



Exploration & Production

GENERAL SPECIFICATION

Logistic and Operational Support

GS EP LSO 110

Environmental effects considerations for helidecks

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1. Scope

This General Specification summarises the requirements for the design, construction and setting up of helidecks on offshore structures (fixed installations: jack-up, platforms, etc. – or floating installations: vessels, semi-sub platforms, barges, FPSOs, MODUs, manned installations or NUI, etc.) regarding the environmental effects.

The design of helidecks shall comply for all aspects with the [CAP 437](#) requirements.

This General Specification is based on two main documents: the [CAP 437](#) (as a standard: see more particularly the Chapter 3) and the [CAA PAPER 2004/02](#) (as a guidance document).

The main points to be addressed during the helideck design process are listed here:

1. Helideck structural design
2. Helideck height and air gap under the helideck
3. Helideck turbulence assessment
4. Temperature rise due to hot exhausts
5. Cold flaring and rapid blow-down systems
6. Special considerations for moving helidecks
7. Multiple platform configurations

The DGEP aviation experts shall approve the design of helidecks.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Standards

Reference	Title
CAP 437	Offshore Helicopter Landing Areas – Guidance on Standards

Professional Documents

Reference	Title
CAA PAPER 2004/02	Helideck Design Considerations – Environmental Effects
DNV-OS-E401	Offshore Standard : Helicopter Decks

Regulations

Reference	Title
ICAO Annex14	Volume II : Heliports



Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP STR 102	Design of offshore topside structure

3. Acronyms

CAA	Civil Aviation Authority (United Kingdom)
CAP	Civil Aviation Publication
CFD	Computational Fluid Dynamics
D Value	The largest overall dimension of the helicopter when rotors are turning
DNV	Det Norske Veritas
FPSO	Floating Production Storage & Offloading
FSO	Floating Storage & Offloading
HLL	Helideck Limitation List
ICAO	International Civil Aviation Organization
LFL	Lower Flammable Limit
LOS	Limited Obstacle Sector ($\leq 150^\circ$; see CAP 437 Glossary)
MODU	Mobile Offshore Drilling Unit
NUI	Normally Unattended Installation
OFS	Obstacle Free Sector ($\geq 210^\circ$; see CAP 437 Glossary)
SLA	Safe Landing Area (see CAP 437 Glossary)

4. Helideck design considerations

4.1 Evidence of helideck problems

It is almost inevitable that helidecks installed on the cramped decks of offshore structures will suffer to some degree from their proximity to tall and bulky structures, and to gas turbine

exhausts and flares. The objective of this General Specification is to help platform designers to create offshore installations and helidecks that are safe and 'friendly' to helicopter operations.

Turbulent airflows and thermal effects are in effect "invisible" obstructions in flight paths around installations and vessels. They can seriously affect flight operations onto a helideck.

Typical ways of minimising risk include:

- Design of a smooth airflow across the helideck
- Assess the thermal flow patterns of hot gas exhausts and take steps to minimise their effects on helicopter flight paths
- Ensure flaring and blowdown (cold venting) of flammable gases cannot prejudice helicopter operations
- Check that the presence of other units or vessels does not infringe obstacle free sectors or introduce new turbulent airflow or emit hot exhaust hazards into the flight path of a helicopter.
- Provide appropriately located meteorological instrumentation, and (for floating units and ships) motion measuring and recording equipment.

These different points will be addressed in this General Specification.

4.2 Helideck structural design

As a reminder, the first step is to design the helideck according to the regulatory design criteria (D Value, SLA, LOS, OFS, Bearing strength, etc.).

The helideck design shall comply with the CAP 437. The compliance with the CAP 437 standards will ensure the compliance with ICAO Annex14 standards.

Concerning deck netting, friction requirements, tie-down points, safety peripheral net, guttering, access points, visual aids, helideck markings, obstacle marking and lighting, the helideck shall comply with the CAP 437, Chapters 3 and 4.

Concerning the strength requirements, loads and punching shear criteria, the helideck shall comply with the CAP 437, Chapter 3. In addition, the structural design shall comply with the GS EP STR 102 requirements defined in section 4.2.4.3 and completed by the Offshore Standard DNV-OS-E401 Section 3 for the strength requirements.

4.3 Helideck aerodynamic issues

4.3.1 General

Helidecks are basically flat plates and so are relatively streamlined structures. Difficulties arise because the wind must deviate around the bulk of the offshore installation causing large areas of flow distortion and turbulent wakes, and because the installation is also often a source of hot or cold gas emissions (cf. CAP 437, parag. 3.3).

The effects fall into three main categories:

- The flow around the bulk of the offshore installation itself. Platforms are slab-sided, non-streamlined assemblies ('bluff bodies') which create regions of **highly distorted and disturbed airflow** in their vicinity.

- The flow around large items of superstructure, notably cranes, drilling derricks and exhaust stacks. Like the platform itself, these are bluff bodies, and it is the **turbulent wake flows** behind these bodies that are important.
- **Hot gas flows** emanating from exhaust outlets and flare systems.

The current design criteria are based ultimately on achieving two objectives:

- The vertical mean wind speed above the helideck at main rotor height should not exceed ± 0.9 m/s for a wind speed of 25 m/s (cf. [CAP 437](#), parag. 3.3.6).
- The maximum temperature rise, averaged over a 3 second time interval, in the vicinity of the flight path and over the landing area (at a height above helideck level which takes into consideration the airspace required above the helideck to accommodate helicopter landing and take-off decision points) should not exceed 2°C (cf. [CAP 437](#), parag. 3.3.9).

These criteria (defined in [CAP 437](#)) are taken to be the limiting conditions for safe helicopter operation. If they are exceeded under any conditions then the helicopter operator is to be advised, **and in most circumstances an appropriate flight limitation should be defined.**

4.3.2 Helideck height and air gap under the helideck

The height of the helideck and the presence of an **air gap** between the helideck and the supporting module are the most important factors in determining wind flow characteristics. The helideck should ideally be located at a height above, or at least equal to, all significant surrounding structures (however, the helideck height should not exceed 60m above sea level: above this height the regularity of helicopter operations may be affected by low cloud base conditions).

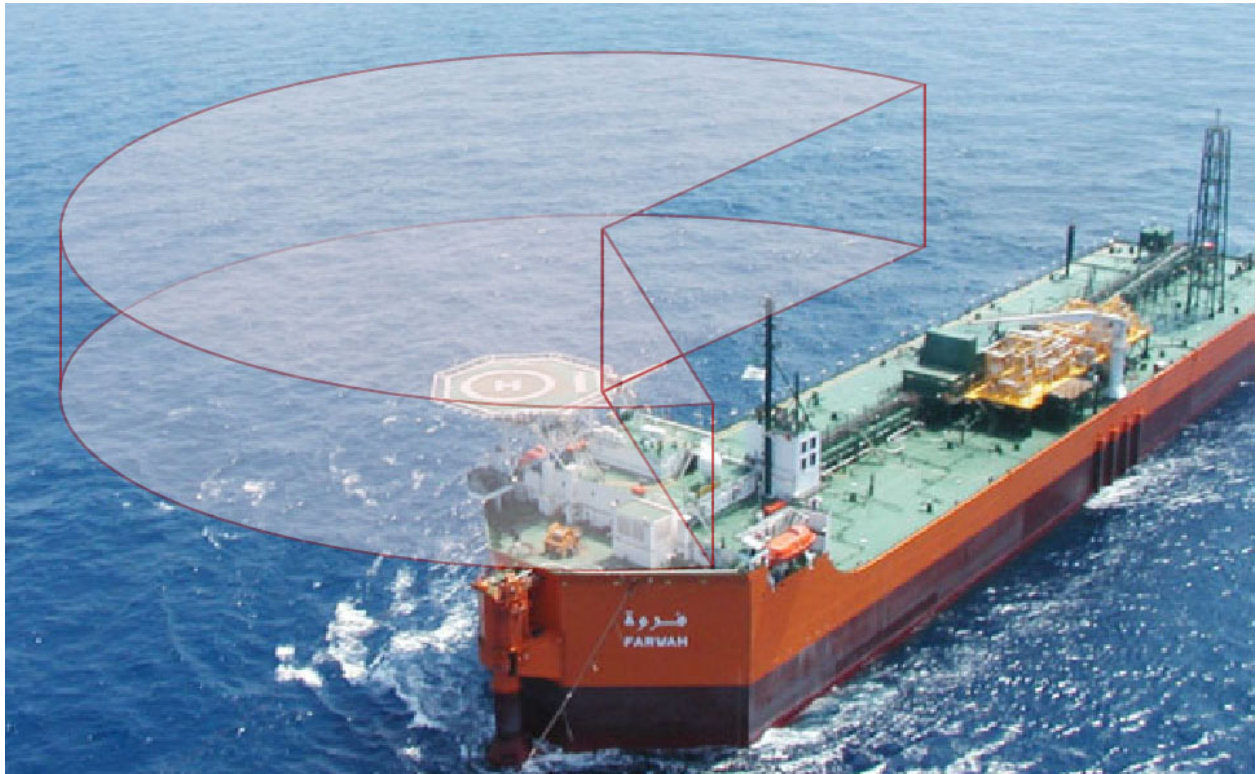
To minimise the occurrence of turbulence and downdraft downwind of adjacent structures, **an appropriate air gap shall be designed under the helideck.** As guidance, it is recommended that the air gap on production platforms should be in the range 3m – 5m. In combination with an **appropriate overhang**, the air gap encourages the disturbed airflow to pass under the deck leaving a relatively linear and clean flow over the top.

4.3.3 Helideck turbulence assessment

The proximity to tall structures or the large size of the installation itself (like FSOs/FPSOs) may generate significant turbulent wake flows.

A careful preliminary study shall be performed to assess the future turbulence in the immediate vicinity of the helideck.

The critical area around the helideck where severe turbulence could be a danger for helicopters shall be materialized as the airspace required above and around the helideck to accommodate helicopter landing and take-off decision points. The sketch here below shows such a critical area (Farwah helideck D = 20 m):



When penetrating inside this “cake”, the helicopter in short final approach reaches a “committed point” after which it is no more possible to abort the landing and perform a go-around (the helicopter is “committed to land”). Such a “cake” (limited to the 210° OFS) extends from the helideck approximately up to 50 to 80 m laterally and about 20 m to 30 m vertically over the helideck surface.

Therefore, a turbulence assessment shall be performed (by wind tunnel testing or CFD methods) to predict the mean velocity and turbulence intensity components for a range of wind angles and heights above the helideck and submitted to DGEP aviation experts.

4.3.4 Temperature rise due to hot exhausts

Increases in ambient air temperature are a potential hazard to helicopters.

Gas turbine power generation systems are usually the most important source of hot exhaust gases on offshore production platforms, but diesel propulsion or auxiliary power system exhausts, or air coolers, could also be significant.

For certain wind directions the hot gas plumes from the exhausts will be carried by the wind directly across the helideck. The hot gas plume mixes with the ambient air and the mixing increases the size of the plume and reduces the temperature (by dilution).

Evaluations of likely temperature rise (based on a Gaussian dispersion model and supported by wind tunnel tests) indicate that **for gas turbine exhausts with release temperatures up to 500°C and flow rates of 50-100 kg/s, the minimum distance required before the temperature rise drops to 2°C rise above ambient is in range 130-190 m.**

Except for very large platforms (or FPSOs), this implies that regardless of design, **there will always be a wind condition where temperature rise above the helideck exceeds 2°C.** It is likely to be impossible, therefore, to design a helideck that is compliant with the criteria under all

conditions. **The design aim becomes one of minimising the occurrence of high temperatures over the helideck rather than eliminating them.**

The helideck shall be located such that winds from the prevailing wind directions carry the plume away from the helicopter approach path. **To minimise the effects for other wind directions, the exhausts should be sufficiently high to ensure that the plumes are above the helicopter approach path. To achieve this, it is recommended that the exhaust outlets be no less than 20-30 m above the helideck, depending on the gas turbine flow rates and temperatures.**

If it is impossible to position the exhaust outlets well above the helideck surface, it is necessary to assess the temperature rise on and around the helideck: a critical area similar to the “cake” described in the above paragraph shall be considered to measure the temperature rise (area extending from the helideck approximately to 50 to 80 m laterally, and about 20 m to 30 m vertically over the helideck surface, depending upon the helideck size).

An example of such a “3-second peak temperature rise” chart is given in the [CAA Paper 2004/02](#), page 35.

For temperature rise data, similar charts shall be included covering the other wind speeds and wind directions where any further local peaks were identified.

These data will be used to define the operational restrictions that will need to be placed on flight operations (rises of 2°C or more above ambient temperatures become an operational issue and require helicopter operators’ review : cf. [CAP 437](#), parag. 3.3.9).

4.3.5 Cold flaring and rapid blow-down systems

A limit of 10% LFL shall be the maximum permissible concentration of hydrocarbon gas within the helicopter operating area (cf. [CAP 437](#), parag. 3.3.10).

As hydrocarbon gas can be released from the production platform process or from drilling rigs at various times, it is important to ensure that a helicopter cannot fly into a cloud of hydrocarbon gas because:

- concentrations above 10% of Lower Flammable Limit (LFL) might cause the helicopter engine to surge or flameout with consequent risk to the helicopter, and
- the helicopter poses a risk to the offshore installation because it is a potential ignition source for the hydrocarbon gas.

Consideration therefore shall be given to **ensuring that gas release points are as remote as possible from the helideck and helicopter flight path**, and that any unforeseen gas releases trigger the automatic activation of the helideck status lights (flashing red). Planned gas releases should only occur when helicopters are not in the area.

The blow-down system shall have venting points that are as remote as possible from the helideck and, in prevailing winds, downwind of the helideck. It is common to have this vent on the flare boom, and this will normally be a good location.

However, it should be noted that **dilution of the gas to 10% LFL may not occur until the plume is a considerable distance from the venting point. This distance could be anywhere between 200m – 500m depending on vent size, venting rate and wind speed.**

4.3.6 Special considerations for moving helidecks

Floating installations and vessels experience dynamic motions due to the ocean waves. These motions are a potential hazard to the helicopter, and operational motion limits shall be set in order to avoid unsafe conditions.

The setting of these operating limits shall involve consideration of two aspects:

- motion limits for executing a safe landing, and
- limits for safely remaining on the deck for the period necessary to effect passenger and cargo transfer (usually not more than 10 minutes).

The setting of helideck performance limitations due to vessel motion is the responsibility of the helicopter operator. These limitations shall not exceed the limitations published in the HLL (see HLL, Part C).

More restrictive limitations on Pitch, Roll and Heave shall apply on Dynamically Positioned Vessels, with high decks (helidecks above 80 ft above sea level) as defined in HLL Part E, Annex 4.

4.3.7 Multiple platform configurations

In assessment of helideck physical characteristics, attention shall always be paid to **adjacent fixed installations (whether separate or bridge-linked), mobile installations and vessels, of a permanent or temporary nature.**

In these situations the **various effects shall be considered for the platform complex as a whole.** It will normally be necessary for the helideck to be located on the platform corners remote from the other platform(s) in order to comply with 210° obstruction-free sector, and for best aerodynamic performance.

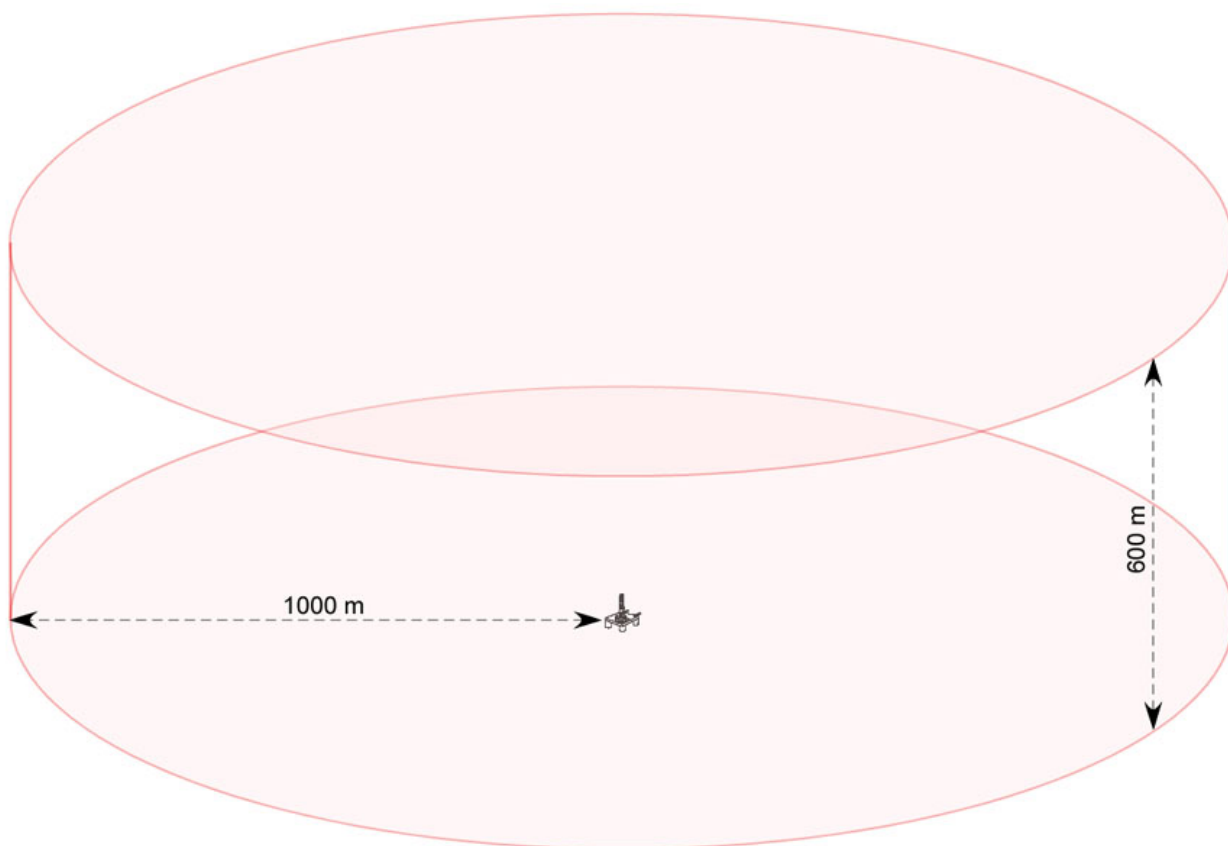
In some cases the platform complex may include more than one helideck, and it shall therefore be necessary to assess the design issues for each of these helidecks.

Combined operations refer to a **temporary** arrangement where one mobile platform or vessel (e.g. a flotel) is operating in close proximity to another permanent installation.

When combined operations are to be carried out, a helideck assessment shall be conducted to evaluate the effect of one platform on the other, and determine any helideck restrictions that should be imposed. Apart from the physical requirements for an unobstructed 210° OFS and falling 5:1 gradient (over at-least 180°), this assessment shall consider the effect of the turbulent wake from one platform impinging on the helideck of the other, and any hot gas exhausts from one influencing the approach to the other helideck.

The problem is the same when a supplementary module is added to an existing platform. **A new study shall be conducted to evaluate the effects of this additional module on existing helidecks.**

As a general rule, for practical purposes, **each helideck protection zone shall be considered to be the airspace extending from sea level to 600 m (2000 feet) above sea level and within 1000 metres of the helideck** (cf. [CAP 437](#), parag. 3.3.13).





Bibliography

HSE/OTO 2001/070	Offshore Installations : guidance on design, construction and certification
BHAB	Helideck Limitation List
UKOOA	Guidelines for the Management of Offshore Helideck Operations
GS EP STR 100	Offshore steel structures - General
GS EP STR 201	Materials for offshore steel structures
GS EP STR 301	Fabrication of offshore steel structures
GS EP STR 401	Loadout, seafastening, transportation and installation of offshore structures
GS EP STR 901	Design rules and construction standards for ancillary structures of offshore installations