore Wind Turbine Generator	A device with large blades that converts the kinetic energy of wind into electrical energy placed offshore
Obstacle	All fixed (including temporary and permanent) and moveable objects or parts of these that are located in an area intended for the safe movement of helicopters or extend above a defined surface intended to protect the helicopter or are located outside of those defined surfaces and have been assessed as a hazard to helicopters.
Offshore helideck	A physical platform on an offshore facility designed and used for helicopter landings and take offs.
Pilot in Command's (PIC)	The person aboard an aircraft who is ultimately responsible for its operation and safety during flight. The PIC must be legally certificated (or otherwise authorized) to operate the aircraft for the specific flight and flight conditions but need not be actually manipulating the controls at any given moment. The PIC is the person legally in charge of the aircraft and its flight safety and operation and would normally be the primary person liable for an infraction of any flight rule.
RD-value	The diameter of a circle made by the main rotor blades while rotating.
Renewable energy	Energy from a source that is not depleted when used, such as wind, solar, water/tidal, and geothermal.

Term	Definition
Search and Rescue (SAR)	The search for and provision of aid to people who are in distress or imminent danger. The general field of search and rescue includes many specialty sub-fields, typically determined by the type of terrain the search is conducted over. These include mountain rescue; ground search and rescue, including the use of search and rescue dogs; urban search and rescue in cities; combat search and rescue on the battlefield and air-sea rescue over water.
Supporting Assets	Supporting assets are vessels, platforms and other structures required to develop, install, operate, and maintain the offshore wind farm
Tip-Path Plane	The imaginary circular plane outlined by the rotor blade tips as they make a cycle of rotation.
Winching	See hoisting above.

6.2 Abbreviations

Table 3: Abbreviations

Abbreviation	Description
AC	Advisory Circular
API	American Petroleum Institute
CAA	Civil Aviation Authority
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations, or Crash-Fire Rescue
ERP	Emergency Response Plan
FAA	Federal Aviation Authority
HHA	Helicopter Hoist Area
HHAM	Helicopter Hoist Area Manual
HHO	Helicopter Hoist Operation
HHOP	Helicopter Hoist Operation Passenger
HSAC	Helicopter Safety Advisory Conference
ICAO	International Civil Aviation Authority
ID	Identification
LED	Light emitting Diode (light source)

Abbreviation	Description
MSL	mean sea level
MTOW/MTOM	Maximum Take Off Weight / Maximum Take Off Mass
NOTAM	Notice to Airman
NVG	Night Vision Goggles
OEI	One Engine Inoperative
OSS	Offshore Sub-Station
OWF	Offshore Wind Farm
PIC	Pilot in Command
RP	Recommended Practice
SAR	Search And Rescue
UK MCA	United Kingdom Maritime and Coastguard Agency
USCG	United States Coast Guard
VMC	Visual Meteorological Conditions
WTG	Wind Turbine Generator

7 HELIDECK DESIGN

When designing a new helideck or utilizing existing assets with pre-existing helidecks for use in this industry, regardless of the type of asset (Wind Farm support vessel, offshore substation or on the WTG itself), HSAC RP-161 provides an industry-accepted guide for the design of helidecks in the United States, currently used in the oil and gas industry. See HSAC RP-161 for other acceptable design standards when contracting vessels with pre-existing helidecks.

Considerations shall be given to the potential design life of the facility and likely future requirements, to include the potential for larger helicopters and/or increased personnel, facilities upgrades, etc. Initial planning shall include all criteria pertaining to the design of a helideck. Valuable assistance during the planning and design phase can be provided by the aviation professionals of the helicopter operators, helideck developers and manufacturers, and the oil and gas and renewable energy companies.

During the design phase of the helideck, consideration shall be given to the Maximum Take-Off Weight (MTOW) landing loads and overall length (D-value) of the design helicopter that the helideck is intended to serve. Due to the unique nature of the offshore wind farms compared to oil & gas assets, additional consideration shall be given to the helideck design. Some of the topics are:

a) Strong winds.

b) Extreme cold weather operations (design of heated helidecks, and snow/ice removal., etc.)

c) Provision of ground power unit in the proximity of the helideck.

d) An offshore wind farm has multiple WTG and supporting assets in close proximity, hence flight path alignments, drop down / falling gradient infringements and obstruction clearance, and associated marking should be taken into consideration.

e) The obstacle environment in proximity to Offshore Wind Farm (OWF) helidecks is typically complex with multiple obstructions. Special planning and analysis must be conducted to ensure safe approach and departure paths. Also, it is imperative that One Engine Inoperative (OEI) climb-out shall be achievable.

8 HELICOPTER HOISTING OPERATIONS

Helicopter Hoisting Operations (HHO) - the hoisting of personnel to or from a helicopter, is always considered a high-risk activity. The safest means for helicopter–ground access for personnel is providing a means in which the helicopter can land to take on or drop off passengers and equipment. Where practicable, the helicopter should always land rather than hoist, because safety is enhanced when the time spent hovering is minimized. If routine hoisting or the transfer of larger parties of personnel is envisaged, it is preferable to fit larger vessels and structures with helidecks. Hoisting personnel on such structures should be limited to emergency situations, including technical emergencies.

While hoist operations might be necessary on top of wind turbine generators, it should not be considered as a means for crew change operations on support vessels or offshore sub-stations.

8.1 Hoisting General Practice

It is normal practice for the hoist arrangement and the pilot in command to be located on the right-hand side of the helicopter.

Some helicopters have the hoist fitted in the left side, primarily for balance considerations, this practice is also acceptable, observing the limits of 8.1.2 below.

8.1.1 Normal Accepted Practice

During helicopter hoisting to a wind platform, the pilot is normally positioned just on the inboard side of the outboard winching platform railings. In this configuration the pilot's perspective of the platform and turbine blade arrangement shall be unimpeded and it is not considered usually necessary to provide any additional visual cues to assist in maintaining a safe lateral distance between the helicopter main rotor and the nearest dominant obstacle.

8.1.2 Cross-Cockpit Hoisting

Where cross-cockpit helicopter hoist operations are envisaged, an aiming point system may need to be established to assist the pilot in determining the position of the helicopter in relation to the winching area platform and to obstacles. This may be achieved by the provision of a sight point marker system or similar aids.

8.2 Hoisting to an Approved Offshore Hoisting Area

In situations in which the D-value of a helideck is not large enough to support the aircraft required for a particular mission, or if the deck is marked non-operational with a landing prohibited marker, there may be a need to conduct cargo or personnel hoist operations to/from the helideck. Personnel hoisting to or from a vessel shall only be considered for Medical Evacuation (MEDEVAC) or other critical or emergency reasons. Therefore, the vessel shall have a hoist plan as part of their emergency response plan, and a full risk assessment shall be conducted by the air operator and vessel to identify potential hazards, such as avoidance of obstacles and man overboard.

For such installations or structures that are normally unmanned, and the need to put a person on that structure is infrequent, the structure shall have a dedicated hoist area that is clear of obstructions.

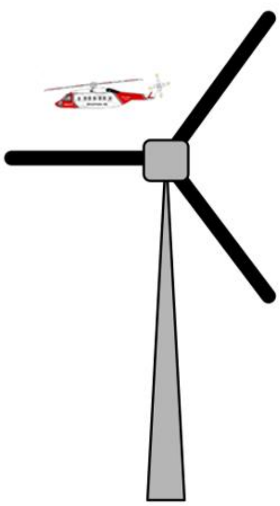
> ***Note:*** *See the ICS Guide to Helicopter/Ship Operations and CAP 437 Chapter 10 for best practices.*

Where an asset has both a helideck and a dedicated hoist area, special procedures and precautions shall be in place to prohibit simultaneous operations.

8.3 Hoisting to WTG Helicopter Hoist Areas

8.3.1 Nacelle Direction, during routine hoisting

During routine helicopter hoist operations, it is normal practice for the nacelle to be motored 90 degrees out of wind so that the upwind blade is horizontal and points into the prevailing wind (known as the advancing blade upwind position). This is the preferred orientation for commercial helicopter hoist operations during transfer of personnel and cargo; it provides good visual references for both pilot and hoist operator, and no turbine blades in front of the helicopter that can create turbulence. However, the actual orientation of the blades may vary to suit specific operational requirements (for example, the retreating blade horizontal position or Y blade (Bunny Ears) position is often preferred when conducting search and rescue operations).



Advancing Blade Horizontal Position:

The advancing blade horizontal position is the is preferred option for commercial HHO with the retreating blade occupying the area closest to the tail rotor.

This position is also known as "Orientation Stop", "Heli-Stop" or "Lazy Y". This is the position usually selected for delivery/recovery of turbine technicians by wind farm helicopters.

Figure 8-1: Routine hoist orientation (Courtesy UK MCA)

8.3.2 SAR hoisting

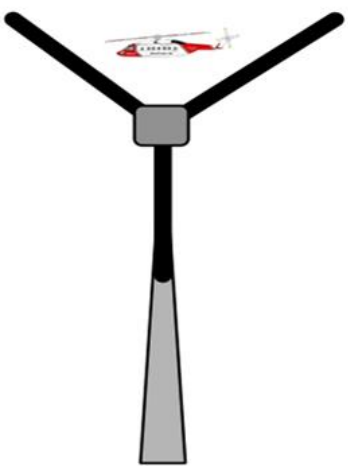
8.3.2.1 Feathering, braking and orientation of wind turbine blades for SAR operations

The wind farm operator will need to know how WTGs in a particular wind farm are shut down, feathered, orientated, and prepared for helicopter operations, as well as how long this process will take. This information must be included in the ERP. Failure to have control of turbines, as described below, may result in rescue not being possible in some situations.

If helicopter rescue is to take place from/to a WTG, the WTG blades will have to be feathered and the rotor brakes applied (and where feasible blades shall be pinned). It may be possible for a SAR helicopter to winch from a nacelle with the blades in a variety of positions, however, the bunny ears is normally preferred or alternately the Retreating Blade Horizontal position, depending on the type of SAR aircraft. It is also imperative that any automatic yaw control systems be disabled, where possible, or, that the SAR helicopter is informed that yaw control cannot be isolated before it arrives over or near to a turbine.

US SAR helicopter rescue winches are located on the right-hand side of the helicopter. Therefore, the nacelle shall normally be rotated so that the blades are at 90 degrees off the wind with the wind blowing on to the left side of the nacelle e.g., if wind is blowing from 270 degrees, the nacelle will need to be rotated to the right so that the hub is facing 360 degrees. This shall be described as the nose cone heading. Nacelles must be held in position so that downwash from the helicopter does not cause the nacelle to rotate.

The blades shall be prepared and in position before the SAR aircraft arrives. Failure to do so may result in significant delay, particularly if repositioning the blades does not occur promptly. This could additionally require the aircraft to leave to refuel.

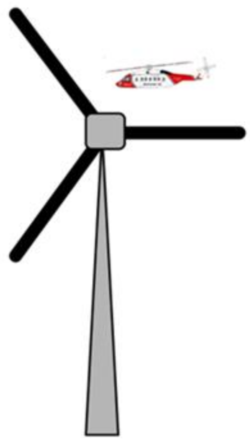


Bunny Ears (SAR) Position:

The Y blade position offers good references with the blade in the pilot and winch operator's 2 o'clock position. The retreating turbine blade aft of the helicopter in the winching position slightly compromises the tail rotor area.

This position is commonly referred to as "Bunny Ears", "Y position" or the "SAR Position" and is the preferred option for winch transfers to the turbine for larger SAR helicopters.

Figure 8-2: SAR position (Courtesy UK MCA)



Retreating Blade Horizontal Position:

The retreating blade horizontal position provides good references with the blade in the pilot and winch operators 2 o'clock position while maintaining a clear area for the tail rotor should the crew wish to offset the aircraft for wind or to improve visual references or escape headings.

This is not considered a standard orientation for commercial HHO but can be requested by SAR helicopters.

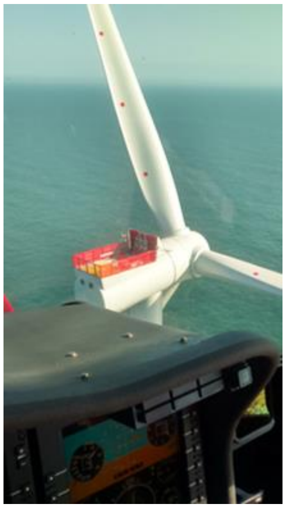


Figure 8-3: Retreating blade horizontal position (alternative SAR position) (Courtesy: UK MCA)

9 WIND TURBINE GENERATOR HOIST PLATFORM DESIGN

9.1 General

The platform design criteria in the following sections have been developed to promote a safe and favorable environment for helicopter hoist operations. It should be recognized that any departure from the best practice platform designs laid out within this section, including deviations from specified dimensions, has potential to compromise the safe and favorable environment secured for helicopter hoist operations. It is therefore recommended that any proposed conceptual arrangements shall be subjected to appropriate testing, including wind tunnel testing and/or Computational Fluid Dynamics (CFD) studies to establish the wind environment at and above the operating area. Studies undertaken shall assess any impact on safe operations that may be caused by an increase in the incidence of turbulence and/or of rotor downwash effects as a result of proposed modified topside arrangements / platform design.

9.2 Hoist Platform Design Considerations

9.2.1 Turbulence and static discharge

The platform shall be constructed so that it generates as little turbulence as possible. The overall platform design shall take into account the need for downdraft from the main rotor to disperse away from the platform. The incidence regarding the discharge of static electricity from the helicopter shall be addressed by ensuring that the platform is capable of grounding the hoist wire and aircraft.

9.2.2 Load-bearing requirements

The platform deck shall be capable of supporting a mass that is approximately five times the weight of an average HHOP (approx. 220 lbs. / 100 kg per person or 1,100 lbs. / 500 kg total).

9.2.3 Overall superimposed load.

To allow for personnel and cargo transfer or rotor downwash, a minimum 40 psf (2.0 kN/m2) live load shall be uniformly distributed over the whole area of the hoisting area, access route and safety zone.

9.2.4 Aircraft Clearance

9.2.4.1 Clearance Criteria

The minimum clearance to be maintained between the tip-path plane of the helicopter rotor blades at hover height above the hoisting area platform and the rear of the plane of rotation of the wind turbine rotor blades at corresponding hover height, shall be a minimum of 16 ft 5 inches (5.0 m) (see Figure 9-2: General arrangement drawing showing safety distances (Courtesy UK CAA)). This shall be determined with the central axis of the helicopter positioned directly above the hoisting area safety railing farthest from the turbine rotor blades.

9.2.4.2 RD-Value Design

To assist in determining if an aircraft can safely meet the clearance requirement stated in 9.2.4.1 above, a hoist platform shall be analyzed by the wind farm operator against the specific RD-Value (Rotor Diameter) of the intended employed helicopters in mind. The results of the analysis must be published in the wind farm operator's Helicopter Hoist Area Manual (HHAM), so it is easy for Air Operators to determine whether their helicopters fulfill clearance requirements. Much like the D-Value that guarantees clearance of a helicopter on a helideck, the RD-Value is intended to guarantee the minimum of 16 ft, 5 inches (5 m)of clearance between the tip path plan of the rotor disc of the helicopter performing HHO to the platform, and the plane of rotation of the wind turbine rotor blades at corresponding hover height, assuming that the aircrew is hovering over the appropriate spot.

9.2.5 Hoisting Area Platform

The hoisting area platform (clear area to which a hoisted person will be lowered) shall be square or rectangular and capable of containing a circle having a minimum diameter of 13 ft (4.0 m). The surface of the hoist area can be either a grating or a solid surface with appropriate friction properties.

9.2.6 Safety Zone

In addition to the hoisting area platform, provision needs to be made for a safety zone to accommodate Helicopter Hoist Operations Passengers (HHOP) at a safe distance away from the hoisting area during helicopter hoist operations. The minimum safe distance is deemed to be not less than 5 feet (1.5 m) from the inboard edge of the hoisting (clear) area.

9.2.7 Access Route

The safety zone shall be connected by an access route to the hoisting area platform located inboard of the hoisting area platform. The safety zone and associated access route shall have the same surface characteristics as the hoisting area platform (see paragraph 9.2.5) except that the overall size may be reduced, such that the dimensions of the safety zone and access route are not less than 8 ft (2.5 m) in length and 3 ft (0.9 m) in width.

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

9.2.8 Enclosure (Railing System)

The hoisting area platform and associated access route and safety zone shall be completely enclosed by a railing system between 4 ft (1.2 m) and 6.5 ft (2.0 m) in height, to always ensure the safety and security of HHOP. The design of the safety rails shall ensure that a free flow of air through the structure is not prevented or disrupted while also guaranteeing that no possibility exists for the hoist hook to get entangled in the railing or in any other part of the platform structure. It is permitted for the railing system to be located along the edge, within the specified clear area of the hoisting area platform, the associated access route and safety zone.

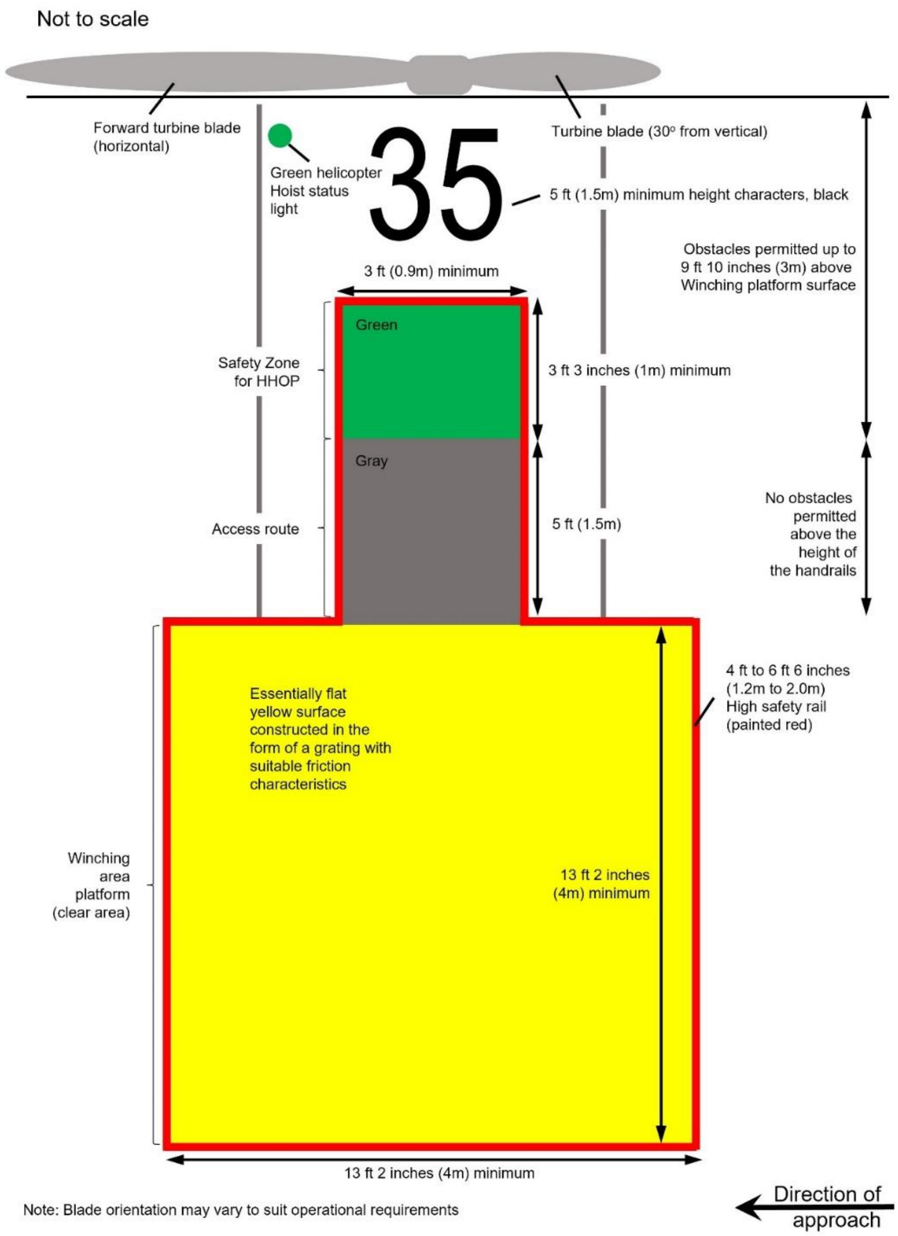


Figure 9-1: Hoisting area, access route and safety zone (Courtesy UK CAA)

9.2.9 Friction Properties & Water Drainage

The surface of the platform, including the safety zone and associated access route, including any marking/painting as required shall display suitable friction characteristics to ensure the safe movement of HHOP in all conditions. The minimum friction coefficient, which shall be verified prior to installation, is 0.5μ.

The surface of the platform shall be flat for helicopter hoist operations. However, the floor may slope down towards the outboard edge of the platform to prevent the pooling of water on the platform. It is recommended that a slope not exceeding 2% (1:50) be provided.

9.2.10 Safety Provisions

9.2.10.1 Nacelle Lock-Out

It is essential that the nacelle shall not turn in azimuth and that the turbine blades shall also be prevented from rotating by the application of the braking system during HHO.

9.2.10.2 Other Equipment in Hoist area

Consideration shall be given to the placement of other equipment on the nacelle or Hoist area. Equipment such as meteorological measurements devices and obstruction lights shall be placed as far as practicable from the hoisting area more towards the safety area to prevent entanglement.

Access hatches and (nacelle) cover plates shall be avoided in the hoisting area to minimize the obstacle on the walking/hoisting surface and prevent damage or injury from being blown open / off as a result of helicopter downdraft.

9.2.10.3 Electrostatic Properties of the Hoist Area

The surface of a hoisting area HHA must be designed in such a way that it allows a static discharge of the helicopter via the winch cable.

8.3.9.10 Operational Requirements

The use of the hoisting area HHA is limited to daylight hours (morning civil twilight to evening civil twilight).

9.2.11 Obstacle Restriction

9.2.11.1 Area

9.2.11.1.1 Distance to 5 ft (1.5M)

Within a horizontal distance of 5 ft (1.5M) measured from the winching (clear) area, no obstacles are permitted to extend above the top of the railing.

9.2.11.1.2 Distance beyond 5 ft (1.5M) up to Plane of Rotation

Beyond 5 ft (1.5M) and out to a distance corresponding to the plane of rotation of the turbine rotor blades, obstacles are permitted up to a height not exceeding 10 ft, (3.0 m) above the surface of the hoisting area. It is required that only fixed obstacles essential to the safety of the operation are present, e.g., anemometer masts, communications antennae, heli-hoist status light etc.

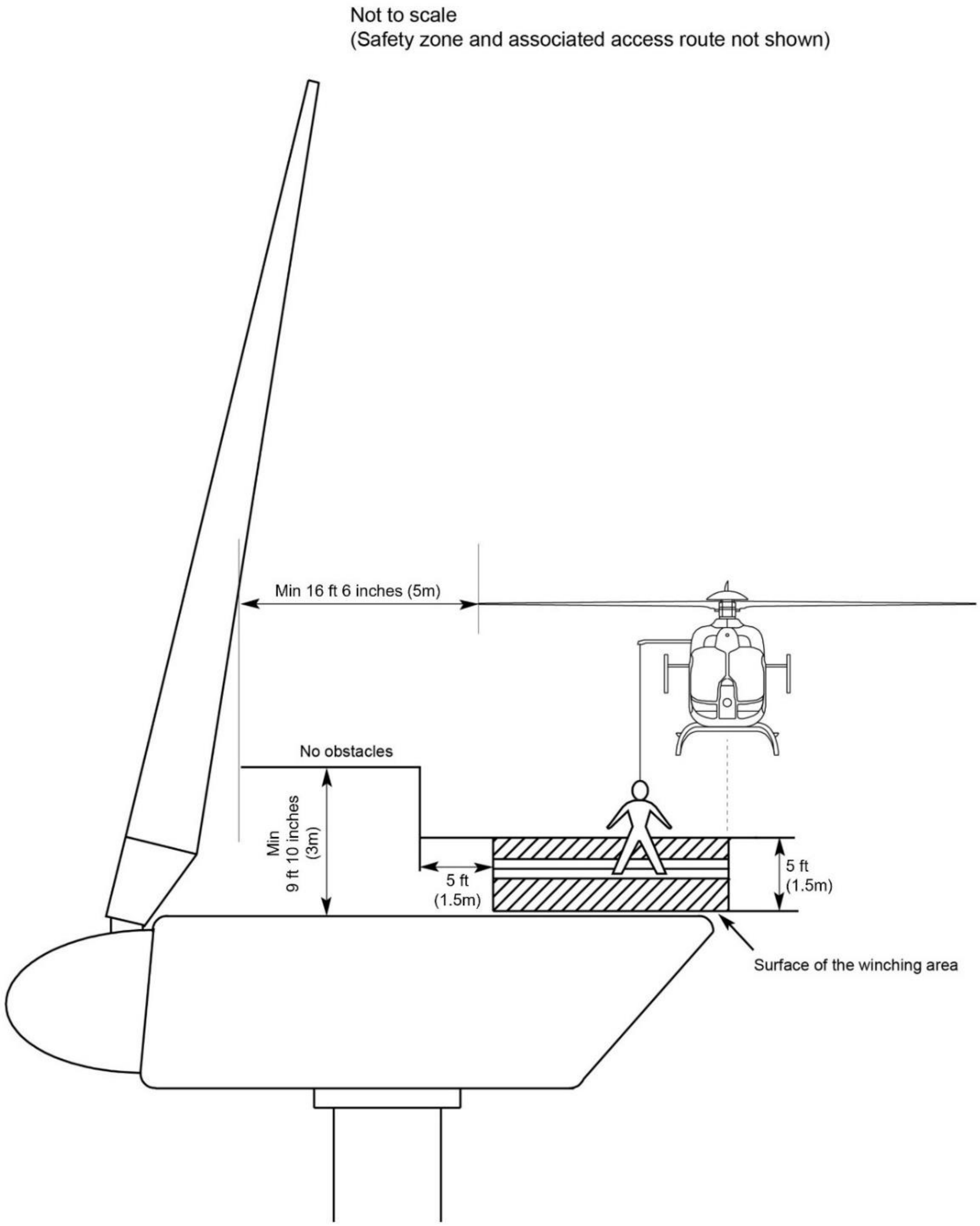


Figure 9-2: General arrangement drawing showing safety distances (Courtesy UK CAA)

9.2.12 Visual Aids

9.2.12.1 Platform

The surface of the hoisting area (a minimum 13 ft (4.0 m) square 'clear area') shall be painted yellow. For the safety zone, green is recommended and a contrasting grey for the associated access route (see Figure 9-1: Hoisting area, access route and safety zone (Courtesy UK CAA)).

9.2.12.2 Railings

The railings around the entire winching area, safety zone and associated access route shall be painted in a conspicuous color, preferably red. See section 9.2.8 for dimensions.

9.2.12.3 Wind Turbine Structure

The wind turbine structure shall be clearly identifiable from the air using a simple designator (typically a two-digit or three-digit number with block identification), painted in 5 ft (1.5M) (minimum) characters in a contrasting color, preferably black. The turbine designator shall be painted on the nacelle top cover ideally utilizing an area adjacent to the turbine rotor blades.

10 WIND TURBINE LIGHTING

> ***Note:*** *See FAA Circular: FAA - AC 70/7460-1M*

For general guidance on wind turbine generator aviation obstacle marking, refer to AC 70/7460-1 and FAA Specification for Obstruction Lighting Equipment, FAA AC 150/5345-43J.

WTGs furthermore feature a number of other lights that aid a hoist operation. These include for example the helicopter hoist status light, and floodlights, should hoisting be planned during dark hours.

10.1 Helicopter Hoist Status Light

A helicopter hoist status light shall be located near the platform in a position in which the pilot at the controls can see it upon approach to the platform and shall convey a "break engaged" status. During HHO, the light shall be ON, indicating that the brake has successfully engaged, locking the nacelle and turbine blades in position, and indicating that the WTG is safe and prepared to receive HHOP.

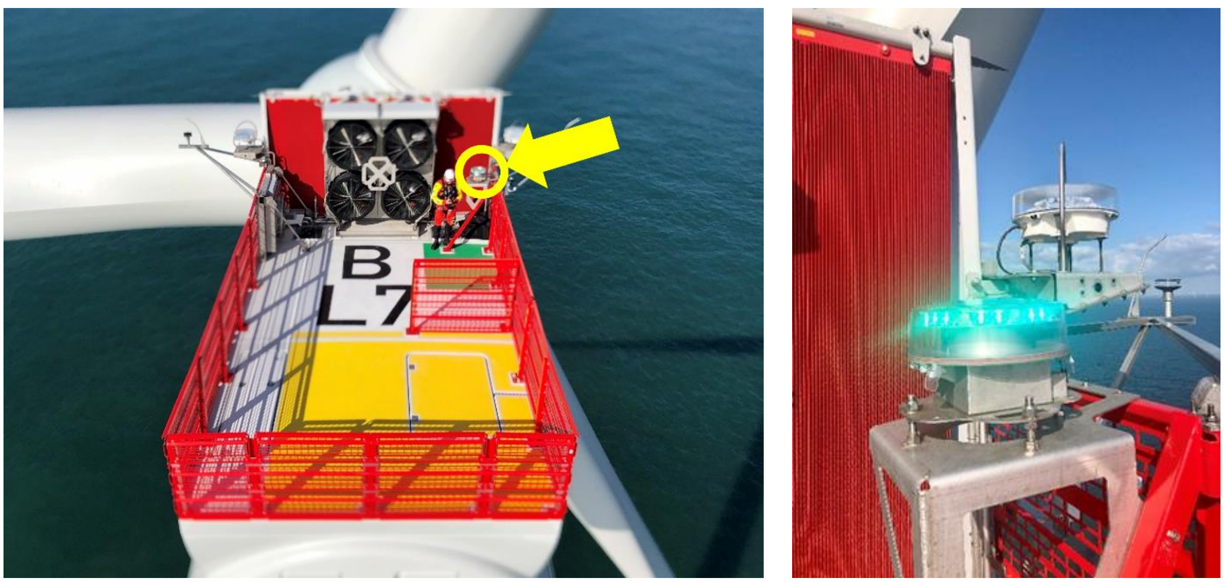


Figure 10-1: Helicopter Hoist Status Light

10.1.1 Function

Wind turbine platforms are required to be provided with a means of indicating that the blades and nacelle are safely secured prior to commencing helicopter hoist operations. A single green light is recommended for this purpose which is capable of displaying both a steady and flashing green signal as follows:

a) A steady green signal is displayed to indicate to the pilot that the turbine blades and nacelle are secure, and it is safe to operate.
b) A flashing green signal is displayed to indicate that the turbine is in a state of preparation to accept hoist operations or, when displayed during hoist operations, that parameters are moving out of limits.

c) When the light is extinguished, this indicates that it is not safe to conduct helicopter hoist operations.

10.1.2 Visibility

The light shall be conspicuous at a range of at least 0.31 statute miles (500m) and detectable at a range of at least 0.44 statute miles (700m) in a meteorological visibility of 1.86 statute miles (3km) in daylight ($E_t = 10^{-3.5}$) and, if required, at night ($E_t = 10^{-6.1}$).

10.1.3 Dazzling and blinding

The light shall not present a source of glare or dazzle the pilot. The critical case in this respect is when the helicopter is closest to the light during the hoist operation itself; at this point, the lowest elevation of the helicopter relative to the light is assumed to be 15 degrees, i.e., at least 10 ft (3m) above the light and laterally displaced by no more than 33 ft (10m). Note that lights with small apertures (e.g., lights using LED sources) will result in higher luminance and will be more likely to cause glare. Care shall be taken in designing the light to avoid excessive luminance.

10.1.4 Hours of operation

Hoist operations are presently conducted in daylight (VMC) conditions but may be permitted to take place at night in the future. Light intensities for both daytime and night operations are therefore specified. In the event that night-time operations are being conducted, the light unit intensity shall be controlled by a photocell as operation of the light at the daylight setting at night is very likely to dazzle the pilot. The photocell shall be installed such that it is shielded from direct sunlight in order to correctly measure ambient light, particularly during sunset and sunrise when the sun is low in the sky.

10.1.5 Location

The light shall be located on the hoist area platform of the wind turbine such that it remains within the field of view of the pilot during the approach to the wind turbine and throughout the hoist operation, i.e., the coverage shall be 360 deg. in azimuth. (The preferred location of the light is on top of the Safety Zone railing as shown in section 10.1 and in Figure 10-1: Helicopter Hoist Status Light above).

10.1.6 Light intensity

The following characteristics shall apply for both steady burning and flashing modes of the helicopter hoist status light. The minimum light intensity profile is given in Table 4: Effective intensity below.

Table 4: Effective intensity

Day/Night	Min. intensity			Max. intensity	
	0° to 2°	>2° to 10°	>10° to 90°	0° to 15°	>15° to 90°
Day	16cd	410cd	16cd	750cd	120cd
Night	3cd	16cd	3cd	60cd	60cd

The effective intensity specified in Table 4: Effective intensity shall apply to all angles of azimuth.

In flashing mode, the light shall flash at a rate of 120 flashes per minute (2 Hz), ±10%. The maximum duty cycle shall be no greater than 50%.

The light shall transition from the daylight setting to the night-time setting when the ambient illuminance falls below 500 lux and shall switch before it reaches 50 lux. The light shall transition from the nighttime setting to the daylight setting when the ambient illuminance rises above 50 lux and before it reaches 500 lux. The transition from one setting to another shall be accomplished smoothly (linear transition to within ±10%) without any noticeable step changes.

The color of the helicopter hoist status light shall be green as defined in FAA Engineering Brief 67D as applicable.

10.1.7 Serviceability

The system shall be designed so that it fails safe, i.e., any failure in the helicopter hoist status light system shall result in the light being extinguished.

11 HELICOPTER HOIST AREAS ON OFFSHORE FACILITIES

On offshore renewable facilities such as offshore substations, Helicopter Hoist Areas (HHA) can be established. They are typically intended for personnel emergencies only (rescue areas) and for access during technical emergencies. It consists of a circular, obstacle-free zone, and a surrounding maneuvering zone (see Figure 11-2: Platform hoist area design and markings).

As mentioned in Chapter 0, offshore platforms where regular personnel transfers by helicopters are intended, the platform shall be fitted with a helideck.

ICAO DOC 9261 Heliport Manual has provided the following note:

> ***Note*** *– the proposed application of this chapter is to winching areas located on ships. However, States may seek to apply the basic same criteria, but with some alleviations, for heli-hoist activities that occur, where permitted, on fixed platforms e.g., for a winching area located on an offshore support sub-station. Applying the same criteria provides an additional degree of conservatism as fixed platforms are not subject to the same effects of motion that occur on ships (the amount of heave, sway or surge motion can vary depending on the location of the winching area on a ship – see Chapter 3, Section 3.2.5.3). Therefore, for winching areas located on fixed platforms, some relaxation of the clear zone dimension (see 7.1.3) and the maneuvering zone (see 7.1.4) may be considered by the appropriate authority.*

Figure 11-1: Example of Helicopter Hoist Area (HHA) on Offshore Sub Station (OSS) (Courtesy: NHV, Tom Buysse)

11.1 Design and obstacle restriction

This chapter contains guidance on design and obstacle restriction.

11.1.1 Design

a) A hoist area shall be located over an area to which the helicopter can safely hover while hoisting to or from the platform. Its location shall allow the pilot an unimpeded view of the whole of the clear zone while facilitating an unobstructed view of the platform.
b) The hoist area shall be located so as to minimize aerodynamic and wave motion effects as well as allowing downdraft from the main rotor to disperse away from the platform.
c) It shall provide adequate deck area adjacent to the maneuvering zone to allow for safe access to the HHA from different directions. In selecting a hoist area, the desirability for keeping the hover height to a minimum shall also be taken into consideration.
d) Hoist area markings shall be located so that their centers coincide with the center of the clear zone (see Figure 1).
e) The 16 ft (5 m) minimum diameter clear zone shall be painted in a conspicuous color, preferably yellow, using non-slip paint.
   1) The non-slip covering must be regularly monitored by the platform operator during the operating life of the system.
   2) The surface must be designed in such a way that it allows a static discharge of the helicopter via the static discharge line.
   3) The slope shall be large enough to avoid water accumulation on the surface.
   4) The surface must be flat.

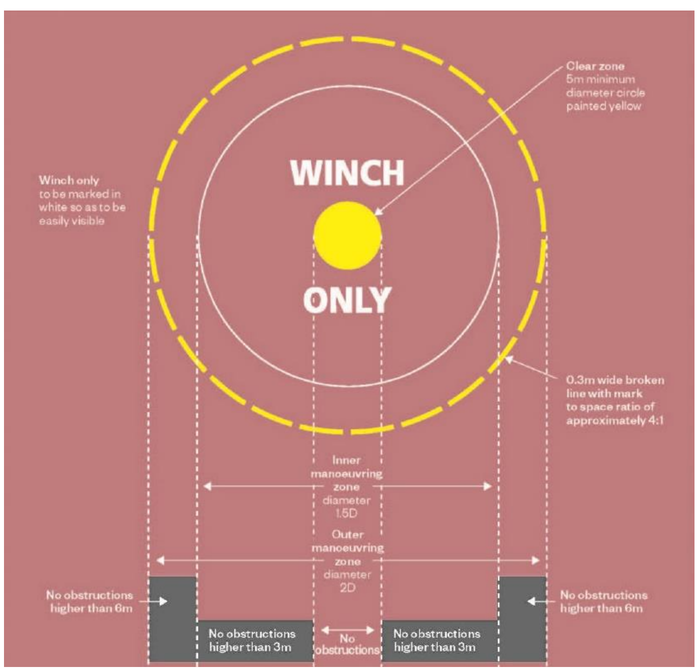


Figure 11-2: Platform hoist area design and markings

11.1.2 Markings

a) A Hoist area outer maneuvering zone marking shall consist of a broken circle with a minimum line width of 1 ft (30 cm) and a mark: space ratio of approximately 4:1. The marking shall be painted in a conspicuous color, preferably yellow. The extent of the inner maneuvering zone may be indicated by painting a thin white line, typically 4 in (10 cm) thickness.
b) Within the maneuvering zone, in a location adjacent to the clear area, 'HOIST ONLY' or 'WINCH ONLY' shall be easily visible to the pilot, painted in not less than 6.5 ft (2 m) characters, in a conspicuous color. For standardization, it is recommended wherever possible that the marking is painted white.

11.1.3 Night markings

a) Where hoisting operations to platforms are required at night, hoist area floodlighting shall be provided to illuminate the clear zone and maneuvering zone areas. Floodlights shall be arranged and adequately shielded to avoid glare to pilots operating in the hover. The floodlight arrangement shall ensure that the shadows are kept to a minimum.
b) The spectral distribution of hoist area floodlights shall be such that the surface and obstacle markings can be clearly identified. The floodlighting arrangement shall ensure that shadows are kept to a minimum.

11.1.4 Load carrying capacity

a) The obstacle-free zone shall be statically load-bearing in relation to the intended load cases, in particular considering rotor downdraft. Reference can be taken from the minimum criteria as mentioned in 9.2.2 for the loads on the Hoisting area.
b) The maneuvering zone does not have to be statically load-bearing as above, and its surface does not have to be solid throughout. It may be partially located over the side of the offshore platform, i.e., above the water.

11.1.5 Access

a) A rescue area shall have at least two independent entry and exit options.
b) To avoid endangering third parties during HHO, measures shall be taken to prevent unnecessary access to the HHA.

11.1.6 Obstructions

a) To reduce the risk of a hoist hook or cable becoming fouled, all guard rails, stanchions, antennae, and other obstructions within the vicinity of the maneuvering zone shall, as far as possible, be either removed, lowered, securely stowed, or be designed to avoid entanglement.
b) All dominant obstacles within, or adjacent to, the maneuvering zone shall be conspicuously marked and, for night operations, be adequately illuminated as per HSAC RP-161 guidance.

c) If the obstacle restrictions for the maneuvering zone are not complied with, the hazard potential that may result from this must be assessed by an aviation advisor/specialist. For this purpose, the distance, direction, and height of the respective obstacles in relation to the geometric center of the obstacle-free zone shall be determined. Obstacles in the immediate vicinity of the obstacle-free zone shall always be moved and/or shortened. Obstacles which, because of their height and/or shape, may pose a hazard to the hoist passenger and/or helicopter shall be modified and marked appropriately. Where appropriate, helicopter hoist operation shall also be restricted accordingly. In case of major nonconformities, the hoist area must be relocated.

All obstacle information must be made available in the Helicopter Hoist Area Manual.

12 HELICOPTER HOIST AREA MANUAL (HHAM)

12.1 Information on construction and equipment

For all HHAs on both WTG and Offshore Platforms, a HHAM shall be developed by the Wind farm Operator. The manual must contain all design, equipment-relevant and usage-relevant information. These are in particular information on the following:

12.1.1 Technical design data

a) Construction and design.
b) Distance of the geometric center of the Helicopter Hoist Area (HHA) to the rear rotor of the wind turbine at the intended hover height.
c) Dimensions of the HHA, the distances to obstacles in proximity to the HHA, the height of obstacles.
d) Type of surface of the HHA.
e) Load capacity of the HHA in lbs. and kilograms.
f) Maximum allowed WTG wind speed for hoist operations in meters per second and knots (WTG design limit).
g) Plan drawing of the WTG.

12.1.2 Markings, lighting, and other optical aids

a) HHA, zones, ID markings, Visual aids, lights.

12.1.3 Organization

a) Contact details of the HHA owner / operator.

12.1.4 Communication

The manual shall include the intended methods of communication between HHOP and the helicopter crew.

12.1.5 Operating procedures

Operating procedures for the HHO activity, including:

a) Prerequisites and restrictions for HHO including authorization process and weather.
b) Normal operating procedures for hoisting personnel and cargo.
c) Emergency procedures.
d) Reference helicopter intended to be used (maximum rotor size).
e) Coordinates of all WTGs with latitude and longitude in degrees, minutes, and seconds according to WGS 84.
f) Heights of all WTGs in meters and feet above mean sea level (MSL).
g) Any operating limitations and hours of operation (typically DAY/VMC).

12.1.6 Distribution

The wind farm operator must make the current HHAM available to the contracted Air Operator(s), relevant authorities as needed, and to the USCG and other relevant entities involved in aerial emergency response. These users, including their contact details, must be noted in a corresponding list in the manual.

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