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RƏQƏMSAL İNKİŞAF VƏ NƏQLİYYAT NAZİRLİYİ
DÖVLƏT MÜLKİ AVİASİYA AGENTLİYİ

ƏMR
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Bakı şəhəri "14" iyun 2024 il

"Offshore Heliports Manual" ("Dənizdə helikopter meydançalarına dair Təlimat") adlı sənədə dəyişikliklərin qüvvəyə minməsi barədə

Beynəlxalq Mülki Aviasiya Təşkilatının tələbləri nəzərə alınmaqla helikopter meydançalarının standartlarını təkmilləşdirmək məqsədilə "Offshore Heliports Manual" ("Dənizdə helikopter meydançalarına dair Təlimat") adlı sənədin 2-ci nəşri işlənib hazırlanmışdır.

Sözügedən sənədin tətbiqini təmin etmək məqsədilə Azərbaycan Respublikası Prezidentinin 2018-ci il 22 may tarixli 90 nömrəli Fərmanı ilə təsdiq edilmiş "Azərbaycan Respublikasının Rəqəmsal İnkişaf və Nəqliyyat Nazirliyi yanında Dövlət Mülki Aviasiya Agentliyi haqqında Əsasnamə"nin 5.6.6-cı yarımbəndini rəhbər tutaraq,

əmr edirəm:

1. "Offshore Heliports Manual" ("Dənizdə helikopter meydançalarına dair Təlimat") sənədinin 2-ci nəşri 2024-cü ilin 14 iyun tarixindən qüvvəyə minsin.
2. Sənədin Dövlət Mülki Aviasiya Agentliyinin (DMAA) və onun tabeliyində "Mülki Aviasiyada Uçuşların Təhlükəsizliyi üzrə Dövlət Müfəttişliyinin aidiyyəti mütəxəssisləri tərəfindən öyrənilməsi və icrası təşkil edilsin.
3. Sənədin yenilənmiş versiyası DMAA-nın rəsmi internet saytında yerləşdirilsin.
4. Əmr bütün şəxsi heyətə çatdırılsın.
5. Əmrin icrasına nəzarət direktorun müavini Bəhruz Məlikova həvalə edilsin.

Direktor **Arif Məmmədov**

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MANUAL

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0.4. RECORD OF AMENDMENTS AND REVISIONS

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Edition: - *Release of a document having incorporated all previous revisions until the current version. New edition of a document will not show revised text in blue color. Current edition of a document shown on each page in footer.*

Revision: *- A change made to a part of document, where it is reflected with blue text or accompanied with a vertical line on right side of a document. Basic information on revisions (number and date) given in the List of effective Pages and indicated in header of affected page and in context itself.*

0.5. TERMS

D. 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 helicopter structure. D is sometimes referred to as D-value.

Design helicopter. The helicopter type having the largest overall length and greatest maximum certificated take-off mass for which a helideck or shipboard heliport has been designed. Both attributes may not reside in the same helicopter.

Dynamic load-bearing surface. A surface capable of supporting the loads generated by a helicopter in motion.

Essential objects permitted. Includes, but may not be limited to: around the touchdown and lift-off area (TLOF): perimeter lights and floodlights, guttering and raised kerb, foam monitors or ring-main system, handrails and associated signage, other lights; on the TLOF: helideck net and helideck touchdown marking (“H” and “circle”) lighting; and in the area between the TLOF perimeter and the FATO perimeter, helideck safety netting is present (for helideck installations completed on or before 1 January 2012, this is permitted to exceed the TLOF surface by 25 cm (10 in)). For helidecks completed after 1 January 2012, the outboard edge of netting shall be flush, level with the TLOF (for shipboard heliports the effective date is 1 January 2015)).

Falling gradient. A surface extending downwards on a gradient of 5:1 measured from the edge of the safety netting (or shelving) located around the TLOF below the elevation of the helideck or shipboard heliport to water level for an arc of not less than 180 degrees, which passes through the centre of the TLOF and outwards to a distance that will allow for safe clearance of obstacles below the TLOF in the event of an engine failure for the type of helicopter the helideck or shipboard heliport is intended to serve. Where high-performing helicopters are exclusively used, consideration may be given to relaxing the falling gradient from a 5:1 to a 3:1 slope.

FATO. A defined area over which the final phase of the approach manoeuvre to hover or land is completed and from which the take-off manoeuvre is commenced.

Helideck. A heliport located on a fixed or floating offshore facility such as an exploration and/or production unit used for the exploitation of oil and gas.

Heliport elevation. The highest point of the final approach and take-off area (FATO).

Limited obstacle sector(s). A sector, not greater than 150 degrees, within which obstacles may be permitted, provided the height of the obstacles is limited.

Obstacle. All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that: are located on an area intended for the surface movement of helicopters; extend above a defined surface intended to protect helicopters in flight; or stand outside those defined surfaces but nonetheless are assessed as a hazard to air navigation.

Obstacle-free sector. A sector, not less than 210 degrees, extending outwards to a distance that will allow for an unobstructed departure path appropriate to the helicopter the TLOF is intended to serve, within which no obstacles above the level of the TLOF are permitted (for helicopters operated in PC1 or PC2 the horizontal extent of this distance will be compatible with the one-engine inoperative capability of the helicopter type to be used).

Shipboard heliport. A heliport located on a ship that may be purpose-built or non-purpose-built. A purpose built shipboard heliport is one designed specifically for helicopter operations. A non-purpose-built shipboard heliport is one that utilizes an area of the ship that is capable of supporting a helicopter but is not designed specifically for it.

Static load-bearing area. A surface capable of supporting the mass of the helicopter situated upon it.

TLOF. An area on which a helicopter may touchdown and lift-off.

Touchdown/positioning marking circle. The TD/PM circle is the reference marking for a normal touchdown, so located that when the pilot's seat is over the marking, the whole of the undercarriage will be within the TLOF and all parts of the helicopter will be clear of any obstacles by a safe margin.

Winching area. An area provided for the hoist transfer by helicopter of personnel or stores to and from a ship.

μ. The coefficient of friction, Mu, is the ratio between the friction force and the vertical load.

0.6. ABBREVIATION

SCAA	State Civil Aviation Agency
AAR-AGA-002	Azerbaijan Aviation Rules-Heliport Standards
AFFF	Aqueous film forming foam
AMSL	Above mean sea level
ATEX	Equipment for potentially explosive atmospheres
BS	British Standard
CAFS	Compressed air foam systems
cd	Candela
CFD	Computational fluid dynamics
cm	Centimetre
CZ	Clear zone
DIFFS	Deck integrated firefighting system
DPS	Dynamic positioning system
EN	European number
FATO	Final approach and take-off area
FFAS	Fixed foam application system
FMS	Fixed monitor system
FOV	Field of view
FPSO	Floating production storage and offloading
FSO	Floating storage and offloading
ft	Feet
GPU	Ground power unit
HDA	Helideck assistant
HD	Helideck directory
HHO	Helicopter hoist operations
HIP	Helideck information plate
HLO	Helicopter landing officer
HMS	Helideck motion system
ICAO	International Civil Aviation Organization
ICS	International Chamber of Shipping
IEC	International Electrotechnical Commission
in	Inches
IMO	International Maritime Organization
ISO	International Organization for Standardization
kg	Kilogram
l	Litre
lb(s)	Pound(s)
LDP	Landing decision point
LED	Light emitting diode
LFL	Lower flammable limit

LNG	Liquefied natural gas
LOA	Limited obstacle area
LOS	Limited obstacle sector
LPA	Limited parking area
lx	lux
m	Metre
mm	Millimetre
MODU	Mobile offshore drilling unit
MTOM	Maximum (certificated) take-off mass
MZ	Manoeuvring zone
N	Newton
NDB	Non-directional beacon
NFPA	National Fire Protection Association
NM	Nautical miles
NPAI	Not permanently attended installation
OFS	Obstacle-free sector
PAI	Permanently attended installation
PC	Performance class
PCF	Post-crash fire
PCOM	Parking Circle Orientation Marking
PIPA	Push-in parking area
PLS	Prohibited landing sector
PPE	Personal protective equipment
PTA	Parking transition area
kN/m^2	Kilonewton per square metre
QFE	Query: field elevation
QNH	Query: nautical height
RAO	Response amplitude operator
RO	Radio operator
RD	Rotor diameter
RMS	Ring-main system
ROTS	Remotely operated TV system
R/T	Radio-telephony or radio communications
s	Second
SLS	Serviceability limit states
SRF	Structural response factor
t	Tonne (1000 kg)
TD/PM	Touchdown/positioning markings
TLOF	Touchdown and lift-off area
ULS	Ultimate limit states
UPS	Uninterrupted power supply
UV	Ultraviolet

0.7. INTRODUCTION

Offshore heliports, even when confined to mineral extraction activities, employ a wide range of offshore landing facilities, including helidecks on fixed platforms, mobile offshore drilling units, crane barges and floating production storage and offloading (FPSO) units, and purpose-built shipboard heliports located on large tankers or on smaller vessels such as diving support vessels, seismic survey vessels, ice-breakers and research vessels. For vessels, in particular, helicopter landing areas may be purpose-built above the bow or stern, purpose-built in an amidships location, or purpose-built overhanging the ship's side. This manual also provides information for non-purpose-built shipboard heliports, whether located on the side of a ship (ship's side) or on other areas not specifically designed to receive helicopters, such as hatch covers (Figure I-1-9. refers). Finally, the document addresses shipboard winching areas, where a helicopter hoist operation (HHO) is completed in lieu of landing. The operation of non-purpose-built shipboard heliports and shipboard winching areas is described in detail in the International Chamber of Shipping (ICS) Helicopter/Ship Guide to Operations.

According to paragraph 14.1 of the Aviation Law of the Republic of Azerbaijan, civil heliports (helidecks) must be certified. Certification of heliports (helidecks) is carried out in accordance with the document "Guidelines for Certification of Aerodromes/Heliports".

1. GENERAL

1.1. HELIDECKS

1.1.1. FIXED PLATFORMS (PERMANENTLY ATTENDED AND NOT PERMANENTLY ATTENDED)

Fixed platforms sit directly on the sea floor and are thus stable. They can be single units or can consist of two or more separate modules for production, processing and accommodation. Separate modules are generally linked by bridges and can be served by more than one helideck. Fixed platforms that are occupied year-round are often referred to as permanently attended installations (PAI), while those facilities that do not subscribe to a permanent attendance model are referred to in this manual as not permanently attended installations (NPAIs). The acronyms PAI and NPAI are used throughout this document, although it is appreciated that may be used additional or alternative acronyms to describe particular attendance models to distinguish specific levels of occupancy of offshore facilities.



Figure I-1-1. A fixed platform with helideck above accommodation, bridge linked to a production platform

1.1.2. MOBILE OFFSHORE DRILLING UNITS: SEMI-SUBMERSIBLE

Semi-submersible units have the hull design of a catamaran and are either towed or self-propelled. A semi-submersible unit has good stability and sea-keeping characteristics and can be positioned dynamically with thrusters or by the use of anchors. These units are heavy duty specialized rigs, with their hull structure submerged at a deep draft (ballasted down fifty feet or more to give it stability) so that a semi-submersible unit, being less affected by wave loadings than a normal ship, is able to operate in adverse weather conditions. They are used in a number of specific offshore roles, such as offshore drilling rigs and heavy lift cranes. In the latter case, a semi-submersible unit is able to transform from a deep to a shallow draft rig by de-ballasting (removing ballast water from the hull), thereby becoming a surface vessel. Semi-submersibles are classified as mobile offshore drilling units (MODUs) and shall therefore comply with standards for helidecks, also addressed in the International Maritime Organization (IMO) MODU Code.



Figure I-1-2. A deep ballasted semi-submersible mobile offshore drilling unit

1.1.3. MOBILE OFFSHORE DRILLING UNITS: SELF-ELEVATING UNIT (JACK-UP)

A jack-up rig, or a self-elevating unit, is a mobile platform that consists of a buoyant hull fitted with a number of moveable legs (typically three or four). These rigs are towed to and from locations or may be self-propelled. When on site the legs (which can measure 137 m (450 ft) or more) are 'jacked' down until they penetrate the seabed or sit on the sea floor, with the main body of the rig about 15.24 m (50 ft) above sea level. The height of the legs when on station is dependent upon the depth of the water. When on tow, the legs are jacked up and specific limitations are applied for helicopter operations to moving decks (Part 1, Chapter 8, 8.3 refers). When in the jacked-down position, helidecks are not subject to significant movement and therefore behave more like fixed platforms. Jack-up rigs are classified as MODUs and shall therefore comply with standards for helidecks, also addressed in the IMO MODU Code.



Figure I-1-3. A three-legged jacked-up mobile offshore drilling unit

1.1.4. FLOATING PRODUCTION STORAGE AND OFFLOADING (FPSO) AND TANKERS

An FPSO unit is a floating vessel used for the production and processing of hydrocarbons and for the storage of oil, until the oil can be offloaded onto a tanker (Figure I-1-4 refers)) or, less frequently, transported through a pipeline. The FPSO extracts and stores the oil while the tanker hooks up to the FPSO before it shuttles the oil ashore. FPSOs are either purpose-built or can be made from the conversion of an oil tanker. They are very effective when used in remote or deep-water locations, where seabed pipelines are not a commercially viable option. Other forms of FPSO may include a floating storage and offloading unit (FSO) or a liquefied natural gas (LNG) floating storage and regasification unit.



Figure I-1-4. Tanker (right) hooks up with a FPSO (left)

1.2. SHIPBOARD HELIPORTS



Figure I-1-5. A tanker with a purpose-built mid-ship centreline shipboard heliport

1.2.1. DRILL SHIPS

Drill ships are merchant vessels designed for use in exploratory offshore drilling for new oil and gas wells. They can be either purpose-built or converted older vessels, and are kept on station by standard anchoring systems or by a dynamic positioning system (DPS). In recent years they have increasingly been used to drill in deep water or in ultra-deep water and, in this operating environment, require the most advanced DPS.



Figure I-1-6. A high-mounted bow helideck on a drill ship

1.2.2. SMALL VESSELS

Support and survey vessels are among the most challenging ships to fly to, especially at night. Vessels can be quite small and the helideck can be high above the bow, over the stern or even amidships.



Figure I-1-7. A high bow mounted helideck on a pipe laying vessel

1.2.3. NON-PURPOSE-BUILT LANDING AREA ON SHIP'S SIDE — TANKER PORT AND STARBOARD

Some helicopter landing areas, located on tankers, consist of non-purpose-built ship side arrangements, located on either side of the vessel. For non-purpose-built facilities, the control of ground-based, and usually immovable, obstacles become an issue. In this case, care needs to be taken to ensure that deck-mounted obstacles, which may form part of the vessel superstructure, do not impinge on the safety of helicopter operations. This is discussed in detail in Chapter 4, 4.6.

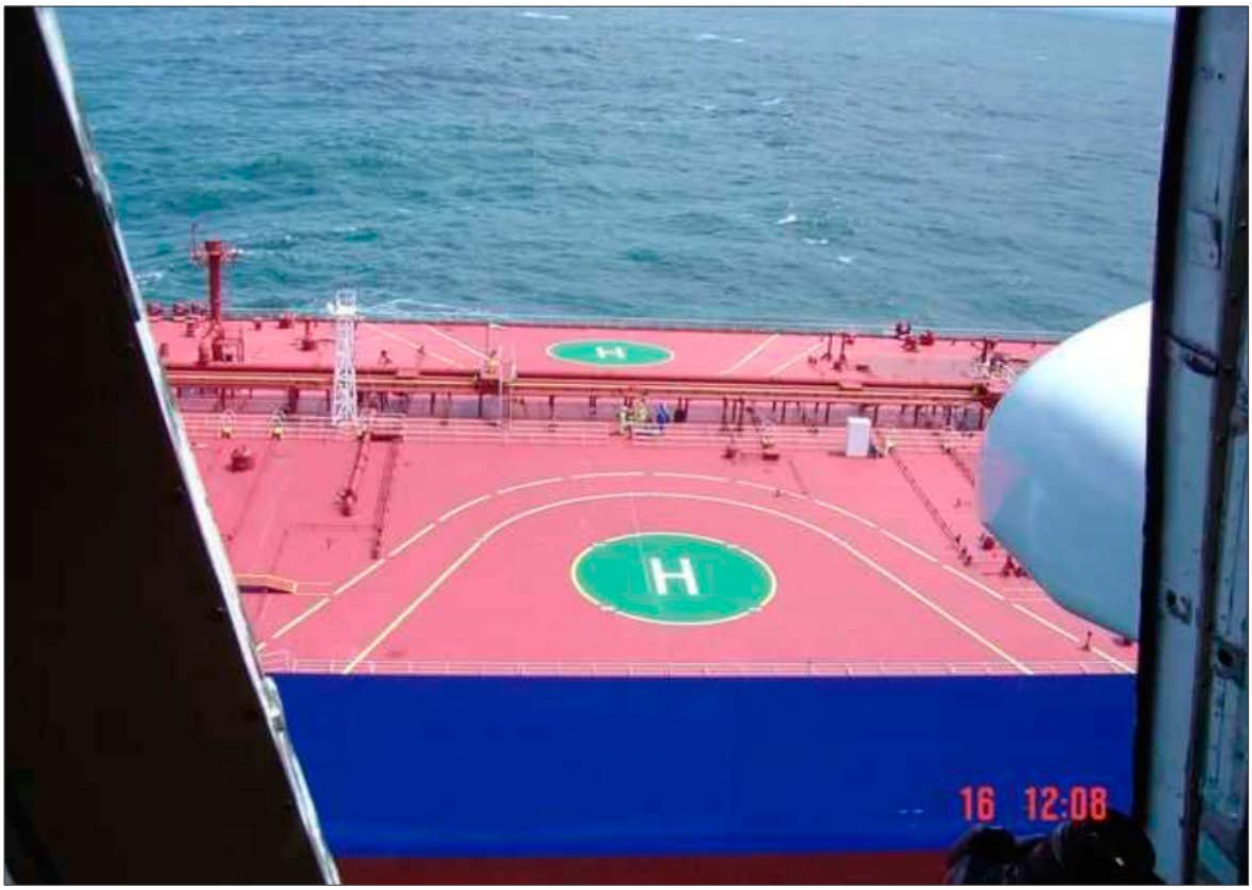


Figure I-1-8. Non-purpose-built ship side landing areas (port and starboard)

1.3. TABLE OF CHARACTERISTICS FOR COMMON OFFSHORE HELICOPTER TYPES

Table I-1-1. D-value, "t" value and other helicopter type criteria (metric units)

Type	*D-value (metres)*	*Perimeter 'D' marking*	*Rotor diameter (metres)*	*Max weight (kg)*	*'t' value*
EC130	12.60	13	10.70	2 432	2.4 t
MD902	11.84	12	10.31	2 835	2.8 t
Bell 206B	11.95	12	9.51	1 452	1.5 t
Bo105D	12.00	12	9.90	2 400	2.4 t
EC135 T2+	12.20	12	10.20	2 910	2.9 t
Bell 407	12.70	13	10.40	2 381	2.4 t
Bell 429	13.00	13	11.00	3 402	3.4 t
Bell 206L IV	12.96	13	10.44	2 018	2.0 t
AS355	12.94	13	10.69	2 600	2.6 t
BK117	13.00	13	11.00	3 200	3.2 t
Bell 427	13.00	13	11.28	2 971	3.0 t
A109	13.05	13	11.00	2 600	2.6 t
AW119	13.02	13	10.83	2 720	2.7 t
EC145/H145	13.03	13	11.00	3 585	3.6 t
AS365 N2	13.68	14	11.93	4 250	4.3 t
AW189	17.60	18	14.60	8 300	8.3 t
EC175/H175	18.06	18	14.80	7 500	7.5 t
AS365 N3	13.73	14	11.94	4 300	4.3 t
EC155 B1	14.30	14	12.60	4 850	4.9 t
Bell 222	15.33	15	14.08	3 742	3.7 t
Bell 430	15.29	15	12.80	4 218	4.2 t
Ka-32	15.90	16	15.90	12 600	12.6 t
S76	16.00	16	13.40	5 307	5.3 t

Type	D-value (metres)	Perimeter 'D' marking	Rotor diameter (metres)	Max weight (kg)	't' value
AW139	16.63	17	13.80	6 800	6.8 t
Bell 412EP	17.13	17	14.02	5 398	5.4 t
Bell 212	17.46	17	14.00	5 080	5.1 t
AS332 L	18.70	19	15.60	8 599	8.6 t
AS332 L2	19.50	20	16.20	9 300	9.3 t
EC225	19.50	20	16.20	11 000	11.0 t
S92A	20.88	21	17.17	12565	12.6 t
Mil Mi-17	25.30	25	21.10	13 000	13.0 t
Mil Mi-8	25.24	25	21.29	12 000	12.0 t
S61N	22.20	22	18.90	9 298	9.3 t
AW101	22.80	23	18.60	15 600	15.6 t

Note: *The specifications presented in this table shall be verified against manufacturer derived data*

Table I-1-2. D-value, "t" value and other helicopter type criteria (imperial units)

Type	D-value (feet)	Perimeter 'D' marking	Rotor diameter (feet)	Max Weight (lbs)	Maximum allowable mass marking
EC130	35.00	35	35.10	5 361	5.4
MD902	38.80	39	33.80	6 250	6.3
Bell 206B	39.20	39	33.00	3 201	3.2
Bo105D	39.36	39	32.48	5 291	5.3
EC135 T2+	40.00	40	33.50	6 400	6.4
Bell 407	41.40	41	35.00	5 250	5.3
Bell 429	41.75	42	36.00	7 500	7.5
Bell 206L	42.40	42	37.00	4 450	4.5
AS355	42.50	43	35.00	5 732	5.7
BK117	42.65	43	36.00	7 055	7.1

Type	*D-value (feet)*	*Perimeter 'D' marking*	*Rotor diameter (feet)*	*Max Weight (lbs)*	*Maximum allowable mass marking*
Bell 427	42.65	43	37.00	6 550	6.6
A109	42.80	43	36.00	5 732	5.7
AW119	42.70	43	35.50	6 000	6.0
EC145	42.70	43	36.00	7 900	7.9
AS365 N2	44.80	45	39.10	9 370	9.4
EC175/H175	44.90	45	35.00	16 535	16.5
AS365 N3	45.00	45	39.10	9 480	9.5
EC155 B1	46.90	47	41.30	10 700	10.7
Bell 222	49.50	50	40.00	8 245	8.2
Bell 430	50.10	50	42.00	9 300	9.3
Ka-32	52.02	52	52.02	27 778	27.8
S76	52.49	52	44.00	11 700	11.7
AW139	54.63	55	45.28	15 000	15.0
Bell 412EP	56.20	56	46.00	11 900	11.9
Bell 212	57.25	57	48.20	11 200	11.2
AW189	57.90	58	47.11	18 300	18.3
AS332 L	61.34	61	49.60	19 000	19.0
AS332 L2	63.94	64	53.20	20 500	20.5
EC225	63.96	64	53.20	24 250	24.3
S92A	68.49	68	56.32	28 000	28.0
Mil Mi-17	83.00	83	69.03	28 660	28.3
Mil Mi-8	82.10	69	69.10	26 455	26.5
S61N	72.80	73	62.00	20 499	20.5
AW101	74.80	75	61.00	34 400	34.4

***Note**: Specifications presented in this table shall be verified against manufacturer derived data.*



Figure I-1-9. An S61N helicopter lands on the hatch cover of a large vessel

2. HELIPORT DATA

2.1. INTRODUCTION

2.1.1. For a fixed facility, the heliport elevation is measured at the highest point of the final approach and take-off area(s) (FATO(s)) and recorded on the helideck information plate (HIP) (Figure I-2-1 refers). Heliport elevation (in feet or metres) is the height of the FATO(s) above mean sea level (AMSL). For floating installations and vessels, the heliport elevation is measured from the keel of the installation/vessel to the highest point of the FATO. The profile information is independent from the draft marking and the actual elevation above the water level. The installation/vessel crew has to calculate the current height above the water level by subtracting the current draft at the perpendicular closest to the helideck and providing this to the helicopter operator.

Note: *The helicopter operator shall include the corrected elevation information supplied by the installation/vessel operator in the helideck template.*

2.1.2. An entry in the helipad directory (HD) shall publish additional information for the helicopter landing area, including the D FATO value, expressed in metric meters, and indicate the maximum allowable weight of the helicopter permitted for flying in FATO, the designation is expressed in metric tons (known as t- value). The D-value, in metres or feet, corresponds to the size (diameter) of the FATO (and where coincident, to the size (diameter) of the TLOF) while the maximum allowable mass is a t-value marking expressing metric tonnes, that equates to the load-bearing strength of the touchdown and liftoff area (TLOF). Detailed guidance on how these marking issues shall be displayed, whether expressed using metric units, is presented in Chapter 5, 5.3 and 5.4.

2.2. AUTHORIZATION OF OFFSHORE HELIPORTS — ASSESSMENT CHECKLIST, CONTENT OF A HELIDECK DIRECTORY (HD) AND CONTENT OF A HELIDECK INFORMATION PLATE (HIP)

2.2.1. GENERAL

2.2.1.1. The content of the operations manual relating to the specific usage of offshore helicopter landing areas (helidecks and shipboard heliports) shall contain both the listing of limitations in an HD and a pictorial representation (template) of each offshore location and its helicopter landing area, recording all necessary permanent information. The HD shall be amended as necessary and indicate the most recent status of each offshore helicopter landing area concerning non-compliance with applicable Standards, contained in Azerbaijan Aviation Rules- Heliport Standards (AAR-AGA-002), with limitations, warnings, cautions or other comments of operational importance. An example of a typical template is shown in Figure I-2-1.

2.2.1.2. In accordance with paragraph *2.1.2 of G-AGA-002*, the Operation Manual should be accepted by the SCAA.

2.2.1.3. In order to ensure that the safety of flights is not compromised, the operator shall obtain relevant information and details for a compilation of the HD, and the pictorial representation, from the owner/operator of the offshore helicopter landing area.

2.2.1.4. If more than one name for the offshore location exists, the common name painted of the surface of the landing area shall be listed, but other recent names shall also be included in the HD (e.g., radio call sign if different). After renaming an offshore location, the previous name shall be retained in the HD for a period of six months following the change.

2.2.1.5. Any limitations associated with an offshore location shall be included in the HD. With complex installation arrangements including combinations of installations/vessels (e.g. combined operations), a separate listing in the HD, accompanied by diagrams where necessary, may be required.

2.2.1.6. Each offshore helicopter landing area shall be assessed based on its limitations, warnings, instructions and restrictions to ensure its safety. The following factors, as a minimum, shall be considered:

a) the physical characteristics of the landing area, including size and load-bearing capability;

b) the preservation of obstacle-protected surfaces (the most basic safeguard for all flights), which include:

1) the minimum 210° obstacle-free sector (OFS);

2) the 150° limited obstacle surface (LOS); and

3) the minimum 180° falling '5:1' gradient with respect to significant obstacles;

Note: *If these sectors/surfaces are infringed, even on a temporary basis and/or if an adjacent installation or vessel infringes the obstacle protected surfaces related to the landing area, an assessment shall be made to determine whether it is necessary to impose operating limitations and/or restrictions to mitigate any non-compliance with the criteria.*

c) marking and lighting:

1) for operations at night:

i) adequate illumination of the perimeter of the landing area, utilizing perimeter lighting;

ii) adequate illumination of the location of the touchdown marking by use of a lit touchdown/positioning marking and lit heliport identification marking or by perimeter floodlighting;

2) presence of dominant obstacle paint schemes and lighting;

3) appropriate condition of helideck markings; and

4) adequacy of general installation and structure lighting;

Note*: Any limitations with respect to non-compliant lighting arrangements shall be annotated as 'daylight-only operations' in the HD.*

d) deck surface:

1) assessment of surface friction;

2) adequacy and condition of helideck net (where provided);

3) fit-for-purpose drainage system;

4) deck edge safety netting or shelving;

5) system of tie-down points adequate for the range of helicopters in use; and

6) cleanliness of the surface e.g. removal of bird guano, sea spray, snow and ice;

e) environment:

1) foreign object damage;

2) assessment of physical turbulence generators, e.g. structure-induced turbulence due to clad derrick;

3) bird control measures in place;

4) air quality degradation due to exhaust emissions, hot gas vents (turbulence and thermal effects) or cold gas vents; and

5) possible inclusion of adjacent offshore installations in air quality assessment;

***Note**: To assess for potential adverse environmental effects described in 2), 4) and 5), an offshore location shall be subject to appropriate studies e.g. wind tunnel testing, computational fluid dynamics (CFD) analysis.*

f) rescue and firefighting:

1) fixed foam application systems (FFAS) for delivery of firefighting media to the landing area, e.g. deck integrated firefighting system (DIFFS);

2) delivery of primary media types, critical area, application rate and duration;

3) deliveries of complementary agent(s), media types, capacity and discharge;

4) personal protective equipment (PPE); and

5) rescue equipment and crash box/cabinet;

g) communications and navigation:

1) presence and/or quality of aeronautical radio(s);

2) radio-telephony (R/T) call sign to match offshore location name and side identification (shall be simple and unique);

3) non-directional beacon (NDB) or equivalent (as appropriate); and

4) radio log;

h) fuelling facilities: in accordance with relevant national guidance and regulations;

i) additional operational and handling equipment:

1) windsock(s);

2) meteorological information including wind, pressure, air temperature and dew point temperature recording/ displaying mean wind (10 minute wind) and gusts;

3) deck motion recording and reporting (helideck motion system - HMS) where applicable;

4) passenger briefing system;

5) chocks;

6) tie-down strops/ropes;

7) weighing scales;

8) a suitable power source for starting helicopters (ground power unit (GPU)) where applicable; and

9) equipment for clearing the landing area of snow and ice and other contaminants;

j) personnel: qualified helicopter landing area staff (e.g. helicopter landing officer/helicopter deck assistant and firefighters, etc.) and persons required to assess local weather conditions or communicate with helicopter by radio-telephony.

2.2.1.7. For offshore locations for which there is incomplete information, 'limited' usage based on the information available may be considered by the operator, subject to a risk assessment prior to the first helicopter visit. During subsequent operations, and before any restriction on heliport usage is lifted, information shall be gathered and the following shall apply:

a) pictorial (static) representation:

1) template blanks (see Figure I-2-1) shall be available to be filled in during flight preparation, on the basis of the information given by the offshore location owner/operator and flight crew observations;

2) where possible, suitably annotated photographs may be used until the HD and template have been completed;

3) until the HD and template have been completed, conservative operational restrictions (e.g. performance, routing, etc.) may be applied;

4) any previous inspection reports shall be obtained and reviewed by the operator; and

5) an inspection of the offshore helicopter landing area shall be carried out to verify the content of the completed HD and template. Once found suitable, the landing area may be considered authorized for use by the operator;

b) with reference to the above, the HD shall contain at least the following:

1) HD revision date and number;

2) generic list of helideck motion limitations;

3) name of offshore location;

4) 'D' value; and

5) limitations, warnings, instructions and restrictions;

***Note**: The content of the helicopter landing area authorization or certificate shall include 3), 4) and 5).*

c) the template shall contain at least the following fields (see Figure I-2-1):

1) name of the offshore location;

2) R/T call sign;

3) helicopter landing area identification marking;

4) side panel identification marking;

5) landing area elevation;

6) maximum installation/vessel height;

7) 'D' value;

8) type of offshore location:

i) fixed: permanently attended installation (PAI);

ii) fixed: not permanently attended installation (NPAI);

iii) vessel type (e.g. diving support vessel, tanker);

iv) mobile offshore drilling unit: semi-submersible;

v) mobile offshore drilling unit: jack-up; and

vi) floating production storage offloading (FPSO);

9) name of the owner/operator;

10) geographical position, where appropriate;

11) communication and navigation (com/nav) frequencies and identification;

12) general drawing of the offshore location showing the helicopter landing area with annotations showing location of derrick, masts, cranes, flare stack, turbine and gas exhausts, side identification panels, windsock, etc.;

13) plan view drawing, chart orientation from the general drawing, to show the above. The plan view will also show the 210 degree sector orientation in degrees true;

14) type of fuelling:

i) pressure and gravity;

ii) pressure only;

iii) gravity only; and

iv) none;

15) type and nature of firefighting equipment;

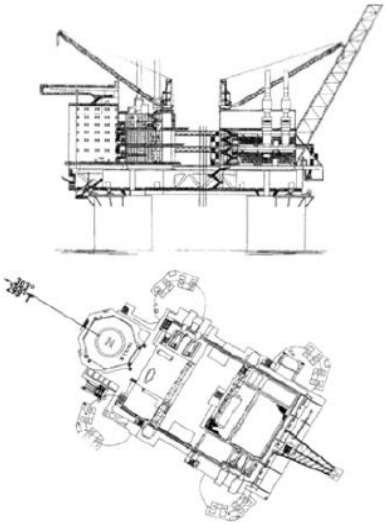
16) availability of ground power unit (GPU);

17) deck heading;

18) maximum allowable mass (metric tonnes “t” value) or lbs; and

19) revision date of publication.

Installation/vessel name		R/T call sign: …		Helideck identification: …
Helideck elevation: … ft.		Maximum height: … ft.		Side identification: …
Type of installation/vessel: …[1]				D-value: …m and/or ft
Position: [2]				Operator[3]
				ATIS: VHF 123.456
COM	LOG: 123.456	VHF	NAV	NDB: 123 (ident.)
	Traffic: 123.456	VHF		GNSS: 123
	Deck: 123.456	VHF		VOR/DME: 123
				Not applicable:



Fuelling: …[4]	GPU: …[5]	Deck heading: …
MTOM: … T and/or lbs	Status light: …[6]	Firefighting equipment: …[7]
		Revision date: …

Figure I-2-1. Helicopter landing area template

1. Fixed permanently attended, fixed not permanently attended; vessel type (e.g. diving support vessel); MODU - semi-submersible; MODU - jack-up; FPSO, tanker.
2. Latitude and longitude in degrees, minutes and decimals of a minute.
3. Name of operator of the installation/vessel.
4. Pressure/gravity; pressure; gravity; no.
5. Yes; no; 28v DC.
6. Yes; no (as required by applicable codes e.g. IMO MODU Code).
7. Type of foam (e.g. 3 per cent aqueous film forming foams (AFFF) (3 per cent AFFF)) and nature of primary media delivery (e.g. DIFFS).

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3. PHYSICAL CHARACTERISTICS

3.1. HELIDECK AND PURPOSE-BUILT SHIPBOARD HELIPORT STRUCTURAL DESIGN

3.1.1. The helicopter landing area and any parking area provided (see Chapter 8, 8.1) shall be of sufficient size and strength and laid out to accommodate the heaviest and largest helicopter requiring to use the facility (referred to as the design helicopter). The structure shall incorporate a load-bearing area designed to resist dynamic loads without disproportionate consequences from the impact of an emergency landing anywhere within the area bounded by the touchdown and lift-off area (TLOF) perimeter markings. Consideration shall be given to the possibility of accommodating an unserviceable helicopter in a parking area (where provided) adjacent to the helideck to allow a relief helicopter to land.

***Note**: If this contingency is designed into the construction and operating philosophy of the installation or vessel, the helicopter operator shall be advised of any mass restrictions imposed on a relief helicopter due to the presence of an unserviceable helicopter, whether elsewhere on the landing area or removed to a parking area, where provided.*

3.1.2. The helicopter landing area and its supporting structure shall be constructed from steel, aluminium alloy or other suitable materials designed and fabricated to applicable standards. Where differing materials are to be used in near contact, the detailing of the connections shall be such as to avoid the incidence of galvanic corrosion.

3.1.3. Both the ultimate limit states (ULS) and the serviceability limit states (SLS) shall be assessed. The structure shall be designed for the SLS and ULS conditions appropriate to the structural component being considered as follows:

a) for deck plate and stiffeners:

1) ULS under all conditions; and
2) SLS for permanent deflection following an emergency landing;

b) for helicopter landing area supporting structure:

1) ULS under all conditions; and
2) SLS.

3.1.4. The supporting structure, deck plates and stringers shall be designed to resist the effects of local wheel or skid actions acting in combination with other permanent, variable and environmental actions. Helicopters shall be assumed to be located within the TLOF perimeter markings in such positions that maximize the internal forces in the component being considered. Deck plates and stiffeners shall be designed to limit the permanent deflection (deformation) under helicopter emergency landing actions to no more than 2.5 per cent of the clear width of the plates between supports. Stiffener webs shall be assessed locally under wheels or skids and at the support areas so as not to fail under landing gear actions due to emergency landings. Tubular structural components forming part of the supporting structure shall be checked for vortex-induced vibrations due to wind.

***Note**: For the purposes of the following sections it may be assumed that single main rotor helicopters will land on the wheel or wheels of two landing gear or on both skids where skid-fitted helicopters are in use. The resulting loads shall be distributed between two main undercarriages. Where advantageous, a tire contact area may be assumed within the manufacturer's specification.*

3.1.5. Case A — Helicopter landing situation

A helideck or a purpose-built shipboard heliport shall be designed to withstand all the forces likely to act when a helicopter lands. The load and load combinations to be considered shall include:

a) Dynamic load due to impact landing.

This shall cover both a heavy landing and an emergency landing. For the former an impact load of 1.5 x maximum (certificated) take-off mass (MTOM) of the design helicopter shall be used, while for an emergency landing an impact load of 2.5 x MTOM shall be applied in any position on the landing area together with the combined effects of b) to g) inclusive. Normally the emergency landing case will govern the design of the structure.

b) Sympathetic response of the landing platform.

After considering the design of the helideck structures, i.e. the supporting beams and columns, and the characteristics of the design helicopter, the dynamic load (see a) above) shall be increased by a suitable structural response factor (SRF) to take account of the sympathetic response of the helicopter landing area structure. The factor to be applied for the design of the helicopter landing area framing depends on the natural frequency of the deck structure. Unless specific values are available based on particular undercarriage behaviour and deck frequency, a minimum SRF of 1.3 shall be assumed.

c) Overall superimposed load on the landing platform.

To allow for any appendages that may be present on the deck surface, such as helideck nets or lighting, in addition to the wheel loads, an allowance of 0.5 kN/m^2 shall be applied over the whole area of the helideck.

d) Lateral load on landing platform supports.

The helicopter landing platform and its supports shall be designed to resist concentrated horizontal imposed actions equivalent to 0.5 x MTOM of the design helicopter, distributed between the undercarriages in proportion to the applied vertical loading in the horizontal direction that will produce the most severe loading for the structural component being considered.

e) Dead load of structural members.

This is the normal gravity load on the element being considered.

f) Environmental actions on the helideck.

1) Wind actions on the helideck structure shall be applied in the direction which, together with the horizontal impact actions, produces the most severe load case for the component considered. The wind speed to be considered shall be that restricting normal (non-emergency) helicopter operations at the landing area. Any vertical up and down action on the helideck structure due to the passage of wind over and under the helideck shall be considered.
2) Inertial actions due to platform motions – the effect of accelerations and dynamic amplification arising from the predicted motions of the fixed or floating platform in a storm condition with aten-year return period shall be considered.

g) Punching Shear.

Where helicopters with wheeled undercarriages are operated, a check shall be made for the punching shear of a wheel of the landing gear with a contact area of 65 x 103 mm^2 acting in any

probable location. Particular attention to detailing shall be taken at the junction of the supports and at the platform deck.

3.1.6. Case B — Helicopter at rest situation

In addition to Case A above, a helideck or a purpose-built shipboard heliport shall be designed to withstand all the applied forces that could result from a helicopter at rest. As such, the following loads shall be taken into account:

a) Imposed load from helicopter at rest.

All parts of the helideck or shipboard heliport shall be assumed to be accessible to helicopters, including any separate parking area (see Chapter 8, 8.1) and shall be designed to resist an imposed (static) load equal to the MTOM of the design helicopter. This load shall be distributed between all the landing gear, and applied in any position so as to produce the most severe loading on each element considered.

b) Overall superimposed load.

To allow for personnel, freight, refuelling equipment and other traffic, snow and ice, and rotor downwash effects etc., a general area imposed action of 2.0 kN/m^2 shall be added to the whole area of the helideck or shipboard heliport.

c) Horizontal actions from a tied-down helicopter including wind actions.

Each tie-down shall be designed to resist the calculated proportion of the total wind action on the design helicopter imposed by a storm wind with a minimum one-year return period.

d) Dead load.

This is the normal gravity load on the element being considered and shall be regarded to act simultaneously in combination with a) and b). Consideration shall also be given to the additional wind loading from any parked or secured helicopter (see also e) 1) below).

e) Environmental actions.

1) Wind loading.

   Wind loading shall be allowed for in the design of the platform. The one-hundred-year return period wind actions on the helicopter landing area structure should be applied in the direction that, together with the imposed lateral loading, produces the most severe load condition on each structural element being considered.

2) Acceleration forces and other dynamic amplification forces.

   For the effects of these forces arising from the predicted motions of mobile installations or vessels, the appropriate environmental conditions corresponding to a ten-year return period shall be considered.

***Note**: Not all helicopter landing areas on ships consist of purpose-built structures. Some helicopter landing areas may alternatively utilize areas of the ship's deck which were not specifically designed for helicopter operations, e.g. main decking on a ship's side, a large hatch cover, etc. In the case of a non-purpose-built structure it shall be established, before authorizing a landing area, that the area selected can withstand the dynamic and static loads imposed for the types of helicopters for which it is intended.*

3.2. HELIDECK/SHIPBOARD HELIPORT DESIGN CONSIDERATIONS — INCLUDING ENVIRONMENTAL EFFECTS

***Note**: In the following sections, the term "helideck" is used throughout to denote a heliport on a fixed or floating*

facility such as an exploration and/or production unit used for the exploitation of oil and gas. Where heliports are located on ships, it would be for the designer to assess whether each aspect of design is appropriate for the "shipboard heliport" under consideration. A stand-alone section (Section 3.2.5 refers) is provided to address special considerations for floating facilities and ships and has particular applicability to all shipboard heliports as well as to helidecks located on floating offshore facilities.

3.2.1. GENERAL DESIGN CONSIDERATIONS

3.2.1.1. The location of a helideck is often a compromise between the conflicting demands of the basic design requirements, the space limitations on the often cramped topsides of offshore facilities, and the need for the facility to provide for a variety of functions. It is almost inevitable that helidecks installed on the cramped topsides of offshore structures will suffer to some degree from their proximity to tall and bulky structures, and to gas turbine exhausts or flares. The objective for designers becomes to create topside designs incorporating helidecks that are safe and 'friendly' to helicopter operations by minimizing adverse environmental effects (mainly aerodynamic, thermal and wave motion) that can affect helicopter operability.

***Note**: Where statutory design parameters cannot be fully met, it may be necessary for restrictions or limitations to be imposed upon helicopter operations which could, in severe cases, lead to a loss of payload when the wind is blowing through a turbulent sector.*

3.2.1.2. Helidecks are basically flat plates and are therefore relatively streamlined structures. In isolation, they would present little disturbance to the wind flow, and helicopters would be able to operate safely to them in a more or less undisturbed airflow environment. Difficulties may arise, however, when the wind has to deviate around the bulk of the offshore installation, causing large areas of flow distortion and turbulent wakes and/or because the producing facility itself is a source of hot or cold gas emissions. The effects fall into three main categories:

1) the flow around the bulk of the offshore facility. Platforms in particular are slab-sided, non-streamlined assemblies (bluff bodies) that create regions of highly distorted and disturbed airflow in the vicinity;

2) the flow around large items of superstructure such as cranes, drilling derricks and exhaust stacks generates turbulence that can affect helicopter operations (see Section 3.2.2). Like the platform itself, these are bluff bodies which encourage turbulent wake flows to form behind the bodies; and

3) hot gas flows emanating from exhaust outlets and flare systems (see Section 3.2.3) and/or cold flaring (see Section 3.2.4).

3.2.1.3. A helideck on a fixed or floating offshore facility shall ideally be located at or above the highest point of the main structure. This will minimize the occurrence of turbulence downwind of adjacent structures. However, while this is desirable, in many parts of the world, for a helideck much in excess of 60 m above sea level, the regularity of helicopter operations may be impacted by low cloud base conditions. Conversely, low elevation helidecks may also adversely affect helicopter operations where one-engine inoperative (dropdown) performance is an operational requirement, i.e. due to the insufficient drop-down between the landing area and the sea surface. Consequently, a trade-off may be required between the height of the helideck above surrounding structures and its absolute height above mean sea level (AMSL).

3.2.1.4. A key driver for the location of the helideck is the need to provide a generous sector, clear of physical obstructions for approaching/departing helicopters and also sufficient vertical clearance for multi-engine helicopters to lose altitude after take-off in the event of an engine failure. This will entail a design incorporating a minimum 210-degree obstacle-free sector with a falling gradient below the landing area over at least 180 degrees of this arc (these issues are discussed further in Chapter 4). Aerodynamically, the helideck shall be as far away as possible from the disturbed wind flow around the platform. and in order to achieve this, in addition to providing the requisite obstruction-free areas described above, it is recommended that the helideck be located on the corner of the facility with as large an overhang as possible.

3.2.1.5. In combination with locating the helideck at an appropriate elevation and providing a vital air gap (see Section 3.2.1.8), the overhang will encourage the disturbed airflow to pass under the helideck, leaving a relatively clean 'horizontal' airflow above the deck. It is recommended that the overhang shall be such that the centre of the helideck is vertically above or outboard of the corner of the facility's superstructure.

3.2.1.6. When determining which corner of the facility the helideck shall overhang, a number of considerations shall be evaluated. The helideck location shall:

a) facilitate a direct approach whenever possible;

b) provide for a clear overshoot;

c) minimize the need for sideways or backwards manoeuvring;

d) minimize the environmental impact due to turbulence, thermal effects etc.; and

e) allow, wherever possible, an approach to be conducted by the commander of the helicopter.

3.2.1.7. The relative weighting of these considerations will change depending on factors such as wind speed. However, the helideck shall generally be located such that winds from prevailing directions carry turbulent wakes and exhaust plumes away from the helicopter approach path. To assess if this is likely to be the case, for fixed facilities, it will usually be necessary for designers to overlay the prevailing wind direction sectors over the centre of the helideck to establish prevailing wind directions, wind speed combinations and to assess the likely impact on helicopter operations for a helideck if sited at a particular location.

3.2.1.8. The height of the helideck AMSL and the presence of an air gap between the helicopter landing area and a supporting module are the most important factors in determining wind flow characteristics in the helideck environment. In combination with an appropriate overhang, an air gap separating the helideck from superstructure beneath it will promote beneficial wind flow over the landing area. If no air gap is provided, then wind conditions immediately above the landing area are likely to be severe, particularly if mounted on top of a large multi-storey accommodation block — it is the distortion of the wind flow that is the cause. However, allowing for an air gap, typically between 3 m and 6 m in height, has the effect of 'smoothing out' distortions in the airflow immediately above the helideck. Helidecks mounted on very tall accommodation blocks will require the largest clearance (typically 5 to 6 m) while those on smaller blocks, and with a very large overhang, will tend to require smaller clearances (typically 3 to 4 m). For shallow

superstructures of three storeys or less, such as are often found on semi-submersible drilling facilities, a 1 m air gap may be sufficient; but there is scope to increase the air gap as long as the size and presence of a more generous air gap does not have an adverse effect on the stability of a floating facility or the sea-keeping qualities of a ship.

***Note**: To avoid wave loading on the helideck, the air gap required by Section 3.2.1.8 is also provided to clear the maximum wave height that might be encountered during transportation and for operational conditions. For a shipboard heliport mounted on the deck of a floating vessel, the maximum vertical displacement due to vessel motion shall also be taken into account.*

3.2.1.9. It is important that the air gap is preserved throughout the operational life of the facility, and care is taken to ensure that the gap between the underside of the helideck structure and the superstructure beneath does not become a storage area for bulky items that might hinder the free flow of air through the gap.

3.2.1.10. Where it is likely that necessary limitations and/or restrictions caused by issues that cannot easily be 'designed out' would have a significant effect on helideck operability, an option may exist for providing a second helideck which could be made available when the wind is blowing through the restricted sector of the primary helideck.

3.2.2. EFFECTS OF STRUCTURE-INDUCED TURBULENCE

3.2.2.1. It is almost inevitable that helidecks installed on cramped topsides of offshore structures will suffer to some degree from their proximity to tall and bulky structures such as drilling derricks, flare towers, cranes or gas turbine exhaust stacks; it is often impractical to site the helideck above every tall structure. Any tall structure above and/or in the vicinity of the helideck may generate areas of turbulence or sheared flow downwind of the obstruction and therefore potentially pose a hazard to the helicopter. The severity of the disturbance will be greater, the bluffer the shape, and the broader the obstruction to the flow. The effect reduces with increasing distance downwind from the source of turbulence.

3.2.2.2. An assessment of the optimum helideck position shall also take into account the location and configuration of drilling derricks, which can vary in relative location during the field life. A fully clad derrick, being a tall and solid structure, may generate significant wake downwind of the obstacle. Since the flow properties of the wake will be unstable, if the helideck is located downwind of a clad derrick, it is likely to be subject to large and random variations in wind speed and direction. As a guide on wake decay from bluff bodies, it shall be assumed that the wake effects will not fully decay for a downwind distance of some ten to twenty structure widths (for a 10 m (33 ft) wide clad derrick this corresponds to a decay distance of between 100 to 200 m). Consequently, it is preferable that a helideck is not placed closer than ten structure widths from a clad derrick. However, few offshore facilities will be large enough to facilitate such clearances in their design, and any specification for a clad derrick has potential to result in operational limitations being applied when the derrick is upwind of the helideck. In contrast, unclad derricks are relatively porous, and while a wake still exists, it will be of a much higher frequency and smaller scale due to the flow being broken up by the lattice element of the structure. Consequently, a helideck can be safely located closer to an unclad derrick than to its clad equivalent. Generally, separations of at least five derrick widths at helideck height shall be the design objective. Separations of significantly less than five structure widths may lead to the imposition of operating restrictions in certain wind conditions.

3.2.2.3. Gas turbine and other exhausts, whether or not in operation, may present a further source of structure-induced turbulence by forming a physical blockage to the air flow over the helideck and creating a turbulent wake (as well as presenting a potential hazard due to the hot exhaust). As a rule of thumb, to mitigate physical turbulence effects at the helideck, it is recommended that a minimum of ten structure widths be established between the obstruction and the helideck.

3.2.2.4. Other potential sources of turbulence which could give rise to turbulence effects may be present on offshore facilities, for example: large structures in close proximity to the helideck or a lay-down area in the vicinity of the helideck. In the latter case, the presence of bulky or tall items placed temporarily in lay-down areas close to the helideck could present a source of turbulence, and may increase hazards, as pilots otherwise familiar with a particular facility would not expect turbulence caused by a temporary obstruction. Ideally, a platform design shall seek to ensure that any proposed lay-down areas are significantly below helideck level and/or are sufficiently remote from the helideck so as not to present a problem for helicopter operations.

3.2.3. TEMPERATURE RISE DUE TO HOT EXHAUSTS

3.2.3.1. Increases in ambient temperature at the helideck are a potential hazard to helicopters, as increased temperatures result in less rotor lift and less engine power margin. Rapid temperature changes are a significant hazard, as the rate of change of temperature in the plume has potential to cause engine compressor surge or stall (often associated with an audible ‘pop’), which can result in loss of engine power, damage to engines and/or helicopter components and, ultimately, engine flame-out. It is therefore extremely important that helicopters avoid these conditions by ensuring that occurrences of higher than ambient conditions are foreseen, mapped, and, where necessary, that steps are taken to reduce payload to maintain an appropriate performance margin.

3.2.3.2. Gas turbine power generation systems are often a significant source of hot exhaust gases on fixed offshore facilities, while diesel propulsion or auxiliary power system exhausts occurring on some floating offshore facilities may also need to be considered. 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 then mixes with the ambient air to increase the size of the plume, at the same time reducing its temperature by dilution.

3.2.3.3. Appropriate modelling designed to evaluate likely temperature rise would indicate that for gas turbine exhausts, with not untypical release temperatures up to 500°C and flow rates of between 50-100 kg/s, the minimum range at which the temperature rise in the plume drops to 2°C above ambient temperature would be in the range of 130-190m downwind of the source. Even where gas turbine generation systems incorporate waste heat recovery systems, resulting in lower gas temperatures of about 250°C, with the same flow rate assumptions the minimum distance before the temperature rise in the plume drops to 2°C above ambient is still in the range of 90-130 m downwind of the source.

3.2.3.4. In consideration of the above, except for the very largest offshore facilities, it is implied that regardless of design, there will always be a wind condition where temperature rise above the helideck exceeds the 2°C threshold. Consequently, it may be impossible to design a helideck that is compliant with these criteria for all conditions. The design aim then becomes one of minimizing the occurrence of high temperatures over the helideck rather than necessarily eliminating them

completely. This can be achieved by ensuring that the facility layout and alignment directions are such that these conditions are only experienced rarely.

3.2.3.5. If it is necessary to locate power generation modules and exhausts close to the helideck, the location can still be acceptable provided that the stacks are high enough to direct the exhaust gas plume clear of arriving/departing helicopters. It is also important to ensure that the design of the stacks does not compromise helideck obstacle protection surfaces or that the stacks are not so wide as to present a source of structure-induced turbulence.

3.2.3.6. The helideck shall be located so that winds from the prevailing wind direction(s) carry the plume away from the helicopter approach/departure paths. To minimize the effects of other wind directions, the exhausts shall be sufficiently high to ensure that the plumes are above all the likely helicopter approach/departure paths. To achieve this, it is recommended that exhaust outlets are no less than 20 to 30 m above the helideck. The provision of downward-facing exhausts that initially direct hot exhaust gases towards the sea shall be avoided, as experience has shown that hot plumes can rise from the sea surface and disperse in an unpredictable way, particularly in light and variable wind conditions.

3.2.3.7. In situations where it is difficult or impractical to reduce the potential interaction between the helicopter and the turbine exhaust plume to a sufficiently low level, consideration shall be given to installing a gas turbine exhaust plume visualization system on facilities having a significant gas turbine exhaust plume problem, in order to highlight the hazard to pilots when operating by day, to minimize the potential effect of the plume by making it easier to see and avoid a plume encounter.

3.2.3.8. Helicopter performance may also be significantly impaired as a result of the combined radiated and convection heat effects from flare plumes under certain wind conditions. In moderate or strong winds, the radiated heat from a lit flare is rapidly dissipated and usually presents little problem for the helicopter, provided flight through the flare plume is avoided. However, in calm or light wind conditions, potential changes in air temperature in the vicinity of the helideck could be much greater and have a marked effect on the performance of the helicopter. Therefore, designers shall exercise great care in determining the location and elevation of flare towers in relation to helicopter operations.

3.2.4. COLD FLARING AND RAPID BLOW-DOWN SYSTEMS

3.2.4.1. Hydrocarbon gas can be released as a result of the production process of installation or from drilling facilities at various times. It is important to ensure that a helicopter does not fly into a cloud of hydrocarbon gas because even relatively low levels of concentration (typically above 10 per cent lower flammable limit (LFL)) can cause a helicopter engine to surge or flame-out with a consequent risk to the helicopter. Also, in these conditions, the helicopter poses a risk to the offshore facility because it is a potential ignition source for any hydrocarbon gas that may be present in the atmosphere. It must therefore be ensured that gas release points are as remote as possible from the helideck and from the helicopter flight path and that, in the event of any unforeseen gas release occurring during helicopter operations, the helicopter pilot is given sufficient warning so that, if necessary, the approach to the helideck can be broken off. Planned gas releases shall only occur when helicopters are not in the area.

3.2.4.2. The blow-down system on a production facility depressurizes the process system releasing hydrocarbon gas. It will normally be designed to reduce the pressure to half its operating value in about fifteen minutes. However, for a large facility, this could feasibly require the release of fifty tonnes of gas, or more. Once down to the target pressure, in fifteen minutes or less, the remainder of the gas will continue to be released from the system. A blow-down may be automatically triggered by the detection of a dangerous condition in the process, or alternatively, manually triggered.

3.2.4.3. The blow-down system shall have venting points that are as remote as possible from the helideck, and prevailing winds shall be downwind of the helideck. It is not uncommon to have this vent on the flare boom, normally a good location. However, dilution of the gas to acceptably low levels of concentration (to <10 per cent LFL) may not occur until the plume is a considerable distance from the venting point. This distance may be anywhere between 200 m and 500 m depending on the size of the vent, the rate of venting and the prevailing wind speed.

3.2.4.4. Drilling facilities often have 'poor-boy degassers' which are used to release gas while circulating a well, but, except for a sudden major crisis such as a blow-out on a drilling facility, they are unlikely to release significant quantities of gas without warning. As with production facilities, it is not likely to be possible to locate the helideck sufficiently distant from the potential source of gas to always guarantee low levels of concentration at the helideck or in the helicopter flight path. The drilling facility may therefore need to curtail helicopter flights when well circulation activity is going on, or when problems are experienced down the well.

3.2.5. SPECIAL CONSIDERATIONS FOR FLOATING FACILITIES AND SHIPS

***Note**: Operating limits for safely remaining on the deck for a period necessary to affect safe passenger and cargo transfer are not considered in detail in Part I. See Chapter 8, 8.3 for deck motions reporting and recording.*

3.2.5.1. As well as experiencing the aerodynamic effects and potential hazards highlighted above, floating installations and ships experience dynamic motions due to ocean waves. These motions are a potential hazard to helicopter operations, and motion limits will need to be established in order to maintain safe landing conditions. The recording and reporting of deck motions for the safe landing of helicopters is discussed in more detail in Chapter 8, 8.3.

3.2.5.2. The setting of helideck performance or motion limitations due to floating installations and ship dynamic motions is usually the responsibility of the helicopter operator and will be influenced by the type of floating facility or ship to which they are operating, the types of helicopters being operated, the operating conditions (e.g. whether day or night) and the location of the helideck (a helicopter operator may, for example, discuss landing limits with the Ship's Master). Limitations typically apply to both vertical linear motions in heave and to angular motions expressed as pitch and roll. Some operators may consider additional parameters such as helideck inclination.

3.2.5.3. The angle of pitch and roll is the same for all points on a facility or ship but the amount of heave, sway or surge motion experienced will vary considerably depending on the precise location of the helideck. The severity of helideck motions will depend on:

a) the wave environment;

b) the size of the floating facility or ship (a smaller facility/ship generally tends to exhibit larger and faster wave induced motions than a large facility/ship where the response amplitude operator (RAO) is lower);

c) the characteristics of the floating facility or ship (certain hull forms exhibit larger wave induced motions than others, or are sensitive to particular sea conditions);

d) whether the floating facility or ship is moored, underway or under tow; and

e) the location of the heliport on a ship (vertical motions tend to be greater at the bow or stern of a ship than at the amidships location, and sway motions due to roll tend to increase with helideck height).

3.2.5.4. Sea States are usually characterised in terms of a significant wave height, an associated wave period and a wave energy spectrum. The motions of a ship or floating facility generally become larger as the significant wave height and period increase, but can be especially severe at certain wave periods (e.g. at natural roll or pitch periods) and may be sensitive to the range in frequency content of the wave spectrum experienced. The motion characteristics of a floating facility or ship may be reliably predicted by recourse to well-established computer models or to physical model testing. Helideck downtime will occur whenever the motions of the floating facility or ship exceed the derived criteria.

3.2.5.5. The operability of a helicopter landing area depends on its location on a floating facility or ship, both longitudinally and transversely. For ships and ship-shaped floating facilities, such as floating production storage and offloading (FPSOs) units, the pitching motion is such that the vertical heave motion experienced at the helideck on the bow or stern will generally be much greater than if the helideck is located amidships. Bow mounted helidecks can be particularly vulnerable to damage from green seas spilling over the superstructure of the ship, unless mounted high above deck level. Helidecks located off the vessel centreline, and cantilevered over the side (which usually provides the benefit of an unobstructed falling gradient over at least 180 degrees) may experience downtime due to heave motions caused by roll; although generally downtime for a helideck located amidships will be less than for a helideck located at the bow or stern of a ship or ship-shaped facility.

Note 1: *The location of the helideck, particularly on drilling facilities, is generally determined by factors other than the need to minimize heave motions, and it may be that the central area of an FPSO or drillship, for example, is otherwise occupied by processing or drilling equipment. A helideck located at the bow or stern may be more accessible to the temporary refuge and/or accommodation on board the facility which is another factor to consider, particularly where the helideck is designated to be a primary means of escape in the event of an incident occurring.*

Note 2: *Some thruster-assisted FPSOs and dynamically positioned facilities or ships have the ability to turn to a desired heading which can be used operationally to minimize helideck downtime due to wave motions and aerodynamic effects. Where dynamic positioning (DP) systems are used to maintain heading control, it is important to ensure that the heading control system has adequate integrity (operability and redundancy) to maintain heading control at all times during helicopter operations.*

3.2.6. HELIDECK DESIGN — ENVIRONMENTAL CRITERIA

3.2.6.1. The design criteria may be applied to new fixed or floating facilities or ships and to significant modifications to existing facilities or ships and/or where operational experience has highlighted potential issues. When considering the volume of airspace to which the following criteria apply, designers shall 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 point). This is considered to be a height above the helideck corresponding to 9.14 m (30 ft) plus wheels-to-rotor height plus one rotor diameter. For the Sikorsky S92, for example, this equates to a column of air approximately 31 m (or 102 ft) above helideck surface level. The formula is clearly type-specific, being predicated on two of the dimensional aspects of the design helicopter, which are specific to type.

3.2.6.2. Generally, with respect to turbulence, a limit on the standard deviation of the vertical airflow velocity of 1.75 m/s shall not be exceeded. However, note that this criterion is close to onshore background turbulence levels and that it would be unusual for a helideck not to exceed this lower threshold limit for at least some wind speeds and directions. In consideration of this, the lower threshold limit of 1.75 m/s is intended to draw attention to conditions that might result in operating difficulties and to alert pilots to exercise caution, unless or until operating experience has confirmed the airflow characteristics to be acceptable. Where these criteria are significantly exceeded (i.e. where the limit exceeds 2.4 m/s), there is the possibility that operational restrictions will be necessary and in this case it may be advisable to consider modifications to the helideck to improve the airflow (such as by increasing the air gap). Fixed or floating facilities or ships where there is a likelihood of exceeding the criteria shall be subjected to appropriate testing e.g. a scale model in a wind tunnel or by computational fluid dynamics (CFD) analysis, to establish the wind environment in which helicopters will be expected to operate.

3.2.6.3. Unless there are no significant heat sources on the facility or ship, designers shall commission a survey of ambient temperature rise based on a Gaussian dispersion model and supported by wind tunnel testing or CFD analysis. Where the results of such modelling and/or testing indicate there may be a rise of air temperature of more than 2°C averaged over a three second time interval, there is the possibility that operational limitations and/or restrictions may need to be applied.

3.2.6.4. For permanent multiple platform configurations, normally consisting of two or more bridge-linked modules in close proximity to each other, the environmental effects of hazards emanating from all constituent modules shall 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 which carries any exhaust plumes from a bridge-linked module in the direction of the helideck.

3.2.6.5. For temporary combined operations where typically one or more mobile facilities and/or ships are operated in close proximity to another (usually fixed) facility, the environmental effects emanating from one facility or ship shall be fully considered for all facilities located together in temporary combined operations.

3.3. GUIDANCE ON HELIDECK SIZE AND SURFACE MOUNTED OBJECTS

***Note**: In respect to D and D-value referenced in the following sections (Sections 3.3 and 3.4), it shall be noted that this corresponds to the largest overall dimension of a single main rotor helicopter when rotors are turning, being measured, and expressed in metres, or in feet, 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 helicopter structure.*

3.3.1. For a helideck which is 1 D or greater, it is presumed that the final approach and take-off area (FATO) and the TLOF will always be coincidental, occupying the same space and having the same load-bearing characteristics. Therefore, for helidecks that are 1 D or greater any reference to FATO may be assumed automatically to include the TLOF; so for a 1 D helideck TLOF is used throughout the relevant sections of AAR-AGA-002 and in Part I of this manual (Figure I-3-1 refers). The FATO and TLOF are each bounded by the circle “1 x D” which is a dynamic load-bearing surface.

3.3.2. For a helideck which is less than 1 D, the TLOF and FATO are regarded to be collocated but are not coincidental as only the TLOF element, consisting of a load-bearing surface, is permitted to apply the reduction below 1 D. The FATO element, for the containment of the helicopter, remains a constant 1 D regardless of the dimension of the reduced TLOF (Figure I-3-2 refers). The FATO is bound by the outer circle from which the obstacle sector surfaces derive their origin. The TLOF is bound by the inner circle (represented as a circle within the octagon shape of the helideck load-bearing area). The FATO outside the TLOF perimeter represents a non-load bearing surface for helicopters as it usually extends over the safety device (whether safety net or safety shelf) which is incapable of supporting even the static load of a helicopter. Therefore, a helideck incorporates one FATO and one TLOF; notwithstanding for a fixed or floating offshore facility, to improve operational flexibility, there may be the possibility to provide additional helideck(s) elsewhere on the facility – the advantages of this are raised in Chapter 3, 3.2.1.10.

3.3.3. It shall be remembered that the basic size of a 1 D FATO with coincident TLOF is, of necessity, a compromise for offshore operations where space is invariably limited. Nonetheless, it is essential that the TLOF provides sufficient space for the landing gear configuration and sufficient surface area to promote a helpful “ground cushion” effect from rotor downwash. The area provided shall also allow adequate room for passengers and crew to alight or embark the helicopter and to transit to and from the operating area safely. In addition, space consideration needs to be given to allow essential on deck operations, such as baggage handling, tying down the helicopter or helicopter refuelling, to occur safely and efficiently, and, in the event of an incident or accident occurring, for rescue and firefighting teams to always have good access to the landing area from an upwind location (see also Chapter 6).

3.3.4. The design shall allow for sufficient clearance from the main rotor and tail rotor of the helicopter to essential objects permitted to be around the perimeter of the TLOF, including obstacles that may be present in the limited obstacle sector (LOS). It shall be clearly understood that a FATO of 1 D is the minimum dimension sufficient for the containment of the helicopter; in this case, where a precise landing is completed (see also Chapter 5, especially the use of touchdown/positioning marking circle), the main and tail rotors will abut the edge of the 1 D circle. For this reason it is important that the yellow touchdown/positioning marking circle is accurately and clearly marked and is used by aircrew every time for positioning the helicopter during the touchdown manoeuvre.

3.3.5. Sufficient margins to allow for touchdown/positioning inaccuracies as a result of normal variations or handling difficulties, for example due to challenging meteorological conditions, aerodynamic effects and/or dynamic motions due to ocean waves, shall be allowed for in the design. The helideck and environs shall provide adequate visual cues and references for aircrew to use throughout the approach to touchdown manoeuvre, from initial helideck location and identification (acquisition) through final approach to hover and to landing. In addition, adequate visual references shall be available for the lift-off and hover into forward flight.

3.3.6. In consequence of the considerations stated above, except where an aeronautical study/risk assessment is able to demonstrate otherwise (see Appendix I-A), the minimum

size for the newbuild design of a TLOF for single main rotor helicopters is deemed to be an area which can accommodate a circle whose dimension is no less than the overall length including rotors of the largest helicopter that the helideck is intended to serve. For helicopters with a MTOM of 3 175 kg or less, it is permitted, on the basis of a risk assessment (see Appendix I-A) to shrink the overall size of the TLOF so that it is less than 1 D, but is not less than 0.83 D.

3.3.7. A FATO of 1 D provides full containment of the helicopter where touchdown markings are used correctly and precisely. For a helideck that has a dynamic load-bearing surface (TLOF) of less than 1 D, elements of the helicopter will inevitably extend beyond the edge of the TLOF. For this reason the TLOF is surrounded by a circle with a diameter of 1 D — which is obstacle-free with the exception of the permitted obstacles discussed in Section 3.3.8 below. In essence, this obstacle-free area represents the standard 1 D FATO from which the limited obstacle sector extends. To ensure obstacle clearance, it is important that the diameter of the touchdown/positioning marking circle is 0.5 of the notional FATO (not of the smaller landing surface (TLOF)) and is located at the centre of the FATO (these points are emphasised in the Appendix I-A sub-1 D risk assessment).

3.3.8. One of the key elements relating to acceptance of a sub-1 D TLOF is the requirement for sufficient clearance to exist from the main or tail rotor of the helicopter to permitted objects which, to ensure safe helideck operations, may need to be present around the TLOF. These essential objects may include guttering, with or without a raised kerb around the helideck, where provided, helideck perimeter lighting systems including helideck perimeter floodlighting, helideck firefighting equipment e.g. a fixed monitor system (FMS) (see Chapter 6) and any handrails or signage associated with the helideck which may not be capable of complete retraction or removal during helicopter operations.

3.3.9. For a helideck having an overall dimension of 1 D or larger, assuming also a D-value greater than 16 m (52.5 ft), the height of permitted objects around the TLOF perimeter shall be no greater than 25 cm (10 in) above helideck level (see Figure I-3-1) but ideally no more than 15 cm (6 in) above helideck level. For a helideck, which has an overall dimension less than 1 D and/or has a D-value of 16 m (52.5 ft) or less, the height of permitted objects around the TLOF perimeter shall be no greater than 5 cm (2 in) above helideck level (see Figure I-3-2).

3.3.10. Essential objects, which because of their function are required to be located around the TLOF perimeter, shall be of a suitable construction when assessed against the undercarriage design of helicopters operating to the helideck. For a helideck having an overall dimension of 1 D or larger, assuming also a D-value greater than 16 m (52.5 ft), where the construction of permitted objects around the TLOF could present a threat to the undercarriage and tail rotor systems of helicopters passing over the TLOF perimeter at low altitude and at low airspeed, more demanding obstacle height restriction for objects around the TLOF shall be considered, so that essential objects are restricted to a height no greater than 15 cm (6 in) above helideck level.

3.3.11. The helideck may be of any shape as long as it can contain within its boundary the minimum prescribed dimensions, which are based on accommodating a usually ‘hypothetical’ circle. Although helidecks may be square, circular or rectangular — all common shapes for early helideck designs — newbuild helidecks are more likely to be hexagonal or octagonal in shape. Consisting of a series of straight sides/edges, these arrangements provide some advantages over early design shapes. For example, multi-sided straight lines can provide more effective visual cues at night than do either a circular or square arrangement. Circular helidecks tend to be less rich in visual cues than do helidecks consisting of a series of straight lines.

3.4. SHIPBOARD HELIPORT SIZE AND SURFACE-MOUNTED OBJECTS

3.4.1. A shipboard heliport may be purpose-built or non-purpose-built and be provided in the bow or stern of a ship, have an over-side location (usually cantilevered), be amidships on or close to the centre line of the ship, be located on the ship's side or, subject to structural considerations (see Section 3.1), utilize other non-purpose-built areas of the ship such as over a hatch cover (see also Chapter 3, 3.2.5).

3.4.2. For a shipboard heliport, regardless of whether it is purpose-built or non-purpose-built, where the diameter of the landing area is 1 D or larger it is presumed that the FATO and TLOF will always be coincidental and therefore the TLOF is assumed to include the FATO when used throughout the relevant sections of AAR-AGA-002, and in this manual. A shipboard heliport commonly incorporates one TLOF, notwithstanding that for a large ship, to improve operational flexibility, there may be opportunity to provide an additional landing area elsewhere on the facility — the advantages of this are raised in Chapter 3.

3.4.3. For a purpose-built shipboard heliport provided in the bow or stern of a ship, where operations are conducted within limited touchdown directions only (see Figure I-3-3), consideration may be given to reducing the load-bearing surface dimension athwartships; provided the helicopter's longitudinal (landing) direction the TLOF dimension is at least 1 D, the width of the TLOF in the athwartships direction may be reduced to no less than 0.83 D. Across both axes the minimum dimension of the FATO is 1 D, so athwartships the FATO will typically overlap the perimeter netting (or safety shelving) on both the port and starboard sides. This portion of the FATO, which for a minimum size (0.83 D TLOF) extends either side beyond the TLOF by 0.085 D, is assumed to be non-load-bearing for helicopters.

3.4.4. The basic size of the FATO and TLOF for a shipboard heliport is, of necessity, a compromise for offshore operations where space is often limited. The landing and take-off (load-bearing) area shall provide sufficient space for the landing gear configuration and a sufficient surface area to promote helpful "ground cushion" effect from rotor downwash. The surface area shall allow adequate room for passengers and crew to alight or embark the helicopter and to transit to and from the operating area safely. In addition, space consideration needs to be given to allow essential on deck operations, such as baggage handling, tying down the helicopter or helicopter refuelling, to occur safely and efficiently, and, in the event of an incident or accident occurring, for rescue and firefighting teams to have good access to the landing area, at all times from an upwind location (see also Chapter 6). For the arrangement described in 3.4.3, operators shall consider running this through the risk assessment 'template' provided for sub-1 D helidecks at Appendix I-A.

3.4.5. The design shall allow for sufficient clearance from the main rotor and tail rotor of the helicopter to objects permitted to be around the perimeter of the TLOF, including objects that may be present in the limited obstacle sector. It shall be clearly understood that a FATO of 1 D is sufficient only for containment of the helicopter; the main and tail rotors will always be at the edge of the 1 D circle — even when the helicopter is perfectly positioned. For this reason, it is important that the touchdown/positioning marking circle is accurately and clearly marked and is used by aircrew for positioning the helicopter during the touchdown manoeuvre.

3.4.6. Sufficient margins to allow for touchdown/positioning inaccuracies as a result of normal variations or handling difficulties, for example due to challenging meteorological conditions, aerodynamic effects and/or dynamic motions due to ocean waves, shall be allowed for in the design. Finally, the helideck and the environs shall provide adequate visual references for the aircrew throughout the approach to touchdown manoeuvre from

initial helideck location and identification (acquisition) through final approach to hover and to landing. In addition, adequate visual references shall be available for lift-off and hover (see Appendix I-A for guidance).

3.4.7. In consequence of the considerations stated above, the minimum size of the FATO and the TLOF for single main rotor helicopters is deemed to be an area which can accommodate a circle whose dimension is no less than the overall length including rotors of the largest (design) helicopter that the shipboard heliport is intended to serve.

3.4.8. In the case of a purpose-built shipboard heliport provided in the bow or stern of a narrow-beam ship, where operations are conducted with limited touchdown directions, it is permissible to make a case for operations to shipboard heliports that are less than 1 D, but are no less than 0.83 D in the athwartships direction. The criterion used to assess operations conducted to sub-1 D helidecks is contained in Appendix I-A and could be used to help inform a decision on safe operations to a sub-1 D shipboard heliport.

3.4.9. Example — For a ship with a bow-mounted shipboard heliport steaming into wind on a heading of 360°, the touchdown heading of the helicopter (nose) is limited in heading between 330° and 030°, while for a ship with a bow-mounted shipboard heliport steaming downwind on a heading of 180°, the touchdown headings of the helicopter (nose) is limited to between 150° and 210°. In each case the ship may need to be manoeuvred to ensure that the direction of the helicopter touchdown heading is aligned with the direction of the relative wind at the time the helicopter is operating. See Figure I-3-3.

***Note**: State Civil Aviation Agency shall carefully consider the available visual references before sanctioning operations to bow- or stern-mounted shipboard heliports at night, especially those which are less than 1 D.*

3.4.10. One of the important elements relating to the minimum size of the FATO and TLOF is the requirement for sufficient clearance to exist from the main or tail rotor of the helicopter to essential objects which may need to be present around a TLOF. For a shipboard heliport, which has an overall dimension less than 1 D and/or has a D-value of 16 m (52.5 ft) or less, the height of essential permitted objects around the TLOF perimeter shall be no greater than 5 cm (2 in) above the level of the landing area, while for a shipboard heliport having an overall dimension of 1 D or greater, assuming also a D-value greater than 16 m, the height of essential permitted objects around the TLOF perimeter shall be no greater than 25 cm (10 in), but ideally no more than 15 cm (6 in), above the level of the landing area. Essential objects may include guttering with or without a raised kerb, where provided, perimeter lighting systems, including perimeter floodlighting and foam monitors where a FMS is the primary means for firefighting (see Chapter 6) and any handrails or signage associated with the shipboard heliport which may not be capable of complete retraction or removal during helicopter operations.

3.4.11. Essential objects, which because of their function are required to be located around the TLOF perimeter, shall be of a suitable construction when assessed against the undercarriage design of helicopters operating to the shipboard heliport. For a purpose-built shipboard heliport having an overall dimension of 1 D or larger, assuming also a D-value greater than 16.00 m (52.5 ft), where the construction of permitted objects around the TLOF could present a threat to the undercarriage and tail rotor systems of helicopters passing over the TLOF perimeter at low altitude and at low airspeed, more demanding obstacle height restriction for objects around the TLOF shall be considered so that essential objects are restricted to a height no greater than 15 cm (6 in) above heliport level.

3.4.12. With the exception of the operation illustrated in Figure I-3-3, a FATO and TLOF for a shipboard heliport may be any shape as long as it can contain a usually ‘hypothetical’

circle with the minimum prescribed dimensions of 1 D. Although purpose-built shipboard heliports may be square, circular or rectangular — a common shape used for early designs — newbuild purpose-built shipboard heliports are more likely to be hexagonal or octagonal in shape. Consisting of a series of straight sides/edges, these arrangements provide some advantages over early design shapes. For example, multi-sided straight lines can provide better visual cues at night than either a circular or a square arrangement.

3.5. HELIDECK SURFACE ARRANGEMENTS

3.5.1. Objects which, due to their function, are required to be located on the surface of the TLOF, such as helideck nets and helideck touchdown marking lighting systems, where provided, shall not exceed a height above surface level prior to installation of more than 2.5 cm (1 in) and may only be present if they do not represent a hazard to helicopter operations. It shall be appreciated that the presence of raised fittings on a helideck has potential to induce dynamic rollover for helicopters fitted with skids and extra care shall be taken when incorporating deck-mounted fittings to helidecks intended for use by skid-fitted helicopters. As a consequence, because of the possible adverse effects of skid tips becoming enmeshed in helideck surface netting, it is recommended that skid-fitted helicopters not operate to helidecks while a net is present. In addition, because of the concerns of dynamic rollover, helicopters shall only operate to helidecks fitted with deck-mounted touchdown marking lighting systems where the system components are suitably finished, and the installed height of the system does not exceed 2.5 cm (1 in). This would include proper arrangements for the chamfering of components (e.g. panels) and the maintenance of suitable friction surface finishes for each element of the system (see Chapter 5, 5.15 and Appendix I-B).

3.5.2. The surface of the landing area shall be sloped to prevent the pooling of water. To this end, the landing area shall contain a suitable drainage system capable of directing rainwater, seawater, firefighting media and fuel spills away from the helideck, to a safe place. To ensure the adequate drainage of a helideck located on a fixed facility, the surface of the helideck shall be laid to a fall or cambered to prevent any liquids accumulating on the landing area. Such falls or cambers shall be approximately 1:100 and shall be designed to drain liquids away from the main structure. A system of guttering, and/or slightly raised kerb, shall be located around the perimeter of the TLOF to prevent spilled fuel falling onto other parts of the facility while directing any spillages to a safe storage or disposal area, which may include the sea surface (where permitted)1. The capacity of the drainage system shall be adequate to contain the maximum likely spillage of fuel on the helideck, taking into account the design helicopter and its fuel capacity, typical fuel loads and uplifts. The design of the drainage system shall preclude blockage by debris. Any deflection of the helideck surface, in service, due to static loads imposed by the helicopter while stationary, shall not modify the surface to the extent that it encourages pooled liquids to remain on the helideck. An example of a helideck drainage system capacity check, based on an S92 helideck design, is attached at Appendix I-C.

3.5.3. The surface of the landing area shall be skid-resistant to both helicopters and personnel using the TLOF. This entails that all essential markings on the surface shall have a coating of non-slip material. Guidance may also be given by SCAA on what minimum friction properties need to be achieved to ensure that a given surface is rendered 'skid-resistant' to helicopters and is suitable for personnel using the helideck. The SCAA shall advise how a helideck can be tested and re-tested, to ensure compliance.

***Note**: It is recognized that certain aluminium helidecks contain holes in the topside construction for the rapid drainage of fluids, including fuel spills which could occur, for example, if a helicopter's fuel system is ruptured by the impact of a crash. In these cases, particular care shall be taken to assess the quality of skid-resistance prior to the helideck going into service. In addition, it is also important to ensure that*

the pattern, and especially the size of any holes, do not have a detrimental effect on helicopter operations, i.e. the surface arrangement shall not promote the breakdown of a helpful ground cushion beneath the helicopter to reduce beneficial ground effect (for a fuller discussion of this issue see Section 3.2).

3.5.4. The helideck surface shall be rendered so as to meet minimum friction coefficients, acceptable to the SCAA (e.g. for helicopter operations on fixed helidecks, not less than 0.6μ inside the touchdown/positioning marking (TD/PM) circle and on the painted markings and 0.5μ outside the TD/PM circle, and for moving helidecks not less than 0.65μ inside the TD/PM circle and on the painted markings and 0.5μ outside the TD/PM circle). However, where an acceptable minimum friction coefficient of 0.6μ for a fixed helideck or 0.65μ for a moving helideck cannot be achieved for operations with wheeled helicopters, there is an option to provide a surface mounted tautly stretched helideck landing net to encompass the touchdown/positioning marking circle and the heliport identification "H" marking, so that for a normal touchdown, the wheeled undercarriage of the helicopter is contained within the perimeter of the net. The net shall not be so large as to compromise the clear interpretation of other markings; for example, the heliport-name marking or the maximum allowable mass marking — the helideck net may need to be modified to achieve this objective, e.g. corners are cropped and removed. Where a net is fitted, the entire surface shall meet a minimum friction coefficient of 0.5μ.

Note 1: *No two adjacent (side-to-side, corner to corner is acceptable) 1 m squares should achieve less than the average surface friction value specified in paragraph 3.5.4 above, except within the TD/PM circle where TD/PM circle and 'H' lighting is installed.*

Note 2: *Where TD/PM circle and 'H' lighting is installed, testing of the TD/PM circle and 'H' painted markings is not required, however, non-slip paint should still be used.*

3.5.5. It is preferable that the net be manufactured from material which is durable, in consideration of the mass of the design helicopter and the forces acting on the net through the undercarriage. Materials selected shall not be prone to wear and tear such as flaking caused by prolonged exposure to adverse weather conditions. The rope shall be secured at regular intervals and tensioned to a suitable level (typically 2 225 N). Generally it shall not be possible to raise any part of the net by more than 25 cm (10 in) above the helideck surface when applying a vigorous vertical pull by hand. The profile of the uninstalled net shall ensure that it does not exceed the touchdown area height constraint requirements specified in Section 3.5.1.

Note*: It is not recommended that nets be provided for operations by skid-fitted helicopters, as skids can easily become enmeshed in netting. Further, it shall also be considered that the presence of a net may have a detrimental effect on certain firefighting solutions where components, when activated, are required to 'pop-up' through the surface of the helideck. This action might be hindered by the presence of a tautly stretched helideck net.*

3.5.6. Sufficient tie-down points and flush-fitting to obviate damage to tires or skids shall be provided for securing the design helicopter. Tie-downs shall be located, and be of such construction, so as to secure the helicopter in severe weather conditions. Construction shall take account of the inertial forces resulting from any movement of a floating facility (See also Section 3.1). Tie-down points shall be compatible with the dimensions of tie-down strop attachments.

3.5.7. Protection safety devices such as perimeter safety nets or safety shelves shall be installed around the edge of the helideck, except where structural protection already exists. For helidecks completed on or after 1 January 2012, any safety device employed shall not exceed the height of the outboard edge of the TLOF, which would present a hazard to helicopter operations. The load-bearing capability of the safety device shall be

assessed fit-for-purpose by reference to the shape and size of the workforce that it is intended to protect.

3.5.8. Where the safety device consists of perimeter netting, this shall be of a flexible nature and be manufactured from a non-flammable material with the inboard edge fastened just below the edge of the helideck. The net itself shall extend to a distance of at least 1.5 m (5 ft) in the horizontal plane and be arranged with an upward slope of approximately 10°. The net shall not act as a trampoline but shall provide a hammock effect to securely contain a person falling or rolling into it, without serious injury. When considering the securing of the net to the structure and the materials used, care shall be taken to ensure each element will meet adequacy of purpose requirements, particularly that netting shall not deteriorate over time due to prolonged exposure to the elements, including ultraviolet light. Perimeter nets may incorporate a hinge arrangement to facilitate the removal of sacrificial panels to allow for periodic testing.

3.5.9. Where the safety device consists of safety shelving, rather than netting, it shall be ensured that the construction and layout of the shelving does not promote any adverse wind flow issues over the helideck (see Section 3.2.2), while providing equivalent personnel safety benefits to Section 3.5.7, and that it is installed to the same minimum dimensions as the netting system described above (at least 1.5 m (5 ft)) in the horizontal plane beyond the edge of the helideck. This solid shelving offers some advantage for promoting helpful ground cushion, especially for helidecks which are sub-1 D. It may also be further covered with netting to improve “grab” capabilities.

3.5.10. Helideck access points shall be located at two or preferably three locations around the landing area to give passengers embarking or disembarking direct access to and from the helicopter without a need to pass around the tail rotor or under the main rotor of those helicopters with a low main rotor profile. The need to preserve, as far as possible, an unobstructed falling gradient over at least 180° shall be carefully weighed against the size and design of the access platform in needing to accommodate vital helideck safety equipment (e.g. firefighting equipment) plus access stairs and signage so that any infringement to the falling gradient is the smallest possible, and preferably not at all.

3.5.11. Escape routes shall be of a suitable size to enable quick and efficient movement of the maximum number of personnel who may require to use them, and to facilitate easy manoeuvring of firefighting equipment and use of stretchers. Typical dimensions for width of escape routes would be 1.2 m (4 ft) for main escape routes and 0.7 m (2.3 ft) for secondary escape routes, with consideration given to areas for manoeuvring a stretcher. Where foam monitors are selected for firefighting and collocated on an access platform, care shall be taken to ensure that the presence of a monitor does not impede or cause injury to escaping personnel due to the operation of the monitor in an emergency situation. Handrails associated with access platforms may need to be made collapsible, retractable or removable where the height constraints of Section 3.3.9 cannot be otherwise met.

3.6. SHIPBOARD HELIPORT SURFACE ARRANGEMENTS

3.6.1. Objects which, due to their function, are required to be located on the surface of the landing area, such as fitted surface nets and touchdown marking lighting systems, shall not exceed an uninstalled height above surface level of more than 2.5 cm (1 in) and shall only be present if they do not represent a hazard to helicopter operations. It shall be appreciated that raised fittings on a shipboard heliport has potential to induce dynamic rollover for helicopters fitted with skids. Because of the possible adverse effects of skid tips becoming enmeshed in the netting, it is not generally recommended that skid-fitted helicopters operate to shipboard heliports with a net present. In addition, because of the

concerns of dynamic rollover, helicopters shall only operate to shipboard heliports fitted with deck-mounted touchdown marking lighting systems where the system components are suitably finished and where the installed height does not exceed 2.5 cm (1 in). This would include proper arrangements for chamfering of components (e.g. panels) and the maintenance of suitable friction qualities for each element of the system (see Chapter 5, 5.15 and Appendix I-B).

***Note**: For a non-purpose-built shipboard heliport, there may be circumstances where non-essential, and otherwise immovable surface-mounted obstructions are located within or immediately adjacent to the landing area which, with robust operational controls, may be assessed not to present a hazard to the helicopter but which may need to be highlighted to be readily visible from the air. There is a scheme for marking of obstacles described in Chapter 4, 4.5, which also provides details of how to complete a helicopter landing area/operating area plan.*

3.6.2. The surface of the landing area shall be arranged to prevent the pooling of water. To this end, the landing area shall be provided with a suitable drainage system capable of directing rainwater, seawater, firefighting media or fuel spills away from the surface of the landing area to a safe place. A system of guttering, and/or a slightly raised kerb, shall be provided around the perimeter of the landing area to prevent spilled fuel falling onto other parts of the facility while directing any spillages to a safe storage or disposal place, which may be the sea surface (where permitted). The capacity of the drainage system shall be adequate to contain the maximum likely spillage of fuel on the landing area taking account the design helicopter with its fuel capacity, typical fuel loads and uplifts. The design of the drainage system shall preclude blockage by debris. Any deflection of the landing area surface due to static loads imposed by a stationary helicopter shall not modify the surface to the extent that it encourages the pooling liquids to remain on the surface of the landing area. An example of a helideck drainage system capacity check, based on an S92 helideck design, is attached at Appendix I-C.

3.6.3. The surface of the landing area shall be skid-resistant to both helicopters and personnel using the landing area. This entails that all essential markings on the surface shall have a coating of non-slip material. Guidance may also be given by SCAA on what minimum friction properties need to be satisfied to ensure that a given surface is rendered skid-resistant to both helicopters and the personnel using it. The SCAA shall also be able to advise how a surface can be tested, and retested, to ensure compliance.

***Note**: It is recognized that certain aluminium shipboard heliports contain holes in the topside construction for the purpose of rapid drainage of fluids including fuel spills which might occur if a helicopter's fuel system is ruptured by the impact of a crash. In this instance, care shall be taken to assess the qualities of skid-resistance prior to the shipboard heliport going into service. For these particular arrangements, it is also important to ensure that the pattern, and especially the size of any holes, does not have a detrimental effect on helicopter operations, i.e. the surface arrangement shall not disrupt the ground cushion beneath the helicopter and so reduce beneficial ground effect. This issue is discussed in more detail in Appendix I-A and in Section 3.2.*

3.6.4. The surface of the landing area shall be rendered to meet a minimum friction coefficient, acceptable to an SCAA (for helicopter operations to shipboard heliports typically not less than 0.65 μ inside the TD/PM circle and on the painted markings and 0.5 μ outside the TD/PM circle). However, where this cannot be achieved for a specific design, the option exists to provide a surface mounted tautly stretched net to encompass the touchdown/positioning marking circle and the heliport identification "H" marking such that for a normal touchdown, the wheeled undercarriage of the helicopter is contained within the landing net. The size of the net shall not compromise the clear interpretation of other markings; for example, the heliport-name marking or the maximum allowable mass marking — the net may be modified to achieve this objective e.g. have the corners

cropped and removed. Where a net is fitted, the entire surface, regardless of whether it is covered by the net, shall meet a minimum friction coefficient of 0.5 μ.

Note 1: *No two adjacent (side-to-side, corner to corner is acceptable) 1 m squares should achieve less than the average surface friction value specified in paragraph 3.6.4 above, except within the TD/PM circle where TD/PM circle and 'H' lighting is installed.*

Note 2: *Where TD/PM circle and 'H' lighting is installed, testing of the TD/PM circle and 'H' painted markings is not required, however, non-slip paint should still be used.*

3.6.5. It is preferable that the landing net be manufactured from material which is durable, considering the mass of the design helicopter and the forces acting on the net through the undercarriage, and which is not prone to wear and tear such as flaking due to prolonged exposure to adverse weather conditions. The rope shall be secured at regular intervals and tensioned to a suitable level (typically 2 225 N). As a general rule, it shall not be possible to raise any part of the net by more than 25 cm (10 in) above the TLOF surface when applying a vigorous vertical pull by hand. The profile of the net shall ensure that it does not exceed the surface level height constraint requirements specified in Section 3.6.1.

Note*: It is not recommended that nets be provided for operations by skid-fitted helicopters as skids can easily become enmeshed in netting. It shall also be considered that the presence of a net may have a detrimental effect on certain firefighting solutions where components, when activated, are required to emerge through the surface of the helideck. This action might be hindered by the presence of a tautly stretched net.*

3.6.6. Sufficient tie-down points and flush-fitting to obviate damage to tires or skids, shall be provided for securing the design helicopter for the shipboard heliport. These shall be located and constructed so as to secure the helicopter in severe weather conditions. Construction shall take account of the inertial forces resulting from any movement of the ship (see also Section 3.1). Tie-down points shall be compatible with the dimensions of tie-down strap attachments.

3.6.7. Protection safety devices, such as perimeter safety nets or safety shelves, shall be installed around the edge of a shipboard heliport except where structural protection exists. For shipboard heliports completed on or after 1 January 2015, any safety device employed shall not exceed the height of the landing area at the outboard edge, which would present a hazard to helicopter operations. The load-bearing capability of the safety device shall be assessed fit-for-purpose according to the size of the workforce that it is intended to protect.

3.6.8. If the safety device consists of perimeter netting, it shall be of a flexible nature and be manufactured from a non-flammable material with the inboard edge fastened just below the edge of the shipboard heliport. The net itself shall extend to a distance of at least 1.5 m (5 ft) in the horizontal plane and be arranged with an upward slope of approximately 10°. The net shall not act as a trampoline but shall display a hammock effect to securely contain a person falling or rolling into it, without serious injury. When considering the securing of the net to the structure and the materials used, care shall be taken to ensure each element will meet adequacy of purpose requirements, particularly that netting shall not deteriorate over time due to prolonged exposure to the elements, including ultraviolet light. Perimeter nets may incorporate a hinge arrangement to facilitate the removal of sacrificial panels to allow for testing.

3.6.9. Where the safety device consists of safety shelving, rather than netting, it shall be ensured that the construction of the shelving does not promote any adverse wind flow issues over the shipboard heliport (see Section 3.2.2), while providing equivalent personnel safety benefits, and that it is installed to the same dimensions as the netting

system described above (at least 1.5 m (5 ft) measured in the horizontal plane from the edge of the landing area). This solid shelving offers some advantage for promoting helpful ground cushion, especially for shipboard heliports which are sub-1 D. It may also be further covered with netting to improve traction.

3.6.10. Shipboard heliport access points shall be located at two or preferably three locations around the landing area to give passengers embarking or disembarking direct access to and from the helicopter without the need to pass around the tail rotor or under the main rotor of those helicopters with a low main rotor profile. The need to preserve, as far as possible, an unobstructed falling 5:1 (or 3:1) gradient over at least 180° shall be carefully weighed with the size and design of the access platform needed to accommodate vital heliport safety equipment (e.g. firefighting stations) plus access stairs and signage so that any infringement to the falling gradient is the smallest possible, and preferably not at all.

3.6.11. Escape routes shall be of a suitable size to enable quick and efficient movement of the maximum number of personnel who may require to use them, and to facilitate easy manoeuvring of firefighting equipment and use of stretchers. Typical dimensions for width of escape routes would be 1.2 m (4 ft) for main escape routes and 0.7 m (2.3 ft) for secondary escape routes, with consideration given to areas for manoeuvring a stretcher. Where foam monitors are selected and collocated on an access platform, care shall be taken to ensure that the presence of a monitor does not impede or cause injury to escaping personnel due to the operation of the monitor in an emergency situation. Handrails associated with access platforms may need to be made collapsible, retractable or removable where the height constraints of Section 3.4.9 cannot be met.

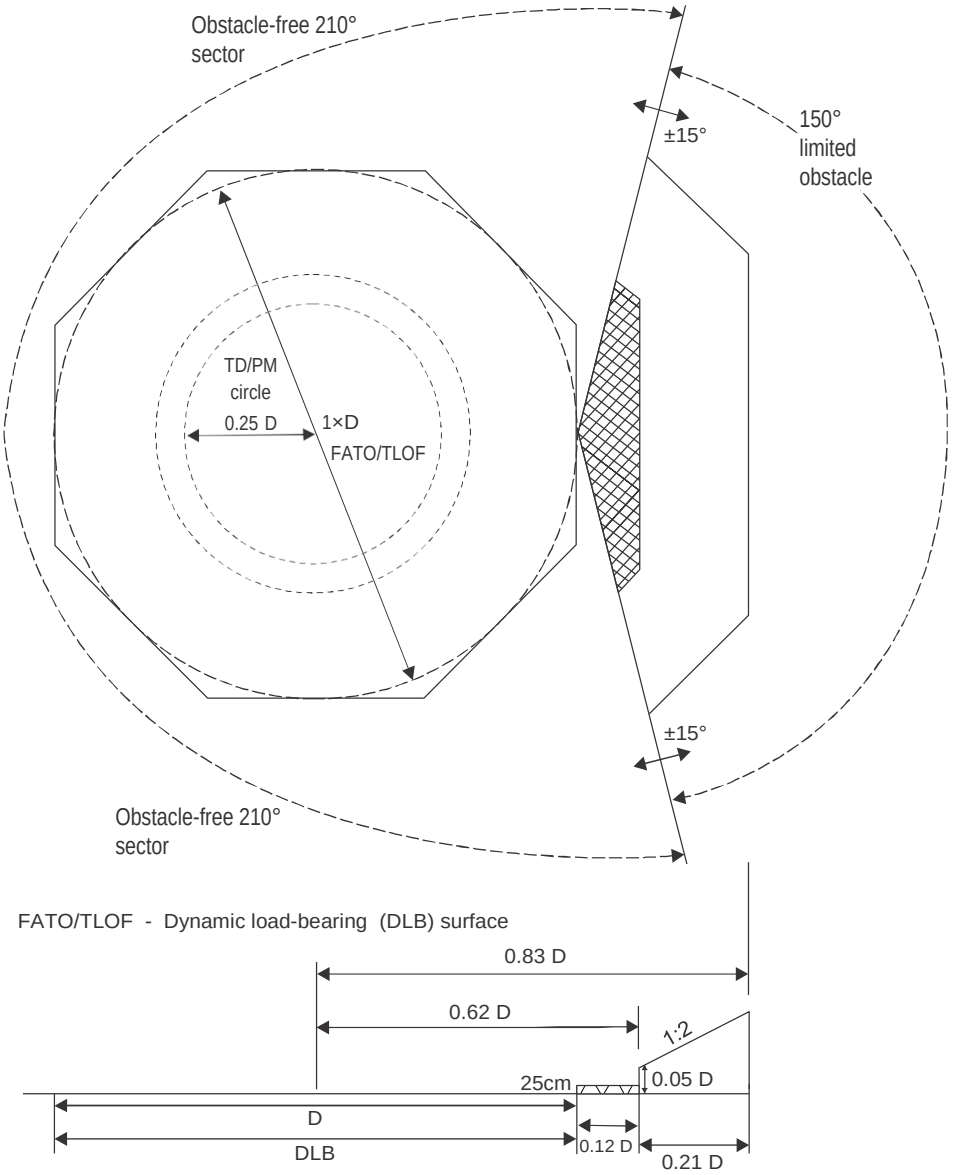


Figure I-3-1. Helideck obstacle limitation sectors and surfaces for a FATO/TLOF of 1D

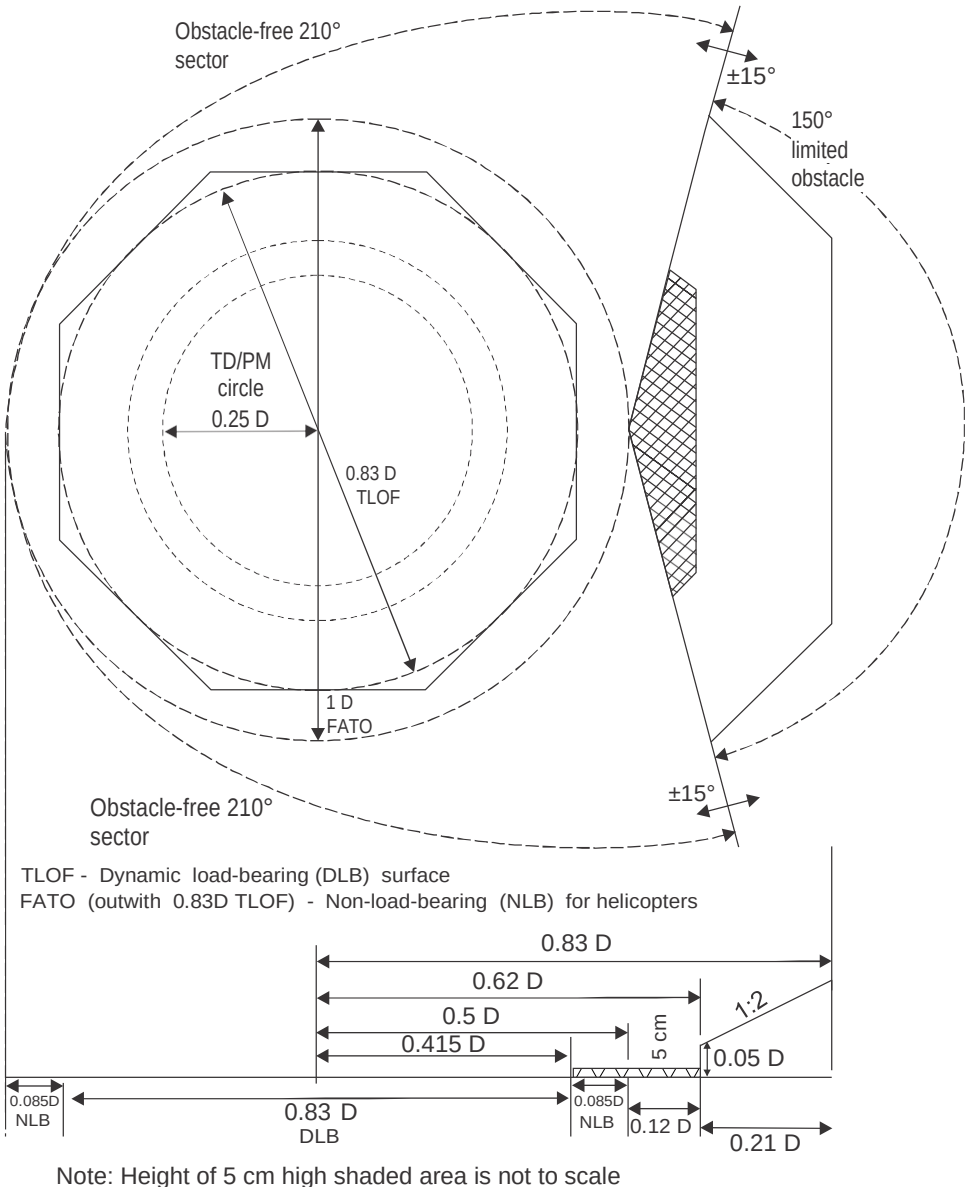


Figure I-3-2. Helideck obstacle limitation sectors and surfaces for a FATO/TLOF less than 1D (particular example is for a minimum-size 0.83D TLOF)

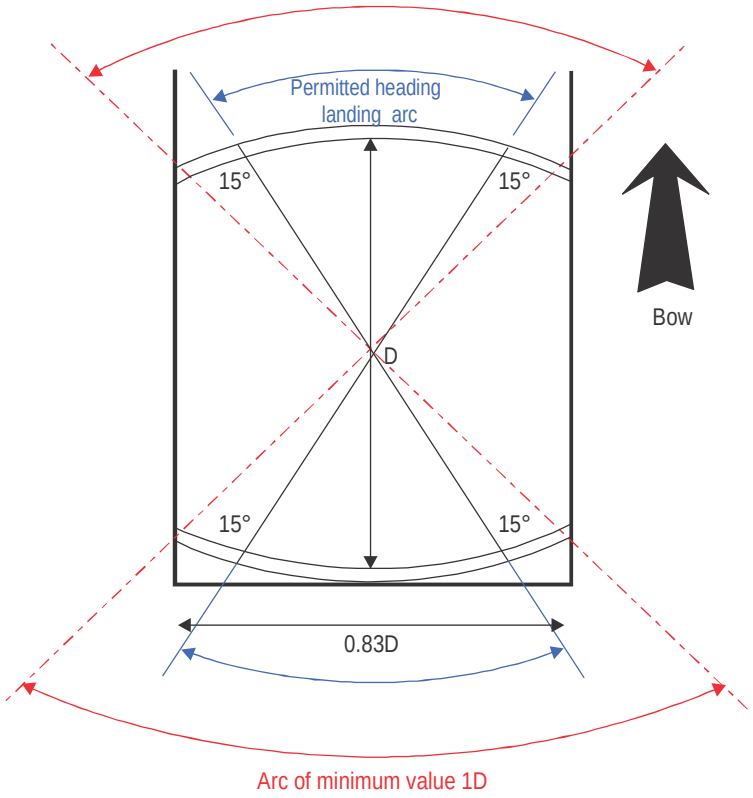


Figure I-3-3. Shipboard permitted landing headings for limited heading operation

4. OBSTACLE ENVIRONMENT

4.1. DESCRIPTION OF SURFACES — HELIDECKS

4.1.1. For any particular type of single main rotor helicopter, the final approach and take-off area (FATO) shall be sufficiently large to contain a circle of diameter D equal to the largest dimension of the helicopter when the rotors are turning. Except for the presence of objects essential for the safe operation of helicopters, the FATO, encapsulating a usually hypothetical D-circle, shall remain unobstructed. Acceptance of essential objects within the periphery of the FATO, intended to be an obstacle-free area to contain the design helicopter, shall be subject to a risk assessment (see Appendix I-A).

4.1.2. From a point on the periphery of the above mentioned D-circle, an obstacle-free approach and take-off sector shall be provided which extends over an angle of at least 210 degrees. Within this sector, obstacle accountability shall be considered out to a distance from the periphery of the FATO that will allow for an unobstructed departure path appropriate to the least well performing helicopter the FATO is intended to serve. The height limitation for obstacles in the obstacle-free sector (OFS) is 25 cm (10 in) for a TLOF of greater than 16 m (52.5 ft) and/or 1 D or greater, but ideally no greater than 15 cm (6 in), and 5 cm (2 in) for a TLOF 16 m (52.5 ft) or less and/or less than 1 D. For helicopters that are operated in performance class (PC) 1 or 2, the horizontal extent of this distance from the edge of the FATO will be based on the one-engine-inoperative capability of the type to be used.

4.1.3. The bisector of the 210-degree OFS will normally pass through the centre of the D-circle. In exceptional cases, for the avoidance of immovable obstacles that may be located on one side towards the edge of the obstacle-free sector boundary, when supported by an aeronautical survey it may be permitted to swing the OFS by up to 15 degrees either clockwise or anti-clockwise to clear an object — as illustrated in Chapter 5, Figure I-5-3. If it is necessary for the 210-degree sector to be swung, then it is normal practice to swing the 180-degree falling gradient in the same direction and by the corresponding amount, unless by doing so an obstacle is then introduced below FATO level, which compromises the falling gradient.

4.1.4. To account for the loss in height of a helicopter following an engine failure occurring during the early stages of the take-off manoeuvre, it is required that a clear zone (CZ) be provided below landing area level covering a sector of at least 180 degrees with its origin based at the centre of the D-circle. The falling gradient is measured downwards to the sea surface from the edge of the (approximately 1.5 m (5 ft)) safety netting or safety shelving on a gradient of 5:1 (5 units vertically (downwards) for every 1 unit horizontally (outwards)). The surface shall extend outwards for a distance that will allow for safe clearance from obstacles below the landing area in the event of an engine failure based on the least well performing helicopter that is serviced by the FATO. For helicopters operated in performance class (PC) 1 or 2, the horizontal extent of this distance from the landing area will be based on the one-engine inoperative capability of the helicopter type in use. All objects that are underneath the final approach and take-off paths will need to be assessed.

4.1.5. As mentioned, the OFS shall extend over a sector of at least 210 degrees, but, obstacles permitting, may extend over the whole 360-degree sector. An obvious example of where a 360-degree OFS could apply is for a facility where the helideck sits above the highest point at an elevation where there is no other significant topside structure present. However, these kinds of facilities (e.g. monopods) are the exception to the rule and it is more likely that obstacles will be present in the remaining limited obstacle sector that protrudes above the level of the FATO on the obstacle side. A limited obstacle sector

(LOS) is therefore normally present and will occupy the remaining sector, covering an arc of up to 150 degrees.

4.1.6. The LOS consists of two segments: the first (inner) segment, which adjoins the periphery of the FATO on the obstacle side, will extend to a horizontal distance of 0.12 D from the edge of the FATO and will have the same shape characteristics as the physical shape of the landing area — as newbuild helidecks are most commonly octagonal or hexagonal in shape, this will mean the extent of the first (and second) segments of the LOS, will be lines parallel to the TLOF perimeter marking which is required to follow the physical shape of the helideck (or shipboard heliport). This is illustrated in Chapter 3, Figures I-3-1 and I-3-2. The height limitation for obstacles in the first segment of the LOS (at 0.12 D) is 25 cm (10 in) for a TLOF of greater than 16 m (52.5 ft) and/or 1 D and 5 cm (2 in) for a TLOF 16 m (52.5) or less and/or less than 1D. Guidance on obstacle-protected surfaces for non-standard square or circular helidecks is given in Section 4.5.

4.1.7. The second segment of the LOS extends from the periphery of the first segment for a further distance of 0.21 D (i.e. a total distance of 0.33 D from the periphery of the FATO). Obstacle limitation within the second segment is more relaxed, most limiting at the forward edge of the second segment where obstacle height restriction is limited to 0.05 D based on the diameter of the FATO. From this point, the obstacle limitation surfaces extend on an upward gradient that equates to a slope of 2 units horizontally for every one unit vertically — the 1:2 slope extends from 0.12 D to 0.33 D. Once beyond 0.33 D from the edge of the FATO, obstacle height restrictions no longer apply.

4.1.8. Obstacles that penetrate either segment of the LOS shall be removed or modified so that they no longer constitute an infringement. Where an immovable object penetrates the LOS, whether in the first and/or second segment (an example of this could be the leg of a self-elevating jack-up facility which is situated right in the LOS — clearly the leg is neither moveable nor modifiable), it may be possible to mitigate the effects of the penetration by applying a prohibited landing sector (PLS) marking, which ensures that a helicopter cannot land with the tail towards the obstacle, where the obstacle is not within the pilot's field of view. The application of a PLS, including the characteristic of the marking, is described in more detail in Chapter 5, 5.11. The benefit of a PLS marking may be maximized by applying it in conjunction with an offset touchdown/positioning marking (the offset marking is discussed in further detail in Chapter 5, 5.7.2 and illustrated in Figure I-5-3, Example B). The application of a PLS, with or without an offset touchdown/positioning marking (TD/PM), shall not be used as an easy (and often temporary) solution to justify the presence of unwanted obstructions; it is always preferable, where practical, to remove, to relocate or to modify an obstacle which would otherwise penetrate through the surface of the LOS.

4.1.9. Experience suggests there can be pressure to accommodate obstacles close to the extended boundary of the OFS but outside the second segment on the limited obstacle side, where there are no specific obstacle restrictions/limitations. The presence of a large solid object, whether a new permanent feature or a temporary one, in close proximity to the helideck has potential to promote turbulence over the helideck in some wind conditions and shall be avoided. This issue is discussed in depth in Chapter 3, 3.2 — but to avoid doubt, any proposed siting near to the helideck shall be subjected to appropriate modelling before it is introduced. Equally, locating a non-rigid (flexible) structure, such as a long whip aerial, in the area immediately adjacent to the helideck can have an impact on the safety of helicopter operations if the whip aerial shall bend into the OFS under the force of an approaching helicopter's rotor downwash. It is therefore recommended that flexible objects, such as whip aerials, are not sited right at the edge of the OFS where they could bend into the protected area.

4.2. DESCRIPTION OF SURFACES — SHIPBOARD HELIPORTS

4.2.1. The surfaces, sectors and warnings described above apply equally in the majority of the cases for shipboard heliports. This includes bow and stern-mounted heliports and purpose-built heliports cantilevered over the side of a vessel. Operators with these types of arrangements shall therefore read all sections above. However, there are also so-called non-standard arrangements which do not apply the same obstacle limitation surfaces as a helideck. These 'exceptions' are described in the remaining paragraphs of this section.

4.2.2. A unique arrangement for the obstacle-protected surfaces and sectors is applied for a purpose-built or non-purpose-built shipboard heliport, typically, but not necessarily, located midships on the centreline of the vessel (e.g. a midships heliport on a tanker — Figure I-1-5.). In this case, an OFS (sometimes known as the clear area) is provided between two limited obstacle sectors (sometimes designated as the manoeuvring zones — forward and aft). Being sandwiched between the OFS provides an obstacle-free funnel for approach and departure, which allows a helicopter operating across the vessel (from port to starboard or vice-versa) to do so free of obstacles and, by providing an LOS (manoeuvring zone) either side of the approach and departure funnel, affords the helicopter some degree of lateral movement by providing obstacle restriction forward and aft in the LOS, for a helicopter operating athwartships to the heliport. The sectors and surfaces applied uniquely to this type of arrangement are illustrated in Figure I-4-1. The markings for this arrangement are addressed in Figure I-5-4.

4.2.3. A further non-standard arrangement is applied to a non-purpose-built landing area located on a ship's side. In this case, the minimum FATO, always coincident with the TLOF, is a circle of 1 D, based on the design helicopter. A CZ, free of obstacles above 25 cm (10 in), is established at the ship's side adjacent to the FATO, for a distance of 1.5 D. This is referred to as the CZ extended at the ship's side. Surrounding the FATO is a manoeuvring zone (MZ), having a width of 0.25 D, which tapers out from the midpoint of the D-circle to a distance of 2 D measured at the ship's side. Two areas adjacent to the ships side inside the inner boundary of the MZ but outside the FATO are referred to as limited obstacle areas (LOA) where obstacles are permitted but shall not exceed a maximum height of 25 cm (10 in). Similar obstacle restrictions apply to the MZ which surround the FATO (also known as the CZ). The obstacle limitation surfaces and sectors for this arrangement are illustrated in Figure I-4-2.

Note: *Where the FATO is 16 m (52.5 ft) or less, the maximum height of obstacles permitted in the MZ and LOA is correspondingly reduced from 25 cm (10 in) to 5 cm (2 in).*

4.2.4. For a non-purpose-built landing area located on a ship's side, which by design utilizes an area of the ship's decking, the tight control of obstacles on the ship's surface is not as straightforward as it would be for any purpose-built heliport structure. In this circumstance it is necessary to develop a system for mapping of obstacles so the operator is aware of their location and any potential impact on helicopter operations. A procedure for mapping of obstacles on non-purpose-built shipboard heliports is fully described in Section 4.6.

Note: *Where the D-value is 16 m (52.5 ft) or less the obstacle height limitation around the landing area is restricted to 5 cm (2 in).*

4.3. TEMPORARY COMBINED OPERATIONS

4.3.1. Temporary combined operations are essentially arrangements where two or more offshore facilities, whether fixed or floating, are in close proximity 'alongside' or 'pulled away' from one another. They may be in place for a matter of hours, days, or for up to several years. On occasion, combined operations may include vessels working alongside

one or more fixed and/or mobile facilities. The close proximity of facilities and/or vessels to one another is likely to entail one or more of the helidecks/shipboard heliports being operationally restricted due to one or more of the obstacle-protected surfaces being compromised and/or due to adverse environmental effects of one installation on the landing area of another (environmental effects are discussed in more detail in Chapter 3, 3.2). For example, the facility pictured in the centre of Figure I-4-3 has obstacle-protected sectors and surfaces (extended OFS as well as the falling gradient) that are severely compromised by the proximity of the other two facilities. A landing prohibited marker (a yellow cross on a red background) is in place on the drilling facility (centre) to prevent operations to the helideck. Where temporary combined operations are planned, prior to helicopter operations, an assessment shall be completed to assess the physical as well as the environmental impact of the arrangements and to assess any flight restrictions or limitations, including prohibitions, which might need to be disseminated to aircrew (usually a temporary instruction). Helidecks (or shipboard heliports), which are determined to be unavailable, shall display the relevant landing prohibited marker by day while, at night, all aeronautical lights shall be extinguished.

4.3.2. Quite often, combined operations will involve both facilities and/or vessels being in close proximity alongside one another, where the effect of one facility on the helideck obstacle-protected surfaces of another is immediately obvious. However, during the life of a combined arrangement, there may also be periods when mobile facilities and/or vessels are pulled away to a stand-off position, which could be at some distance. It will be necessary for operators to reappraise the situation for a combined operation in the stand-off configuration. With one or more installations or vessels pulled away, there may be an opportunity to relax or remove limitations imposed for the ”alongside” configuration. This is normally an assessment for the helicopter operator to make.

4.4. MULTIPLE PLATFORM CONFIGURATIONS/LOCATION OF STANDBY VESSELS

4.4.1. Where two or more fixed structures are permanently bridge-linked, the overall design shall ensure that the sectors and surfaces provided for the helideck are not compromised by other modules which may form part of a multiple platform configuration. It is also important to assess the environmental impact of all modules on the flying environment around the helideck. This is discussed in further detail in Chapter 3, 3.2.

4.4.2. Where there is an intention to add new modules to an existing platform arrangement, it is important to make an assessment of the potential impact that additional platforms might have on helideck operations. This will include an assessment of the sectors and surfaces for the helideck which shall not be compromised due to the location of a new platform, or modification to an existing platform. This will include a detailed analysis of the environmental impact on the flying environment around the helideck, which is addressed in further detail in Chapter 3, 3.2.

4.4.3. The presence of a Standby Vessel in the vicinity of an active helideck operation is a legal requirement in many offshore sectors. The location of the Standby Vessel, and any other vessel present on the sea surface, shall not compromise the safety of the helicopter operation. It is prudent to re-emphasize the following, based on the note from AAR-AGA-002, Section 4.2.14:

Note: *Where there is a requirement to position, at sea surface level, one or more offshore support vessel(s) (e.g. a Standby Vessel) [or tanker] essential to the operation of a fixed or floating offshore facility, but located within the proximity of the fixed or floating offshore facility['s obstacle-free sector (OFS)], any offshore support vessel(s) would need to be positioned so as not to compromise the safety of helicopter operations during take-off departure and/or approach to landing.*

4.5. GUIDANCE FOR OBSTACLE-PROTECTED SURFACES FOR SQUARE OR CIRCULAR HELIDECKS

4.5.1. Earlier, a description of surfaces for helidecks including the characteristics of the limited obstacle sector (LOS) which assumes in each case that the shape of the helideck consists of an octagon or a hexagon, was addressed. This is because the great majority of newly built helidecks, and purpose-built shipboard heliports, are configured for one of these shapes. However, helidecks and shipboard heliports may also be quadrilateral (mainly square) or circular, so it is important to provide some guidance on the characteristics of the obstacle-protected surfaces for square and circular helidecks and shipboard heliports. While evidently there are any number of different variations of shapes possible (as long as the extent of the dynamic load-bearing area provided is able to accommodate the usually hypothetical D-circle), characteristics for the sectors and surfaces of non-standard shapes will, in the main, have a resemblance to one of the schemes used for octagonal or hexagonal helidecks (illustrated in Chapter 3) or to arrangements for circular or square helidecks or shipboard heliports, as illustrated in this section of Chapter 4 — see Figures I-4-4 to I-4-7.

4.5.2. The extent of the 150° LOS segments in the case of a helideck or shipboard heliport that is any shape other than circular will be represented by straight lines parallel to the perimeter of the TLOF. The limiting dimensions of the two segments for the LOS measured from the inboard edge of the landing area are similar — the first (inner) sector comprising a 0.12 D segment where the height limitation for obstacles is 25 cm (10 in) for helidecks of 1 D and greater provided they are also greater than D=16 m (52.5 ft), or 5 cm (2 in) for helidecks where the D-value is 16 m (52.5 ft) or less and/or is less than 1 D. The second segment extending out a further 0.21 D originating at a height of 0.05 D above the helideck surface at the inner edge rises on a 1:2 slope out to an overall distance of 0.33 D. For circular helidecks or shipboard heliports, the segments and sectors represented by straight lines are replaced using sectors shaped in an arc. The overall dimensions are ostensibly the same, but the penetration of the surface at certain points along the arc is somewhat more limited. This is illustrated below: Figures I-4-4 and I-4-5 address 1.0 D helideck/shipboard heliport arrangements, and Figures I-4-6 and I-4-7 address 0.83 D helideck/shipboard heliport arrangements.

4.6. MAPPING OF OBSTACLES ON NON-PURPOSE-BUILT SHIPBOARD HELIPORTS

4.6.1. This section provides guidance on the completion of a helicopter landing area plan for the benefit of helicopter operators. The helicopter landing area plan provides additional information regarding the vessel's surface and the helicopter landing area (a non-purpose-built ship's side arrangement). The plan shall be prepared in advance of any intended helicopter operations and shall be stored on the vessel and provided to the helicopter operator. Amendments to the plan shall be made when appropriate.

4.6.2. The system described assumes paper versions of a helicopter landing area plan would be made, but this procedure lends itself just as easily to an electronic form of dissemination. Whichever method is used to create and file the helicopter landing area plan, it shall include templates annotated with vessel-specific data, including any obstructions within the FATO/TLOF (a 1 D circular CZ) or within the manoeuvring zone or LOA. Templates shall be annotated with the obstructions that exceed the height limits prescribed for the specific areas in Figure I-4-2 — for the LOA and the MZ the obstruction height limit is 25 cm (10 in) while for the FATO/TLOF the obstruction height limit is 2.5 cm (1 in) (if the FATO/TLOF is 16 m (52.5 ft) or less the obstruction height limit for the LOA and MZ are reduced to 5 cm (2 in)).

4.6.3. The template shall ideally include a photograph showing the ship's helicopter operating area to provide a helicopter pilot with a quick reference guide to the ship, the helicopter operating area(s) and notable obstructions. Care in recording the nature and location of obstructions on the template is very important. Accurate measurements of the position and height of all significant obstructions relative to the helicopter touchdown markings shall be taken.

4.6.4. Any identified obstacles shall be colour-coded on the template and painted on the physical surface of the vessel. Colour-coding and painting will define the safety significance of an obstruction. For the purpose of standardization, the following paint colour schemes are recommended:

a) red and white painted stripes shall be used for marking the position of notifiable objects within the MZ, the CZ or the LOA where they exceed the height limits for these zones — see Figure I-4-8:

1) objects within the CZ of a height exceeding 2.5 cm (1 in);

2) objects outside the CZ but within the MZ or LOA which exceed a height of 25 cm (10 in); and

3) where the diameter of the CZ is 16 m (52.5 ft) or less limitation in the MZ and LOA applies to objects which exceed a height of 5 cm (2 in);

b) yellow and black painted stripes shall be applied for marking objects beyond the MZ to which it is considered appropriate to draw the attention of the helicopter pilot. Yellow and black stripes may also be used to mark objects within the MZ, the CZ and the LOA which, though below the height limits for these sectors, are still considered appropriate to draw to the attention of the helicopter pilot.

4.6.5. Vessel details shall be included on the template and a photograph that shows the location of the helicopter landing area shall be scanned and forwarded to the helicopter operator in a colour presentation. An indication of the scale used shall also be provided.

4.6.6. Figure I-4-8 shows an example of a helicopter landing area plan for a ship's side non-purpose-built heliport on a tanker. The red/yellow/green colour coding presentation corresponds to the absolute height of the obstruction above deck level. The Butterworth Lid at 30 cm (1 ft) is shown in green. The tank wash line at 60 cm (0.6 m, 2 ft) is shown in yellow and the dominant vents at 230 cm (2.3 m, 7.5 ft) are shown in red.

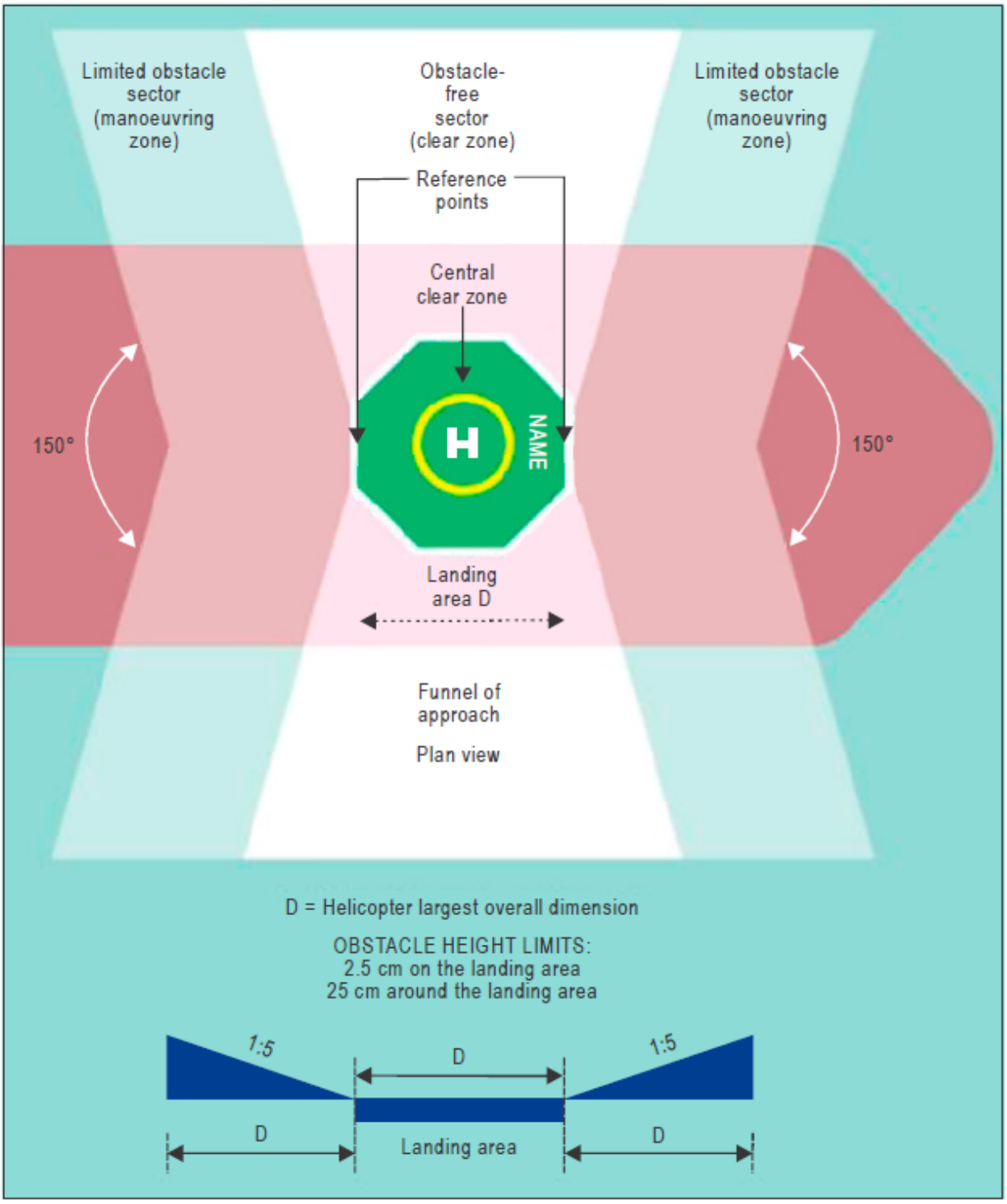


Figure I-4-1. A purpose-built or non-purpose-built midship centreline landing area

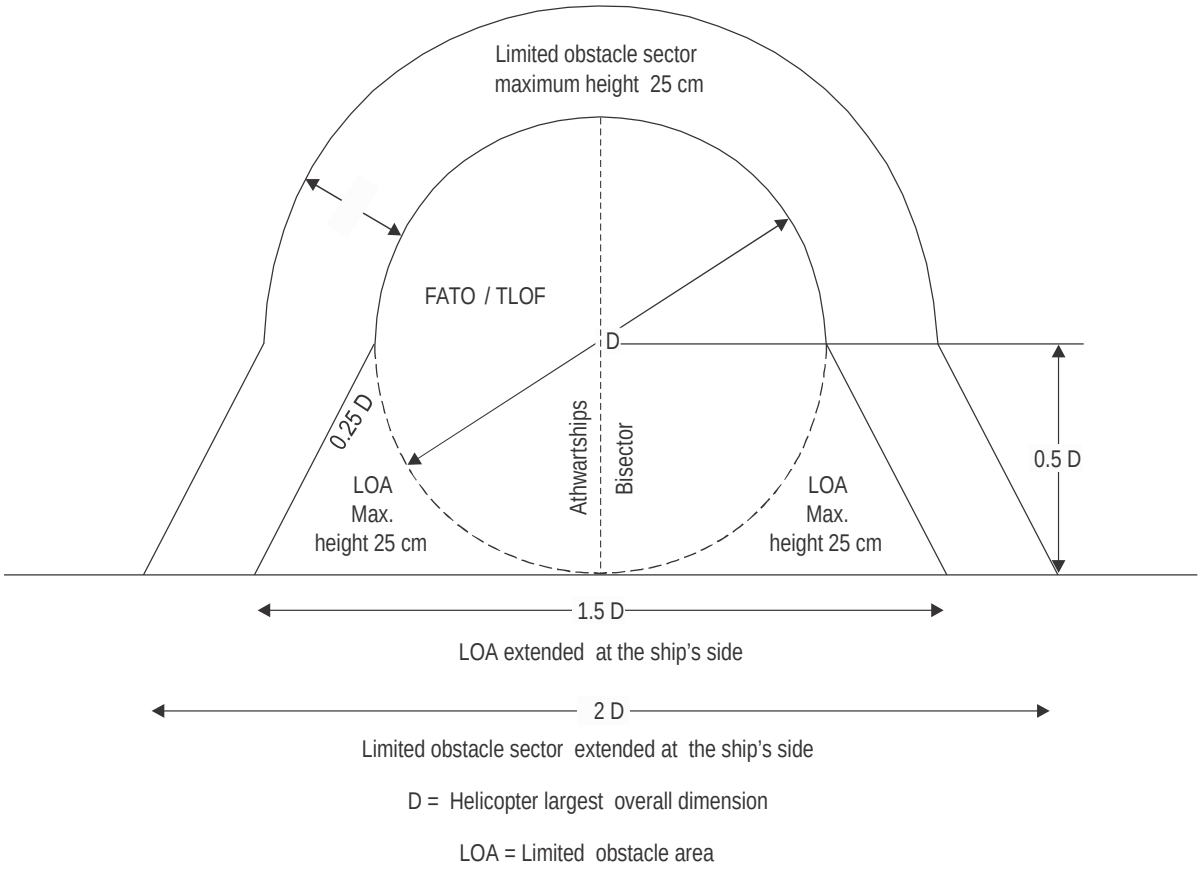


Figure I-4-2. Ships-side non-purpose-built heliport obstacle limitation sectors and surfaces



Figure I-4-3. A temporary combined operation showing relative position of each helideck 210º sector.

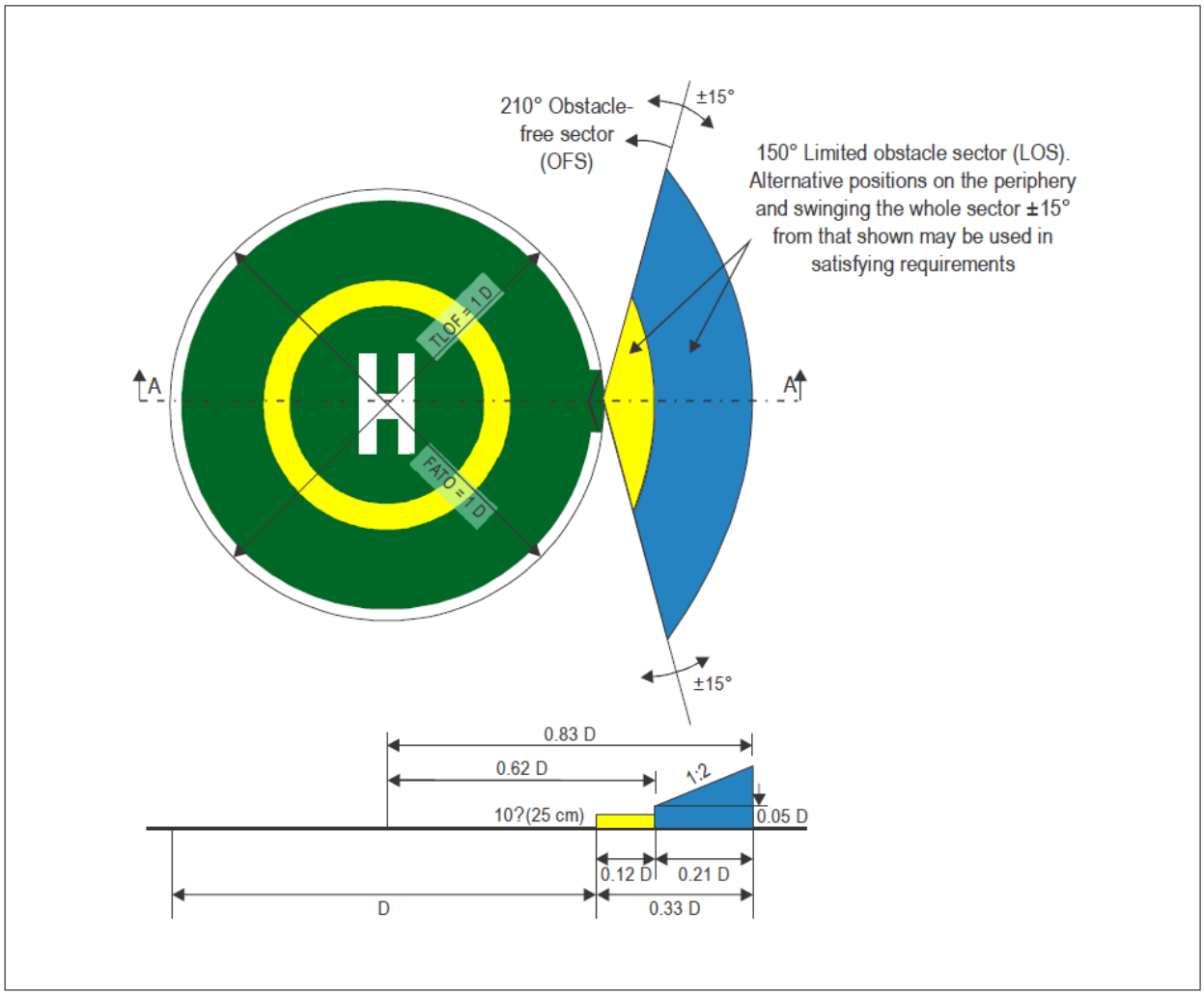


Figure I-4-4. Helideck obstacle limitation sectors and surfaces for a 1 D circular FATO and coincidental TLOF

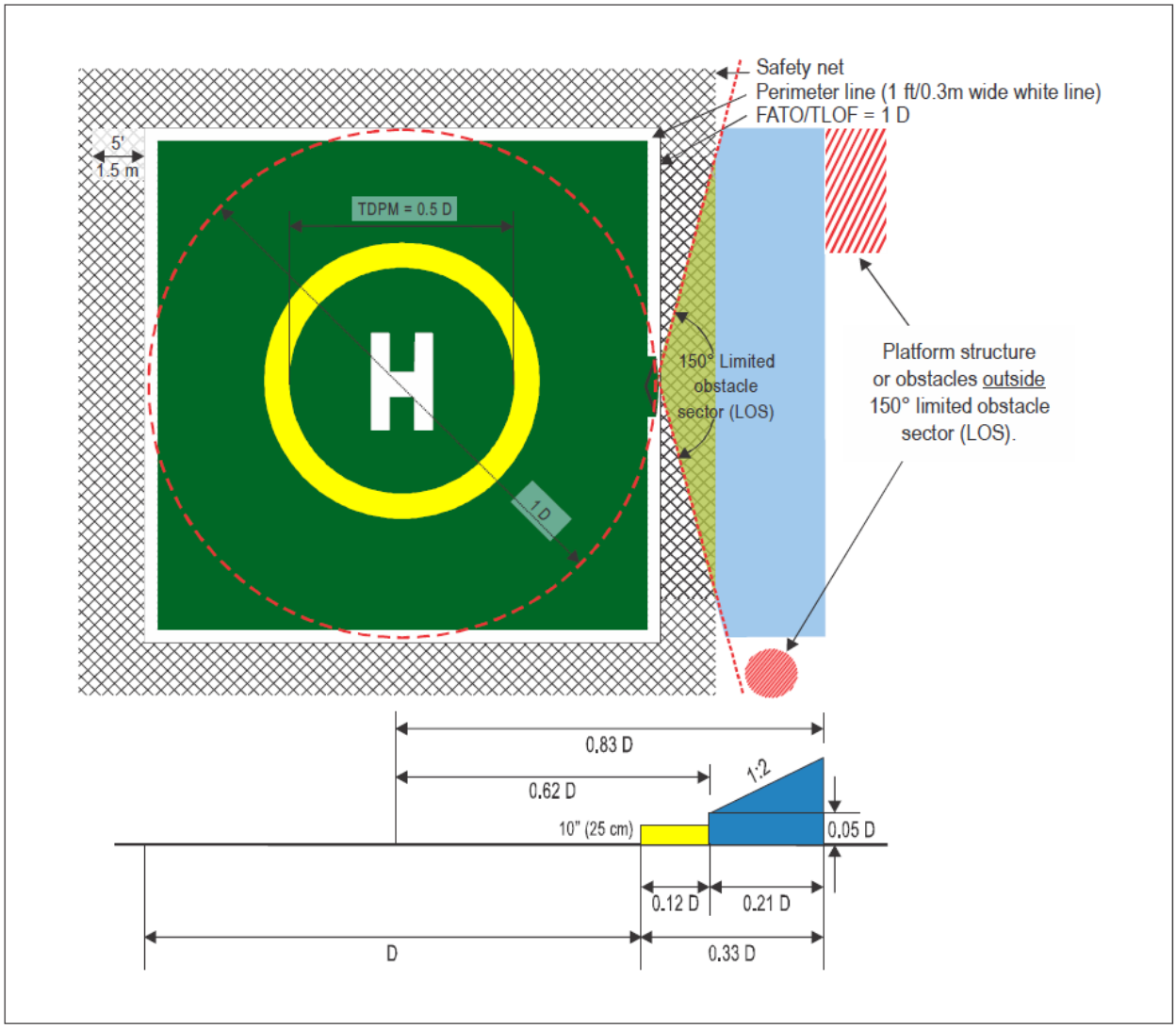


Figure I-4-5. Helideck obstacle limitation sectors and surfaces for a 1 D square FATO and coincidental TLOF

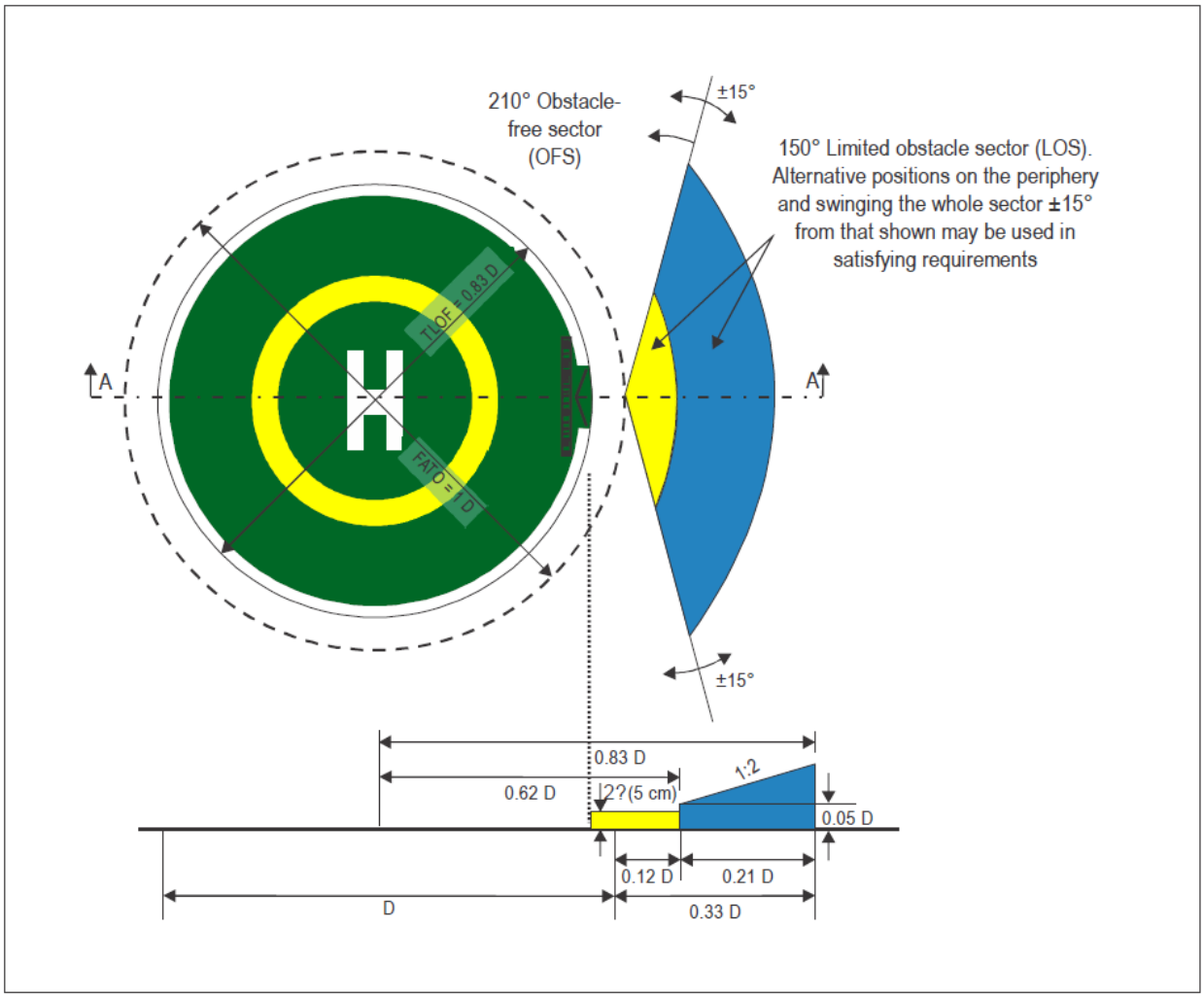


Figure I-4-6. Helideck obstacle limitation sectors and surfaces for a 0.83 D circular TLOF with collocated 1 D FATO

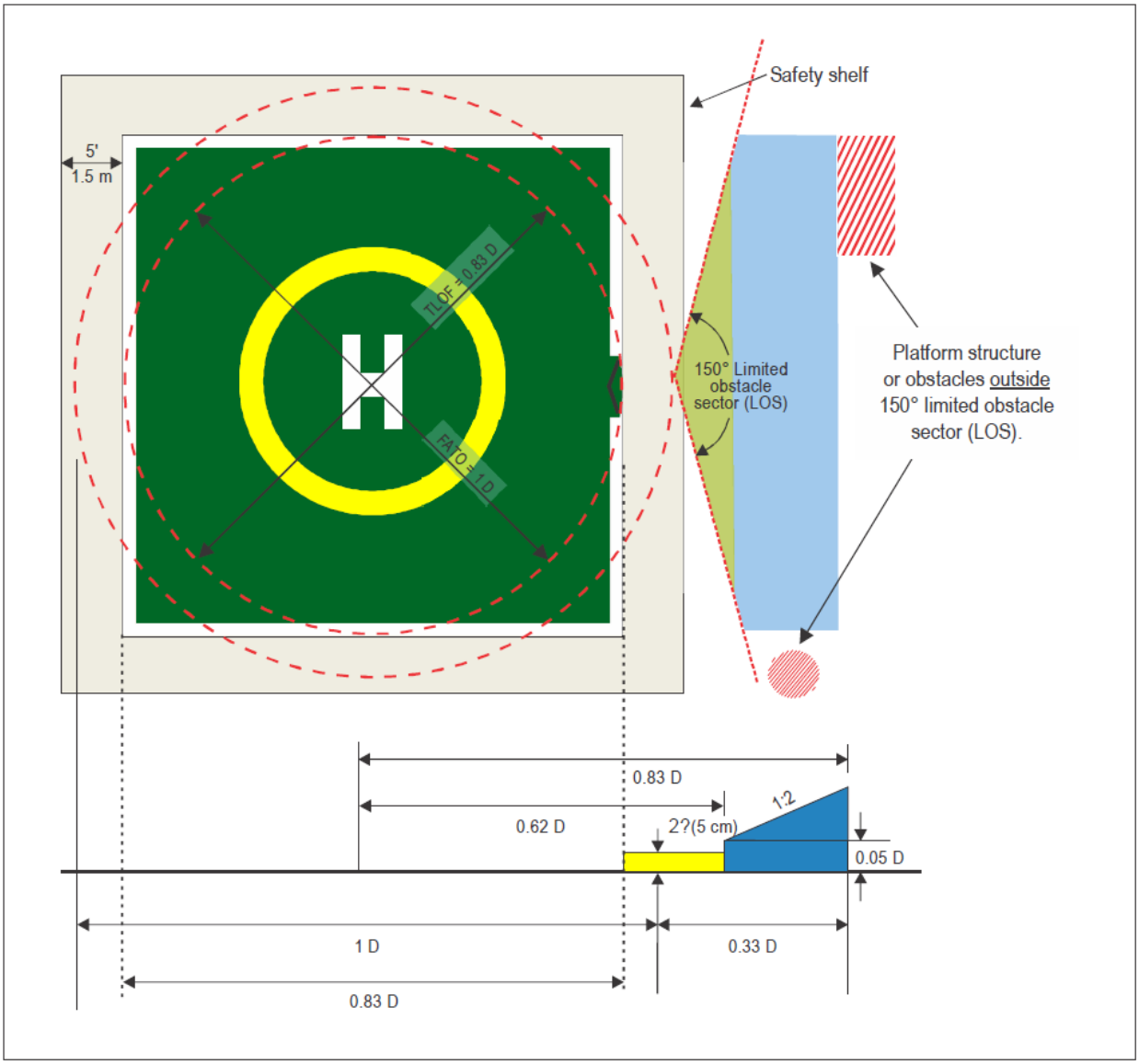


Figure I-4-7. Helideck obstacle limitation sectors and surfaces for a 0.83 D square TLOF with collocated 1 D FATO

Ship details

Date compilled	18 November 2008
Name of ship	SAMARINDA
Company name	Carthusian Shipping Line
Max Deck Height	26 m
D Value	19 m
Contact name	Capt David Wilkinson

Obstruction

Item	Description	Height
	Tank wash line	0.6 m
	Vent	2.3 m
	Butterworth Ltd	30 cm
	Vent	2.3 m

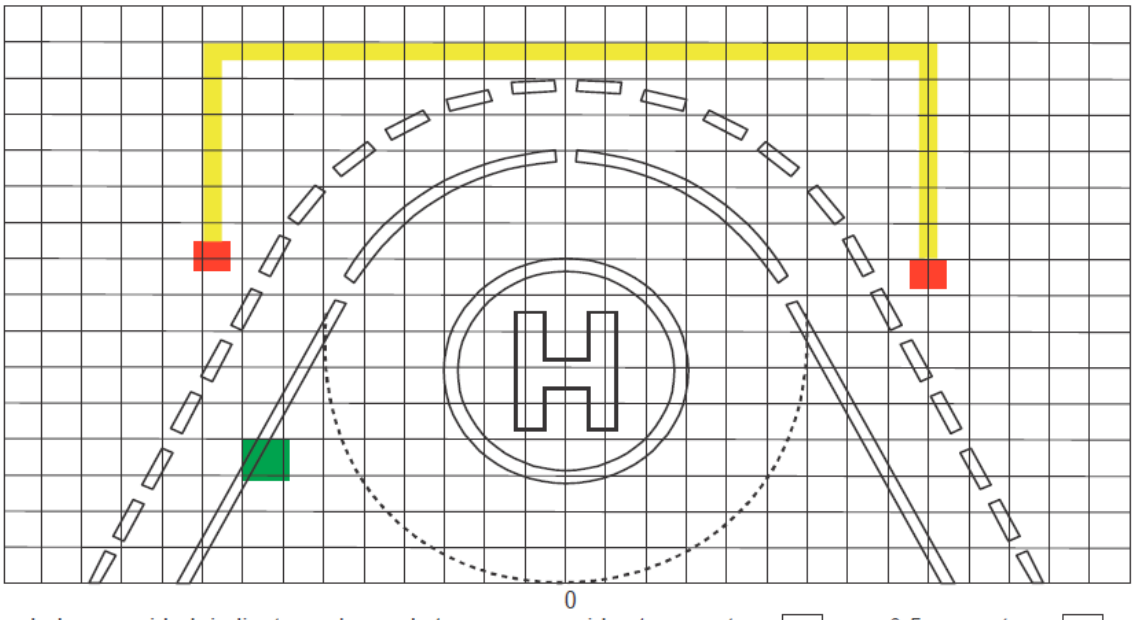




Figure I-4-8. Helicopter landing area plan for a ship's side non-purpose-built heliport on a tanker

5. VISUAL AIDS — MARKING AND LIGHTING

5.1. GENERAL

5.1.1. A helideck or shipboard heliport intended for use by day only, in good visibility conditions, will need to display markings only, while a helideck or shipboard heliport intended for use at night and/or in reduced visibility conditions by day and night, will need to display appropriate lighting in addition to defined markings. The marking and lighting aids described in this chapter are, in some cases, amplifications of those included in AAR-AGA-002 and have been developed primarily in support of visual heliport operations.

5.1.2. It is not intended that this chapter shall address every option of a detailed marking scheme for non-purpose-built shipboard heliports, given that the precise layout, including the surface colour of the main deck on which markings will be overlaid, can vary from ship to ship. As the underlying surface colour can vary considerably, some discretion will need to be exercised in the colour selection of paint schemes. The primary objective in every case shall be to ensure that heliport markings achieve a good contrast with the surface of the ship and are fit-for-purpose with regards to the maritime environment in which the ship will be operating. Figure I-5-1 illustrates the difficulties that may be encountered in the pursuit of this objective. A specific marking scheme for a non-purpose-built shipboard heliport (ship's side arrangement) is illustrated in detail in Figure I-5-11. Specific marking and lighting schemes for winching areas are addressed in detail in Chapter 7.

5.1.3. It has been found that on surfaces of light colour, such as natural aluminium, the conspicuity of white and yellow markings, in particular, can be improved by outlining them with a thin black line (typically 10 cm (4 in)) or by overlaying white or yellow markings on a painted black background (proven to be particularly effective for enhancing the heliport/helideck name marking). An example of how this can work in practice is illustrated in Figure I-5-6.

5.1.4. Azerbaijan Aviation Rules-Aerodrome standards and Azerbaijan Aviation Rules – Heliport standards do not currently go into detail on the issue of acceptable tolerances for the size and spacing of marking and lighting. SCAA determine what tolerance shall be allowed giving due diligence to the clear interpretation of visual cues and the safety of operations at all times, i.e. in the interest of providing clear and effective visual cues being interpreted from the air, there may be more allowance given for a slightly oversized marking than for one which is too small, with the exception of where the given specifications are treated as maximum dimensions. Wherever practical, it is recommended that the font type Clearview Hwy-5W is used.

5.1.5. As well as providing effective unambiguous markings and lighting on a helideck (or shipboard heliport) there may be an operational requirement to display the name of a fixed or floating facility (or vessel) in other locations so they are readily identifiable from the air (and sea) from all normal angles and directions of approach. In this case, identifiers shall be unique, simple and consistent with other information given to aircrew (e.g. radio-telephony (R/T) call sign, name on a pre-flight helideck information plate (HIP) (see Chapter 2) and be readable, at ranges that are at or beyond the helicopter's landing decision point (LDP), both by day and, where required, by night. Effective side signage, which could make use of available technologies such as retro-reflective panels, LED clusters or fibre optic systems, will assist aircrew with early positive recognition of the facility or vessel and so help to minimize the possibility of landing on the wrong rig.

***Note**:Other simple measures may be introduced to mitigate the incidence of an undesirable landing such as increasing the size of the heliport name marking to 1.5 m (5 ft) (i.e. above the minimum dimensions specified in Chapter 5, 5.8.1), or painting a second heliport name marking aligned with the normal direction of approach for a bow-mounted helideck with the vessel heading steaming into wind (i.e. a second heliport name marking painted between the outboard edge of the shipboard heliport and the yellow touchdown/positioning marking (T/PM) circle facing toward the helicopter will assist the pilot with positive recognition earlier on in the approach), and by extinguishing the touchdown and lift-off area (TLOF) floodlights and or circle-H lighting, at night, in the case where a helideck or shipboard heliport is unprepared and potentially unsafe when it is not expecting to receive helicopters.*

5.2. WIND DIRECTION INDICATOR

5.2.1. An offshore facility or ship shall be equipped with at least one wind direction indicator to provide a visual indication of the wind conditions prevailing over the facility during helicopter operations.

5.2.2. The location of the primary wind direction indicator shall be in an undisturbed airstream avoiding any effects caused by nearby structures (see also Chapter 3, 3.2.2), and unaffected by rotor downwash from the helicopter. The location of the wind direction indicator shall not compromise the established obstacle protected surfaces (see Chapter 4). Typically, a primary wind direction indicator will consist of a coloured windsock.

5.2.3. The windsock shall be easy visible to the pilot on the approach (at a height of at least 200 m (656 ft)), in the hover and while touched down on the surface of the TLOF, and prior to take-off. Where these operational objectives cannot be fully achieved by the use of a single windsock, consideration shall be given to locating a second windsock in the vicinity of the helideck or shipboard heliport, which could also be used to indicate a specific difference between the local wind over the TLOF and the free stream wind at the installation or ship (which the pilot will reference for an approach).

5.2.4. A windsock shall be a truncated cone made of a suitable lightweight fabric with a minimum length of at least 1.2 m (4 ft), a diameter at the larger end of at least 0.3 m (1 ft) and a diameter at the smaller end of at least 0.15 m (0.5 ft). The colour shall contrast well with the operating background in the offshore environment. Ideally a single coloured windsock, preferably orange or white, shall be selected. However, where a combination of colours is found to provide better conspicuity against a changing operating background, orange and white, red and white or black and white colour schemes could be selected, arranged as five alternate bands with the first and last band being the darker colour.

5.2.5. If a helideck or shipboard heliport is intended to be operated at night, the windsock(s) will need to be illuminated. This can be achieved by internal illumination, perhaps a floodlight pointing through the wind cone. Alternatively, the windsock can be externally highlighted using, for example, area floodlighting. Care shall be taken to ensure that any system used to illuminate a windsock highlights the entire cone section while not presenting a source of glare to a pilot operating at night.

5.3. HELIPORT IDENTIFICATION (H) MARKING

5.3.1. A heliport identification marking shall be provided for a helideck or a shipboard heliport in the form of a white “H” with a height of 4 m (13 ft), an overall width not exceeding 3 m (10 ft) and a stroke width not exceeding 0.75 m (2.5 ft). In circumstances where the D-value of a helideck or shipboard heliport is less than 16 m (52.5 ft), AAR-AGA-002

permits the size of the marking to be reduced such that the dimensions of the "H" are 3 m (10 ft) (in height) with an overall width not exceeding 2.25 m (7.4 ft) and a stroke width not exceeding 0.5 m (1.6 ft). A typical 'standardsize' heliport identification marking is shown in Figure I-5-2.

5.3.2. A heliport identification "H" marking shall ideally be located in the centre of the final approach and take-off (FATO), except where the results of an aeronautical survey indicate that an offset marking may be beneficial to helicopter operations and still allow for the safe movement of personnel around the helicopter, in which case the centre of the "H" may be offset by up to 0.1 D towards the outboard edge of the FATO. An example of where this measure may be used could be for an oversized helideck — one that exceeds the minimum 1 D dimensional requirement — but that also has immovable obstructions close to the inboard perimeter, in the limited obstacle sector (LOS). In this case, moving the touchdown marking location away from the centre of the FATO towards the outboard edge will improve clearances from dominant obstacles, while, in theory, still facilitating adequate on deck clearance around the helicopter for the safe movement of passengers and for the efficiency of helideck operations, such as refuelling. A comparison of the location of the touchdown markings, whether centralized or fully offset, are shown in Figure I-5-3, examples A and B.

5.3.3. The heliport identification marking, regardless of whether it is based on the centre of the FATO or not, shall always be established in the centre of the touchdown/positioning marking circle (see Chapter 5, 5.7). For a helideck, and for a purpose-built shipboard heliport, the centreline of the cross bar of the "H" shall be passed through by the bisector of the obstacle-free sector (OFS). Where, in exceptional cases, it is necessary for the chevron marking (see Chapter 5, 5.9) to be swung for a helideck (e.g. to clear an immovable obstacle which might otherwise penetrate the 210-degree sector), it will be necessary to swing the "H" marking by the corresponding angle, to indicate to aircrew on approach that the sector has been swung. The maximum swung sector shall not exceed ± 15 degrees from the normal for the OFS. A 'swung' heliport identification "H" marking is illustrated in Figure I-5-4.

5.4. MAXIMUM ALLOWABLE MASS MARKING

5.4.1. A maximum allowable mass marking shall be arranged so as to be readable from the preferred final approach direction (on a fixed facility this will usually be in a direction lining up with the prevailing wind direction for the facility).

5.4.2. The maximum allowable mass marking shall be expressed as a one-, two- or three-digit number corresponding to the maximum allowable mass of the heaviest helicopter permitted to use the TLOF in accordance with the structural requirements detailed in Chapter 3, 3.1. In most cases the maximum allowable mass marking will correspond to the maximum (certificated) take-off mass (MTOM) for the design helicopter type, but this need not necessarily be the case if the structural calculations performed for the helideck or shipboard heliport confirm a structural limit that is different from (i.e. exceeding) the MTOM of the design helicopter. Where the MTOM is expressed in metric tonnes, the suffix "t" will be painted with the numerical marking.

5.4.3. For a maximum allowable mass marking expressed in metric units the minimum requirement is to depict a marking rounded to the nearest 1 000 kg. A Standard is made in AAR-AGA-002 for the marking to be expressed to the nearest 100 kg. The following examples are offered, based on current manufacturer derived data. The figures shall be regarded for illustrative purposes only, and as a helicopter's MTOM can increase, especially following introduction to service of a new type, designers are advised to verify specific helicopter data with the manufacturer or offshore helicopter operator:

Bolkow 117: MTOM 3 200 kg is expressed as “03 t” or “3.2 t”

Super Puma AS 332L: MTOM 8 599 kg is expressed as “09 t” or “8.6 t”

Sikorsky S92: MTOM 12 565 kg is expressed as “13 t” or “12.6 t”

5.4.4. For helicopter types with a MTOM of less than 3 175 kg (7 000 lbs) there is acceptance for the use of a TLOF which is less than 1 D, but is no less than 0.83 D. The following examples are presented for helicopter types which have a MTOM of less than 3 175 kg:

Bolkow 105 MTOM 2 400 kg to be expressed as “02 t” or “2.4 t” (metric); or

MTOM 5 291 lbs to be expressed as 5.3.

EC 135T2 MTOM 2 910 kg to be expressed as “03 t” or “2.9 t” (metric); or

MTOM 6 400 lbs to be expressed as 6.4.

5.4.5. The size of the characters to be used for the maximum allowable mass marking is presented in AAR-AGA-002, Figure 5-4, which represents the full character height of 1.5 m (5 ft) applicable for the largest helidecks and shipboard heliports. For smaller helidecks and shipboard heliports, character heights may be reduced to 90 cm (3 ft) or 60 cm (2 ft). In each case, the thickness of characters shall be correspondingly reduced. The characteristics applicable for the decimal point, where required, are also included.

FATO D-value	***Min. height of characters***	***Dimensions of decimal point***
< 15 m	0.6 m	12 cm^2
15 m to 30 m	0.9 m	18 cm^2
> 30 m	1.5 m	30 cm^2

5.4.6. The numbers and, where appropriate, the letter of the marking and the decimal point, shall be painted in a colour contrasting with the background. For a helideck or purpose-built shipboard heliport to contrast effectively with the background (see Section 5.10), the maximum allowable mass marking would normally be white.

5.5. D-VALUE MARKINGS

5.5.1. D-value markings shall be displayed within the broken white TLOF perimeter line at three locations, as presented in Figure I-5-8 and Figure I-5-9, for least one marking to be readable from the final approach direction. For a purpose-built shipboard heliport in an amidships location, having a chevron at either end (see Figure I-5-5), two D-value markings are required to be displayed — one on the portside of the heliport and the other on the starboard side.

5.5.2. The D-value marking shall be painted white in not less than 90 cm (3 ft) characters where the dimension of the FATO is 15 m or greater and not less than 60 cm (2 ft) characters where the dimension of the FATO is less than 15 m (49 feet). Where the

FATO is greater than 30 m (98 ft), the characters shall be increased to at least 1.5 m (approximately 5 ft). This is summarized in the table below. The thickness of the 1.5 m characters shall accord with AAR-AGA-002, Figure 5-4, with a corresponding reduction in thickness for 0.9 m and 0.6 m height characters.

FATO D-value	***Min. height of characters***
< 15 m	0.6 m
15 m — 30 m	0.9 m
> 30 m	1.5 m

5.5.3. The D-value shall be expressed to the nearest whole number with 0.5 rounded up, e.g. EC 225 has a D-value of 19.50 m (64 ft), therefore this is expressed as “20”.

5.5.4. Where imperial units are used in preference to metric measurements

5.5.4.1. The recommended method of designating the helideck limitations is to have the weight and D size marked in a box, outlined in red, in red numerals on a white background, as shown below in Figure I-5-5A. The height of the figures shall be 3 ft. (0.9 m) with the line width of the box approximately 5 in (12 cm). For smaller helidecks where space may be limited, provided the box and numerals are discernible at a range which is compatible with a pilot’s landing decision point (LDP), giving sufficient time to affect a go-around if necessary, the height of the figures may be reduced to no less than 18 in (45 cm).

5.5.4.2. The weight/size limitation box marking shall be visible from the preferred direction of approach. It is recommended that on square or rectangular helidecks, the box shall be located relative to the preferred direction of approach (when facing the helideck). For circular, hexagonal and other similarly-shaped helidecks, the box shall be located on the right-hand side of the TLOF and outside the touchdown/positioning marking (TD/PM) circle, when viewed from the preferred direction of approach.

5.6. TLOF PERIMETER MARKING

5.6.1. A TLOF perimeter marking denoting the extent of the TLOF shall be painted around the edge of the TLOF using a continuous white line having a thickness of at least 30 cm (12 in).

5.6.2. The TLOF perimeter line shall follow the physical shape of the helideck or shipboard heliport, such that where the deck shape is octagonal or hexagonal, the shape of the painted white TLOF marking will correspond to an octagon or hexagon. A TLOF marking shall only be circular where the physical shape of the helideck or shipboard heliport is also circular.

5.7. TOUCHDOWN/POSITIONING MARKING CIRCLE

5.7.1. A TD/PM circle shall be provided on a helideck or shipboard heliport to assist a helicopter to touchdown and be positioned accurately by the pilot. The TD/PM is so located that when the pilot’s seat is over the marking, the whole of the undercarriage is comfortably within the TLOF and all parts of the helicopter are clear of any obstacles by a safe margin. Figure I-5-6 illustrates how the TD/PM shall be used by aircrew to position the helicopter,

facilitate requisite clearances from all obstacles, and allow passengers to make a safe approach to alight the helicopter (and a safe passage for egress).

5.7.2. A TD/PM circle shall ideally be located in the centre of the FATO, except where the results of an aeronautical survey indicates that an offset marking may be beneficial to the safety of helicopter operations, and not detrimental to the safe movement of personnel, in which case, the centre of the circle may be offset by up to 0.1 D away from the centre towards the outboard edge of the FATO. An example of where an offset marking may be beneficial is for an oversized helideck, one that exceeds the minimum 1 D dimensional requirement, that also has immovable obstructions close to the inboard perimeter, in the LOS. In this case, moving the TD/PM circle location away from the centre of the FATO and towards the outboard edge will improve clearances to dominant obstacles, while, in theory, still allowing adequate on deck clearance around the helicopter for the safe movement of passengers and for the efficiency of helideck operations, such as refuelling. For helidecks that are less than 1 D, it is not recommended that an offset marking be utilized. A comparison of the location of the touchdown markings, whether centralized or offset, is shown in Figure I-5-3, examples A and B.

5.7.3. The TD/PM circle shall be painted yellow and have a line width of at least 1 m (3 ft) for helidecks and purpose-built shipboard heliports having a D-value of 16 m (52.5 ft) or greater. For those facilities having a D-value of less than 16 m (52.5 ft), the line width of the marking may be reduced to 0.5 m (1.6 ft).

5.7.4. For a 1 D or greater helideck, and for a shipboard heliport, the inner diameter of the touchdown/positioning marking shall be 0.5 D of the design helicopter. So for a helideck designed for the Sikorsky S92 (D = 20.88 m (68.5 ft)) the inner diameter of the touchdown/positioning marking circle is 10.44 m (34.3 ft). The thickness of the marking is 1 m (3 ft). For helidecks which are less than 1 D, the inner diameter of the TD/PM shall be 0.5 D of the notional FATO. Generic dimensions, for helidecks and shipboard heliports which are 1 D or greater and/or 16 m (52.5 ft) or greater, are shown in Figure I-5-7.

5.8. HELIPORT NAME MARKING

5.8.1. The heliport name marking shall be painted on the helideck or shipboard heliport in minimum 1.2 m (3.9 ft) preferably white painted characters between the chevron (see Section 5.9) and the TD/PM circle (see Section 5.7). Care shall be taken to ensure that the name is to no degree obscured by a helideck net (where fitted).

5.8.2. The heliport name marking shall consist of the name or the alphanumeric designator of the helideck or shipboard heliport as used in the radio-telephony (R/T) communications. Providing a name that is unique and simple will ensure that the mental process of recognition for aircrew is kept to a minimum at a time when a pilot's concentration is being exercised by the demands of the final approach and landing manoeuvre.

5.8.3. To allow for recognition of the facility or vessel further up the approach manoeuvre, consideration shall be given to increasing the character height of the heliport name marking from 1.2 m (4 ft) to 1.5 m (5 ft). Where the character height is 1.5 m (5 ft), the character widths and stroke widths shall be in accordance with AAR-AGA-002, Figure 5-4. The character widths and stroke widths of nominal 1.2 m characters shall be 80 per cent of those prescribed in Figure 5-4 of AAR-AGA-002. Where the heliport name marking consists of more than one word, it is recommended that the space between words be approximately 50 per cent of character height.

5.8.4. In accordance with Section 5.1.5, some types of floating facilities and vessels may benefit from a second name marking diametrically opposite the first marking, with the characters facing the opposite direction (so that the feet of characters are located adjacent to the

outboard edge of the TD/PM circle. Having a name marking on both ends of the TD/PM circle will ensure that one marking is always readable the right way up for aircrew on approach, e.g. for a bow-mounted helideck on a vessel that is steaming into wind, a second name marking oriented towards the main vessel structure (aft) and located between the outer edge of the circle and the outboard edge of the helideck will be more easy to process for aircrew approaching into wind than will a heliport name marking located in the normal location. In this case aircrew would be required to process a marking which is upside down.

5.9. HELIDECK OBSTACLE-FREE SECTOR (CHEVRON) MARKING

5.9.1. A helideck or shipboard heliport with obstacles that penetrate above the level of the TLOF is required to display an OFS (chevron) marking to denote the origin of the OFS. For a 1 D or greater helideck, the apex of the chevron is located at a distance from the centre of the TLOF that is equal to the radius of the largest circle which can be drawn in the TLOF. The arrangement is shown in Figure I-5-7. For a purpose-built shipboard heliport in an amidships location, the marking scheme will consist of a chevron at both ends (see Figure I-5-5).

5.9.2. The origin of the OFS shall be marked on the helideck or shipboard heliport by a black chevron, each leg being 79 cm (2.6 ft) long and 10 cm (4 in) wide, forming the angle of the obstacle-free sector in the manner shown in Figure I-5-7. Where exceptionally the OFS is swung (by up to ± 15 degrees — see also Section 5.3.3 and Figure I-5-4) then the chevron is correspondingly swung. Where there is insufficient space to accommodate the chevron precisely, the chevron marking, but not the point of origin of the OFS, may be displaced by up to 30 cm (11 in) towards the centre of the TLOF.

5.9.3. The purpose of the chevron is widely misunderstood to provide a form of visual indication to the aircrew that the OFS is clear of obstructions. However, the marking is too small for the purposes of aircrew and instead is intended as a visual tool for a helicopter landing officer (HLO) (who has charge of the helideck operation on the ground) to ensure that the 210-degree OFS is clear of any obstructions, fixed or mobile, before giving a helicopter clearance to land. The black chevron may be painted on top of the white TLOF perimeter line to achieve maximum clarity for helideck crew.

5.9.4. Adjacent to and where practical inboard of the chevron, the certified D-value of the helideck is painted in 10 cm (4 in) alphanumeric characters. The D-value of the helideck shall be expressed in metres to two decimal places (e.g. “D = 16.05 m”).

5.9.5. For a TLOF which is less than 1 D, but not less than 0.83 D, the chevron is positioned at 0.5 D from the centre of the FATO which will take the point of origin outside the TLOF. If practical, this is where the black chevron marking shall be painted. If impractical to paint the chevron at this location, then the chevron shall be relocated to the TLOF perimeter on the bisector of the OFS. In this case the distance and direction of displacement along with the words “WARNING DISPLACED CHEVRON” are marked in a box beneath the chevron in black characters not less than 10 cm (4 in) high. An example of the arrangement for a sub-1 D helideck is shown in Figure I-5-9.

5.10. HELIDECK AND SHIPBOARD HELIPORT SURFACE MARKING

5.10.1. A surface background marking is provided to assist a pilot in identifying the location of the helideck or shipboard heliport during an approach to land by day and to emphasize the position of the touchdown markings etc. The helideck or shipboard heliport surface

encapsulated by the white TLOF perimeter marking shall be dark green using a high friction coating.

5.10.2. Aluminium helidecks are now widely in use throughout the offshore industry. Some of these are a natural light grey colour and may present painting difficulties. The natural light grey colour of aluminium may be acceptable provided the conspicuity of helideck markings is assessed, preferably from the air, and if necessary, enhanced. How this is achieved in practice is discussed further in Section 5.1.3.

5.11. PROHIBITED LANDING SECTOR MARKING

5.11.1. Helideck-prohibited landing sector markings are used where it is necessary to protect the helicopter from landing or manoeuvring in close proximity to limiting obstructions which, being of an immovable nature, may compromise the sectors and surfaces established for the helideck (an example might be a jack-up leg penetrating the 150-degree limited obstacle sector or a crane on the edge of the LOS).

5.11.2. A prohibited landing sector (PLS) is therefore established utilizing the marking arrangement shown in Figure I-5-10. The hatched marking is overlaid on the portion of the yellow TD/PM circle and extending out to the TLOF perimeter marking within the relevant headings, for which it would be deemed unsafe to place the nose of the helicopter (due to the presence of an obstacle behind the tail of the aircraft, which due to the landing orientation of the helicopter would be beyond the field of view of the aircrew).

5.11.3. The arc of coverage shall be sufficient to ensure that the tail rotor system will be positioned clear of the obstruction when hovering above, and touching down on, the yellow circle at any location beyond the PLS marking. As a guide it is recommended that the PLS marking extends by a minimum 10 to 15 degrees either side of the edge of the obstacle (this implies that even for a simple whip aerial infringement the PLS arc applied will be an arc of no less than 20 to 30 degrees of coverage).

5.11.4. The sector of the TD/PM circle, opposite from the personnel access point, shall be bordered in red with the words “no nose” clearly marked in red on a white background as shown in Figure I-5-10. When positioning over the TD/PM circle, helicopters shall be manoeuvred so as to keep the aircraft nose clear of the “no nose” marked sector of the TD/PM circle at all times. The minimum prohibited “no nose” marking shall cover an arc of at least 30 degrees.

5.11.5. The following figure shows the required location and dimensions of the marking scheme. Colours of markings may vary depending on the underlying surface colour of the vessel. This is discussed in more detail in Chapter 5, 5.1.2 and Figure I-5-1. For guidance on mapping of obstructions see Chapter 4, 4.6. For TLOF lighting systems, special considerations for non-purpose-built shipboard heliports are addressed in Section 5.15.

5.12. GENERAL CONSIDERATIONS FOR LIGHTS INCLUDING SCREENING

5.12.1. The specification for the TLOF lighting system presented in the following sections assumes that the performance of the lighting will not be diminished due to the relative intensity, configuration or colour of other lighting sources present on a fixed or floating facility or on a vessel. Where other non-aeronautical lighting has potential to cause confusion, or to diminish or prevent the clear interpretation of aeronautical ground lights, it will be necessary for the facility or vessel operator, and if possible, the HLO, to extinguish, screen, or otherwise modify, non-aeronautical light sources to ensure the effectiveness of helideck or shipboard heliport lighting systems are not compromised. To achieve this, operators shall give consideration to shielding any high intensity light sources from approaching helicopters by fitting screens or louvers.

5.12.2. The helideck and shipboard heliport lighting systems specified in the following sections, and detailed in AAR-AGA-002 (Chapter 5), and Appendix I-B of this document, are designed on the assumption that operations occur in typical night viewing conditions, with an assumed eye threshold illuminance of Et = $10^{-6.1}$ llux. If there is an expectation for aeronautical lighting to be used in more demanding viewing conditions, such as at twilight or during typical day conditions, (where Et = $10^{-5.0}$ lux for twilight and Et = $10^{-4.0}$ lux for normal day), it shall be recognized that the 'true night' viewing ranges achieved by the system design will decay considerably in more demanding viewing conditions (i.e. the range at which a particular visual aid becomes detectable and conspicuous at night will decrease if that same aid is used at twilight or by day because the higher background brightness leads to a decreasing probability of detection). It is not the intention of this manual to discuss these issues in detail — suffice to say, that to achieve the same 'night' detection range for a particular visual aid, viewed in the most demanding typical day conditions, will require a very much brighter lighting system. Further guidance is provided in the Manual on Visual Aids (G-AGA-014).

5.13. TLOF LIGHTING SYSTEMS UTILISING FLOODLIGHT SOLUTIONS

5.13.1. The TLOF, as defined by the white TLOF perimeter marking (see Section 5.6) shall be delineated by fixed omnidirectional green TLOF perimeter lights visible from on or above the level of the TLOF (the whole pattern formed by the perimeter lights shall not be visible to aircrew from below the level of the landing area, whether on a fixed or floating facility or vessel). The photometric specification of TLOF perimeter lights is provided in the isocandela diagrams in AAR-AGA-002, Figure 5-11 (Illustration 6).

5.13.2. TLOF perimeter lights, around the edge of the area designated for use as the TLOF, shall be spaced at not more than 3 m (10 ft) intervals (measured between light sources) and shall follow the shape of the helideck or shipboard heliport (e.g. for an octagonal helideck, the TLOF perimeter lights shall be arranged to form an octagon). To avoid lights creating a trip hazard at points of access and egress it may be necessary to provide sources that are flushmounted (i.e. recessed) into the surface. The pattern of lights shall be formed using regular spacing. However, to avoid potential trip hazards, blocking foam dispensing nozzles, etc., it may be desirable to move lights to one side. In this case, TLOF perimeter lights may be relocated by up to ± 0.5 m (1.6 ft) such that the maximum gap between two adjacent TLOF perimeter lights is no more than 3.5 m (11.5 ft) and the minimum no less than 2.5 m (8.2 ft).

5.13.3. TLOF floodlights shall be arranged around the perimeter of the TLOF so as to avoid glare to pilots in flight or to personnel working on the area. Floodlighting can easily become misaligned and the HLO shall instigate daily checks to ensure that misaligned lights are corrected and do not create a hazard to flight operations by providing a source of glare (the glare issue may be reduced by fitting appropriate hoods (louvers) onto deck-mounted floodlights). Notwithstanding, lights shall be realigned when, in the opinion of aircrew, they are creating a glare hazard during flight operations.

5.13.4. Another issue with deck-mounted floodlighting, given their shallow angle of attack and the potentially very large area needing to be illuminated, especially over the touchdown markings, is what is commonly known as the black hole effect. In this case, adequate illumination is dispensed in areas adjacent to the perimeter lights, but a black hole is left in the centre of the landing area where the lights cannot properly illuminate the central touchdown area markings. Designers shall aim to create a lighting environment which achieves an average horizontal illuminance of the floodlighting which is at least 10 lx, with a uniformity ratio (average to minimum) of not more than 8:1, measured on the surface of the TLOF. Furthermore, the spectral distribution of TLOF area floodlights shall

ensure adequate illumination of the surface markings (especially the TD/PM circle) and obstacle markings (this may include a prohibited landing sector marking, where present).

5.13.5. Given the challenges of meeting the above specifications, designers may be tempted to provide multiple floodlighting units, in seeking to achieve the recommendations for spectral distribution and average horizontal illuminance for floodlighting set in AAR-AGA-002. However, being very much brighter than the TLOF perimeter lights, floodlighting has a tendency to make the pattern of the green perimeter lights less obvious, due to the number and intensity of much brighter floodlights. As the green pattern provided by the TLOF perimeter lights generates the initial source of helideck acquisition for aircrew, the desire to specify multiple sets of floodlights shall be resisted. For all but the largest helidecks a compliment of between four and six floodlights shall be sufficient (up to eight for the largest helidecks). Providing that technologies are selected which promote good, sharp, beam control, this shall optimize their effectiveness and offer the best opportunity to effectively illuminate touchdown markings. To mitigate the glare issue as much as possible, floodlights shall be mounted to ensure the centreline of the floodlight beam is at a 45-degree angle to the reciprocal of the prevailing wind direction. This will minimize any glare or disruption to the pattern formed by the green perimeter lights for the majority of approaches. Figure I-5-12 provides a typical floodlighting arrangement.

5.13.6. The height of the installed TLOF perimeter lights and floodlights shall not exceed 25 cm (10 in) above the level of the TLOF, but ideally shall not exceed 15 cm (6 in) for helidecks which are 1 D or greater and/or have a D-value greater than 16 m (52.5 ft), and 5 cm (2 in) for helidecks which are sub-1 D, but not less than 0.83 D, and/or have a D-value of 16 m (52.5 ft) or less. TLOF lighting shall be inset when a light extending above the surface could endanger helicopter operations (see also Chapter 3, 3.4.10).

5.13.7. In addition to providing the visual cues needed for helideck recognition for approach and landing, helideck floodlighting may be used at night to facilitate on deck operations such as passenger movements, refuelling operations, freight handling, etc. Where there is potential for floodlights to dazzle a pilot during the approach to land or during takeoff manoeuvres, they shall be switched off for the duration of the approach and departure. Therefore, all floodlights shall be capable of being switched off at a pilot's request. All TLOF lighting shall be fed from an uninterrupted power supply (UPS) system.

5.13.8. For some helidecks or shipboard heliports, it may be possible to site additional high-mounted floodlighting away from the TLOF perimeter, such as a ship's bridge or pointing down from a hangar. In this case, extra care shall be taken to ensure that additional sources do not cause a source of glare to a pilot, especially when lifting in the hover to transition into forward flight, and do not present a competing source to the green TLOF perimeter lights. Screens or louvers shall be considered for any additional high-mounted sources.

5.14. TLOF LIGHTING SYSTEMS UTILIZING "H" AND CIRCLE LIGHTING — DETAILS OF A SCHEME FIRST ADOPTED IN THE UNITED KINGDOM

5.14.1. As an effective alternative to providing illumination of the touchdown markings by the use of deck-mounted floodlighting, operators may wish to consider a scheme for a lit TD/PM and a lit heliport identification marking. This scheme is presented in detail in Appendix I-B, together with the photometric specification for green TLOF perimeter lights.

5.14.2. The lit TD/PM and the lit heliport identification marking scheme has been developed to be compatible with helicopters having wheeled undercarriages. Although the design specification presented in Appendix I-B ensures segments and subsections are compliant with the maximum height for obstacles on the TLOF surface (2.5 cm (1 in)), and are likely to withstand the point loading presented by typically lighter skidded

helicopters, due to the potential for raised fittings to induce dynamic rollover, it is important to establish compatibility with skid-fitted helicopter operations before lighting is installed on helidecks and shipboard heliports used by skid-fitted helicopters.

5.14.3. The specification for a complete helideck/shipboard heliport lighting scheme is presented in Appendix I-B. The detail therein is not considered mandatory but it is nevertheless reproduced here to demonstrate an acceptable alternative means of compliance. Figure I-5-13 shows the illumination of the TLOF for a helideck using the lit TD/PM and the lit heliport identification marking scheme described in the previous section and in Appendix I-B alongside a helideck, which utilizes the conventional floodlighting solution described above.

5.15. LIGHTING SYSTEMS — SPECIAL CONSIDERATIONS FOR NON-PURPOSE-BUILT SHIPBOARD HELIPORTS

Given the possible presence of obstructions within the landing area (see Chapter 4, 4.6) SCAA may decide not to permit night operations unless a risk assessment can demonstrate it is safe to do so. Where night operations are permitted, specific lighting schemes for non-purpose-built shipboard heliports may utilize an area floodlighting solution to illuminate the TLOF and markings as illustrated in Figure I-5-14.

5.16. VISUAL AIDS FOR DENOTING OBSTACLES — MARKING AND LIGHTING (INCLUDING FLOODLIGHTING)

5.16.1. Fixed obstacles which present a hazard to helicopters shall 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 m (1.6 ft), or more than 6 m (20 ft) wide. The colour shall be chosen to contrast with the background to the maximum extent.

5.16.2. Obstacles to be marked in these contrasting colours include any lattice tower structures and crane booms which are close to the helideck or to the LOS boundary. Similarly parts of the leg (or legs) of a self-elevating jack-up unit that are adjacent to the helideck and which extend, or can extend above it, shall also be marked in the same manner.

5.16.3. Omnidirectional low intensity steady red obstruction lights having a minimum intensity of 10 cd for angles of elevation between 0 degrees and 30 degrees shall 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 shall apply, in particular, to all crane booms on an offshore facility or vessel. Objects which are more than 15 m (50 ft) higher than the landing area shall be fitted with intermediate low intensity steady red obstruction lights of the same intensity spaced at 10 m (33 ft) 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 a helicopter pilot. Facilities may, where appropriate, consider alternative equivalent technologies to highlight dominant obstacles in the vicinity of the helideck.

5.16.4. An omnidirectional low intensity steady red obstruction light shall be fitted to the highest point of the installation. The light shall have a minimum intensity of 50 cd for angles of elevation between zero and 15 degrees, and a minimum 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 shall be fitted as near to the extremity as possible.

5.16.5. In the particular case of jack-up units, it is recommended that when the tops of the legs are the highest points on the facility, they shall be fitted with omnidirectional low intensity steady red lights of the same intensity and characteristics as described in the above paragraph. In addition, the leg (or legs) adjacent to the helideck shall be fitted with intermediate low intensity steady red lights of the same intensity and characteristics as described in Section 5.16.3 at 10 m (33 ft) intervals down to the level of the landing area. As an alternative, the legs may be floodlit providing the helicopter pilot is not dazzled.

5.16.6. Any ancillary structure within one kilometre of the helideck, and which is 10 m (33 ft) or more above helideck height, shall be similarly fitted with red lights.

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

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

5.16.9. For some helidecks, especially those that are on not permanently attended installations (NPAIs), it may be beneficial to improve depth perception by deploying floodlighting to illuminate the main structure (or legs) of the platform. This can help to address the visual illusion that a helideck appears to be floating in space. Care shall be taken to ensure that any potential source of glare from structure lighting is eliminated by directing it away from the approach pathof the helicopter and/or by providing louvers.



Figure I-5-1. S61N operating to a non-purpose-built ship's side heliport

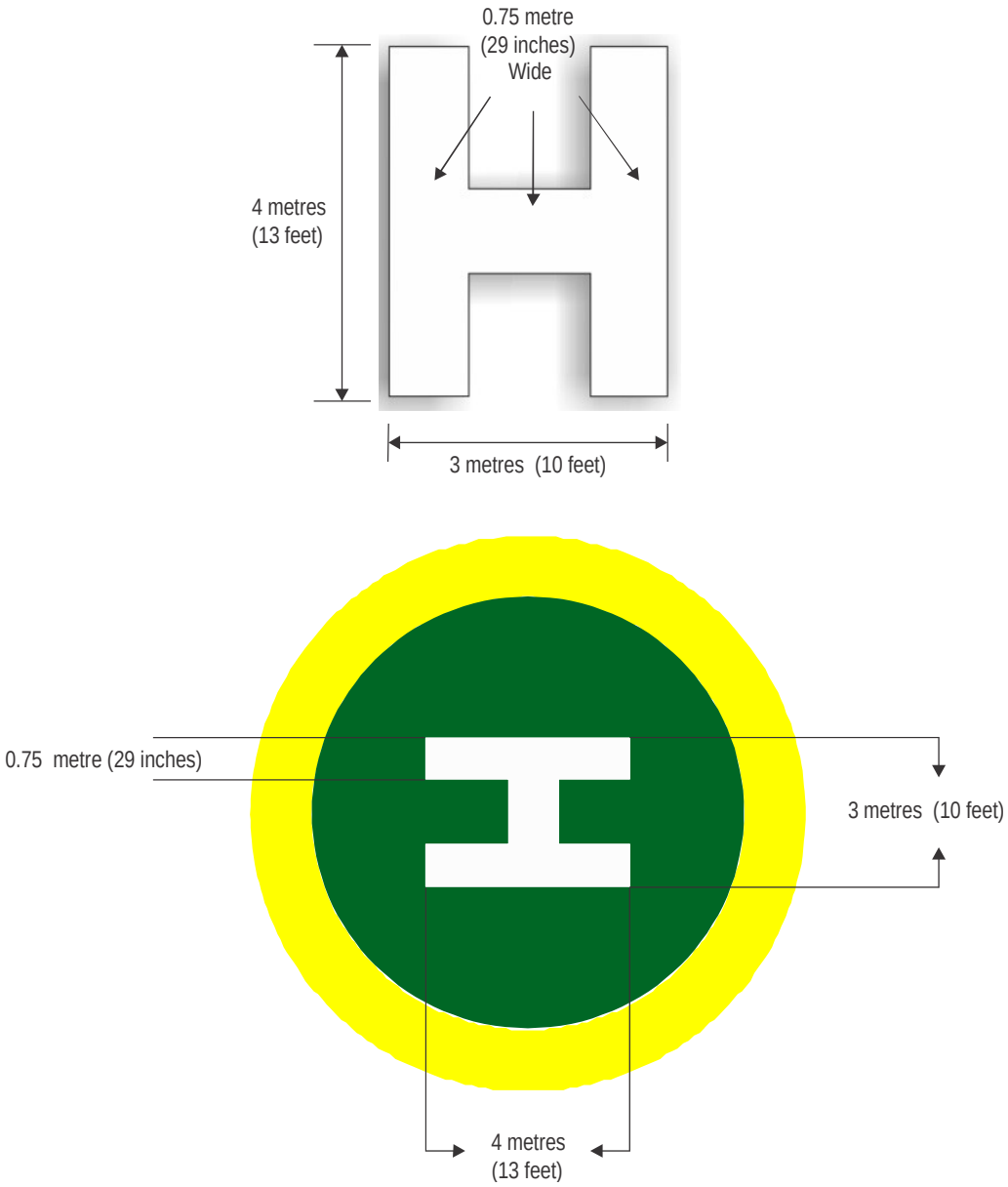
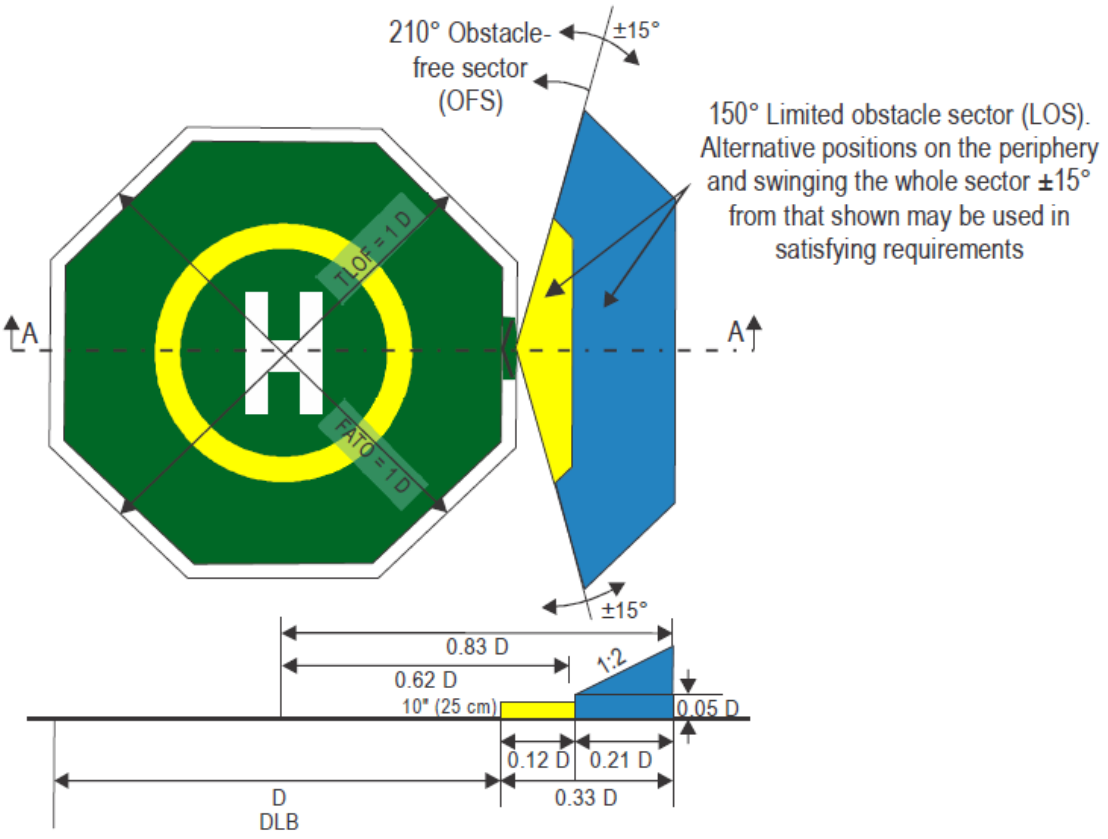
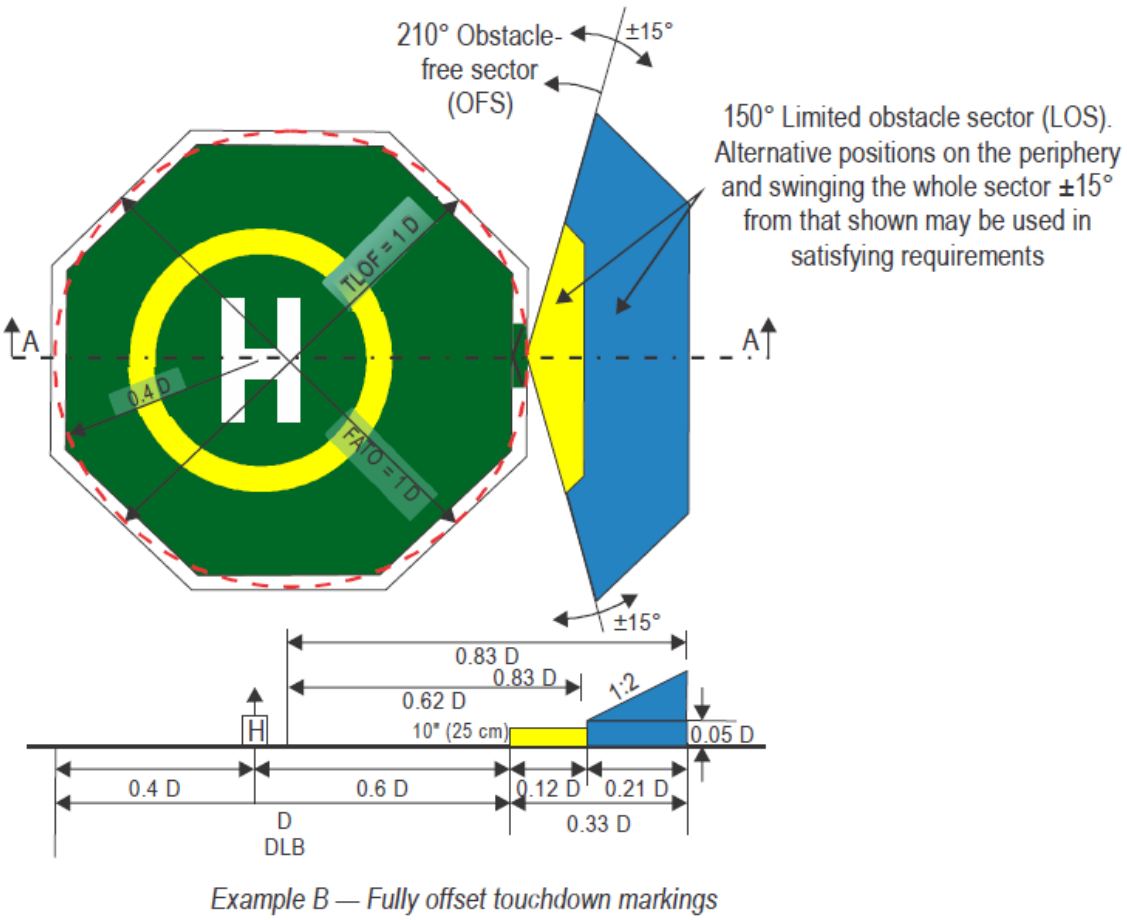


Figure I-5-2. Dimensions of the heliport identification “H” marking (standard size)



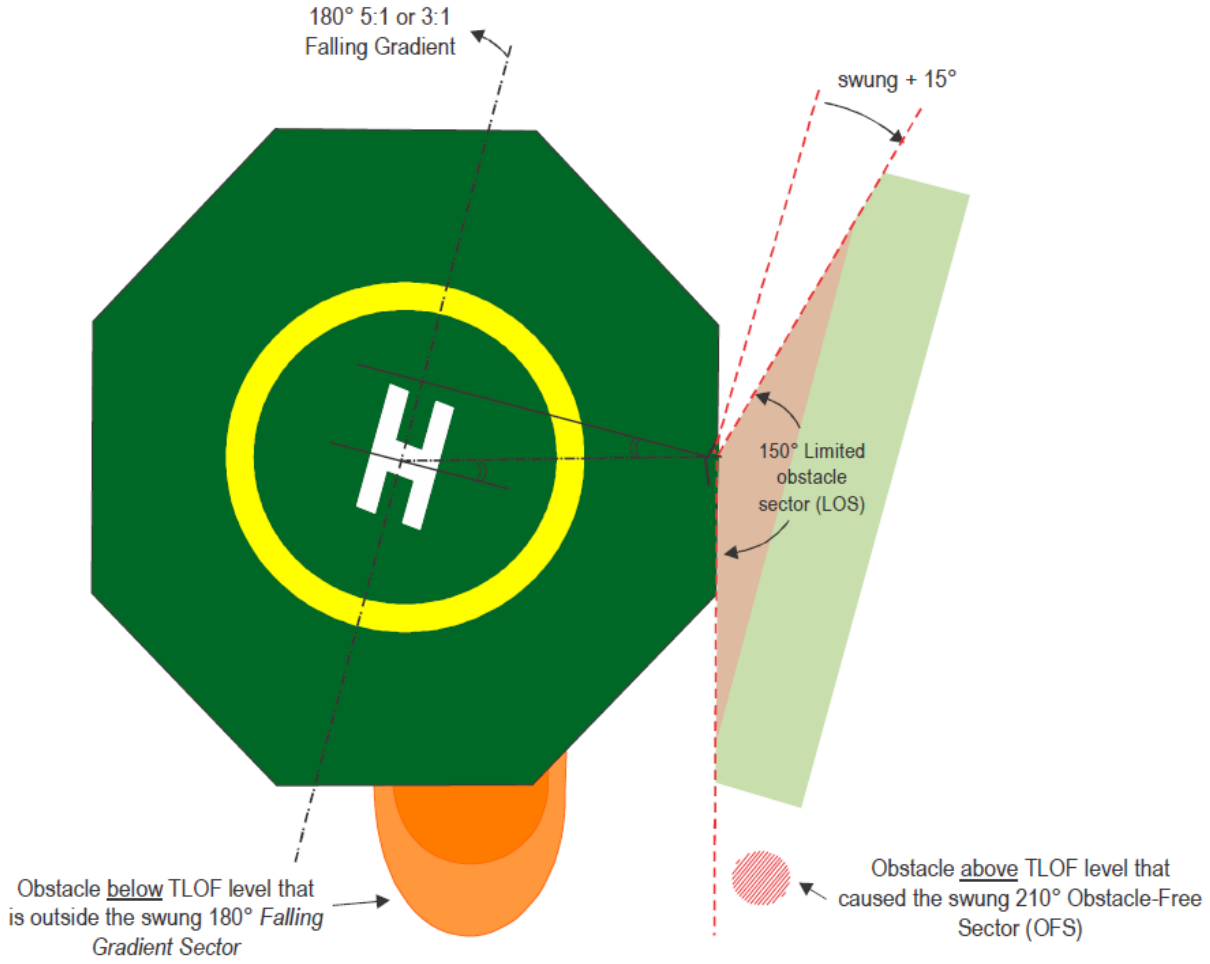
Example A — Centralized touchdown markings

Figure I-5-3. Location of touchdown markings (Example A)



Example B — Fully offset touchdown markings

Figure I-5-3. Location of touchdown markings (Example B)



Note 1: *The bisector of the 210° obstacle-free sector (OFS) shall normally pass through the Centre of the D-circle. The sector may be 'swung' by up to 15° in either direction from the normal. (A 15° clockwise swing is illustrated).*

Note 2: *If the 210° OFS is swung, then it would be normal practice to swing the 180° falling 5:1 gradient by a corresponding amount to indicate, and align with, the swung OFS.*

Figure I-5-4. Heliport identification marking reflecting a swung OFS (in this case the OFS is swung by 15 degrees in a clockwise direction to avoid an obstacle)

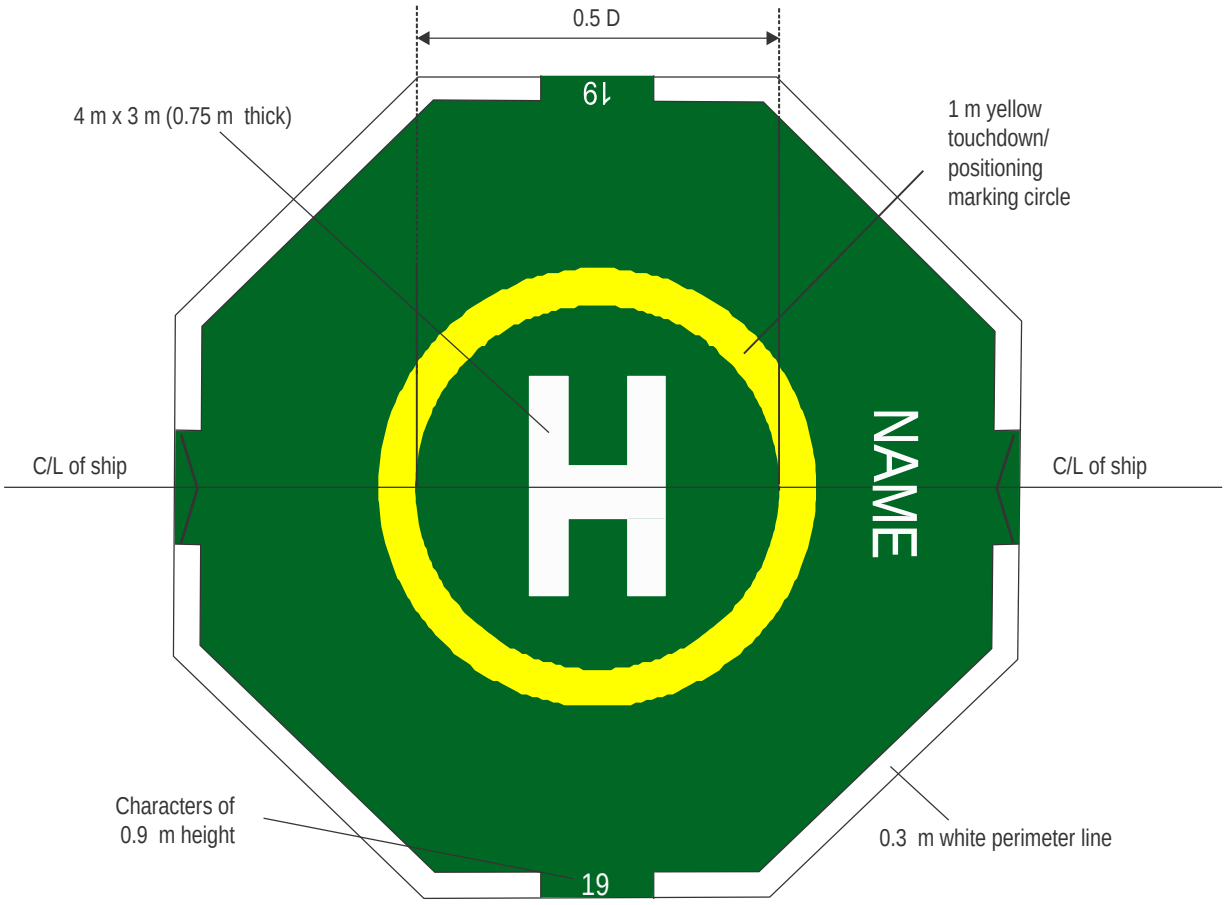


Figure I-5-5. D-value markings for a purpose-built shipboard heliport in an amidships location

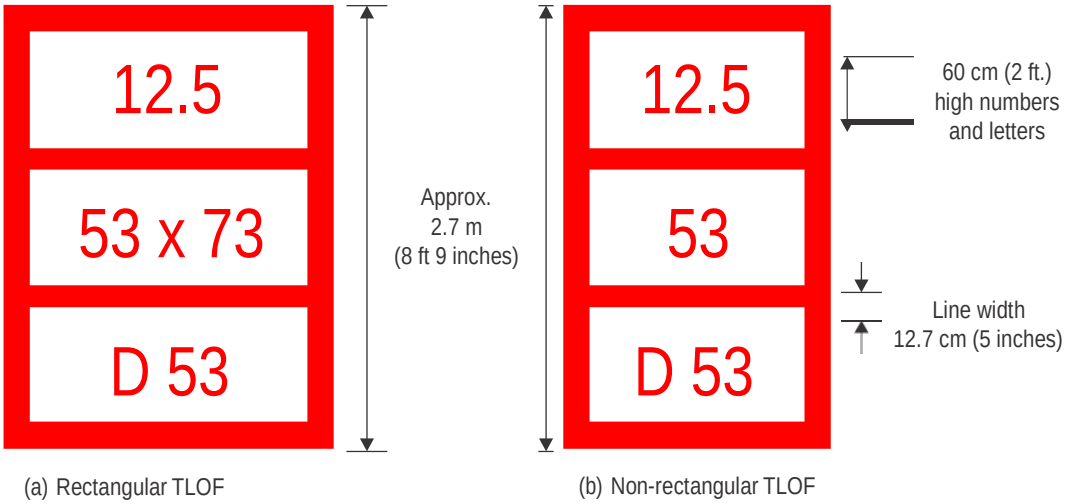


Figure I-5-5A. Helideck limitation markings — imperial units



Figure I-5-6. Accurate positioning of a helicopter by correct use of the touchdown/positioning marking (TD/PM) circle

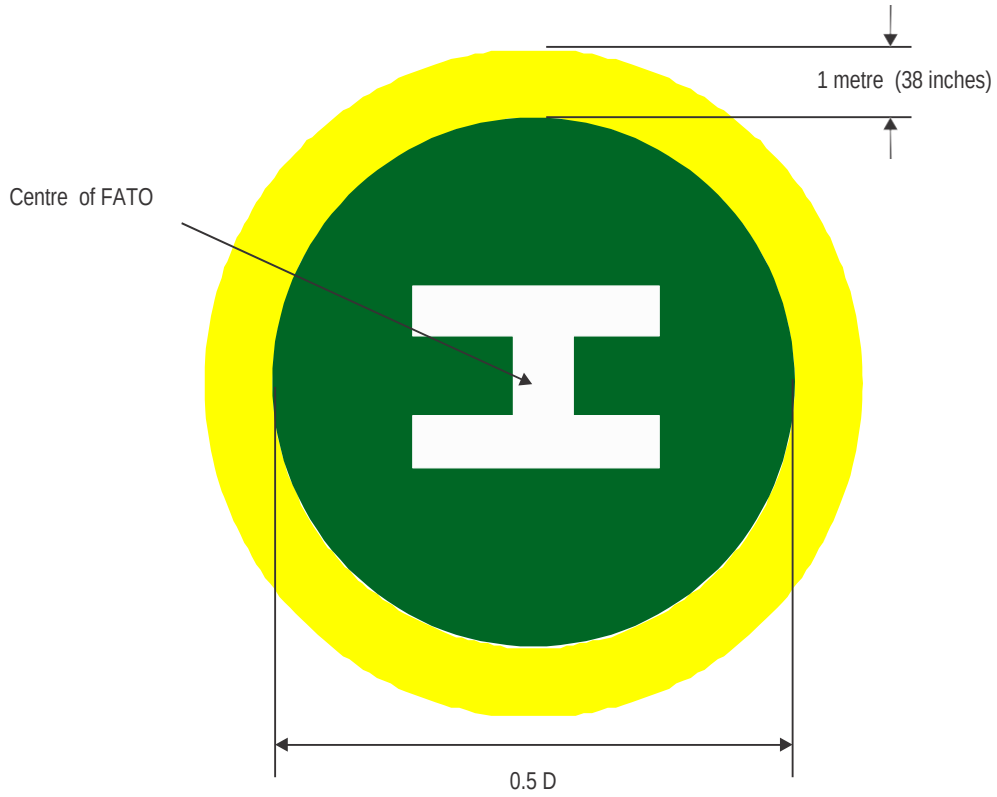


Figure I-5-7. Touchdown/positioning marking circle (painted yellow)

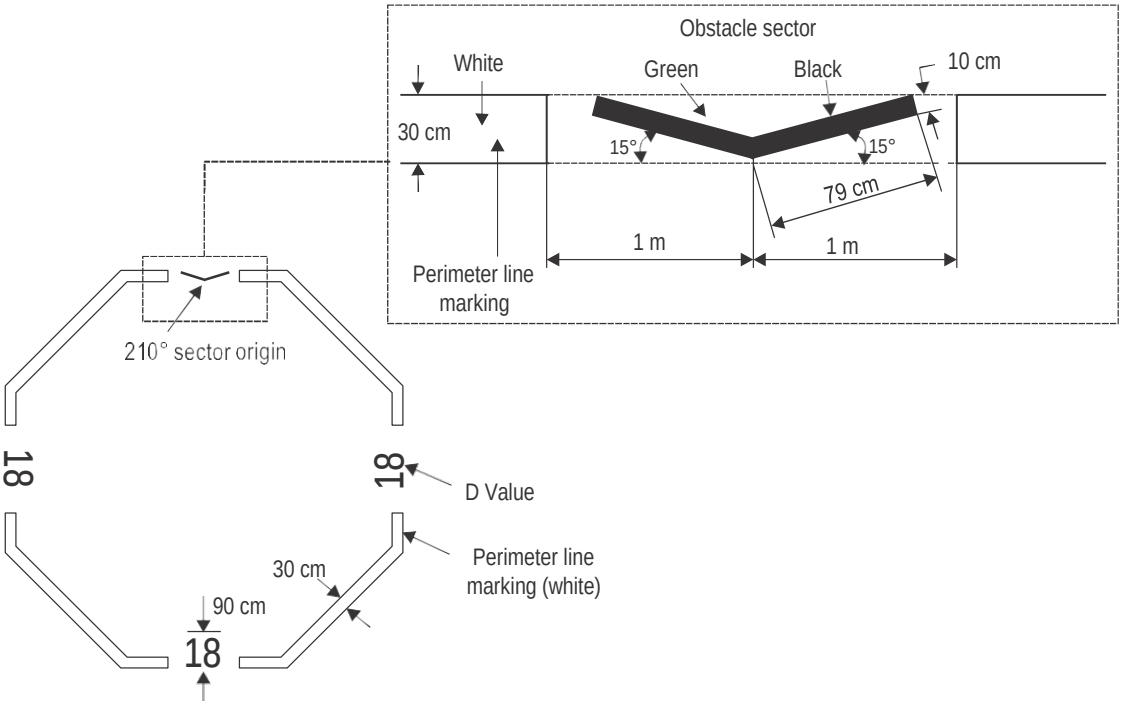


Figure I-5-8. Chevron for a 1 D helideck and helideck D-value markings

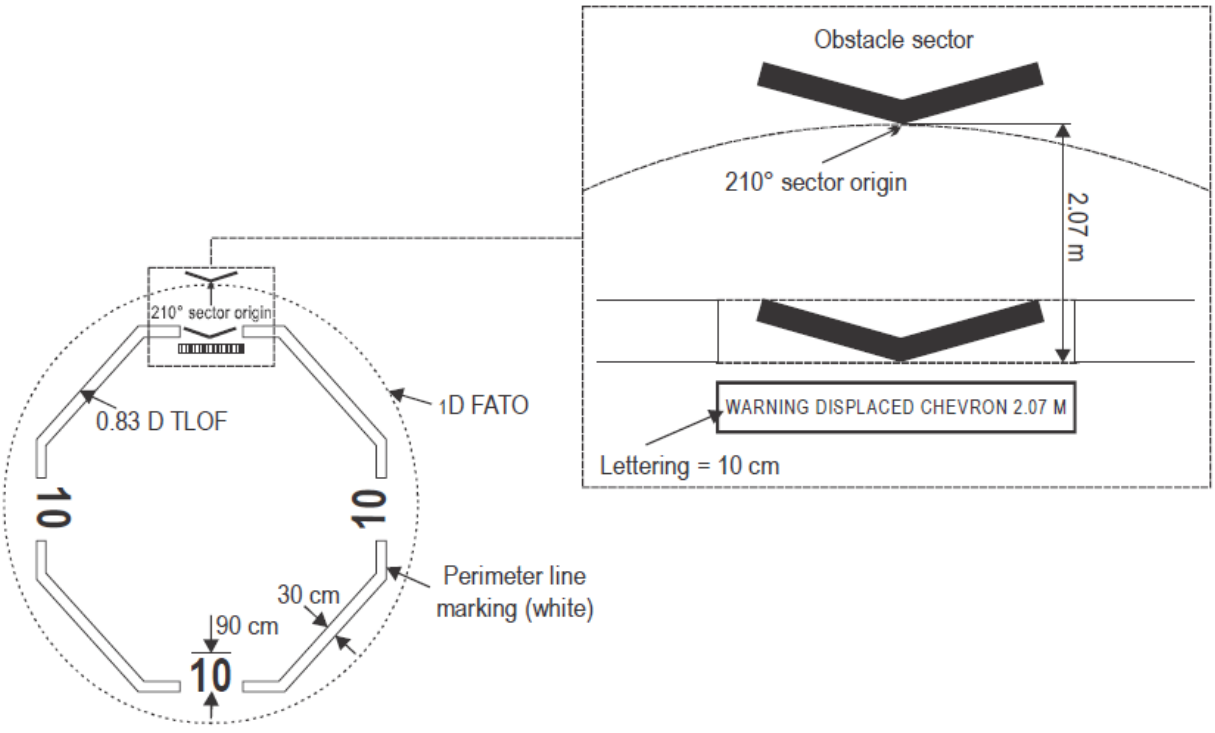


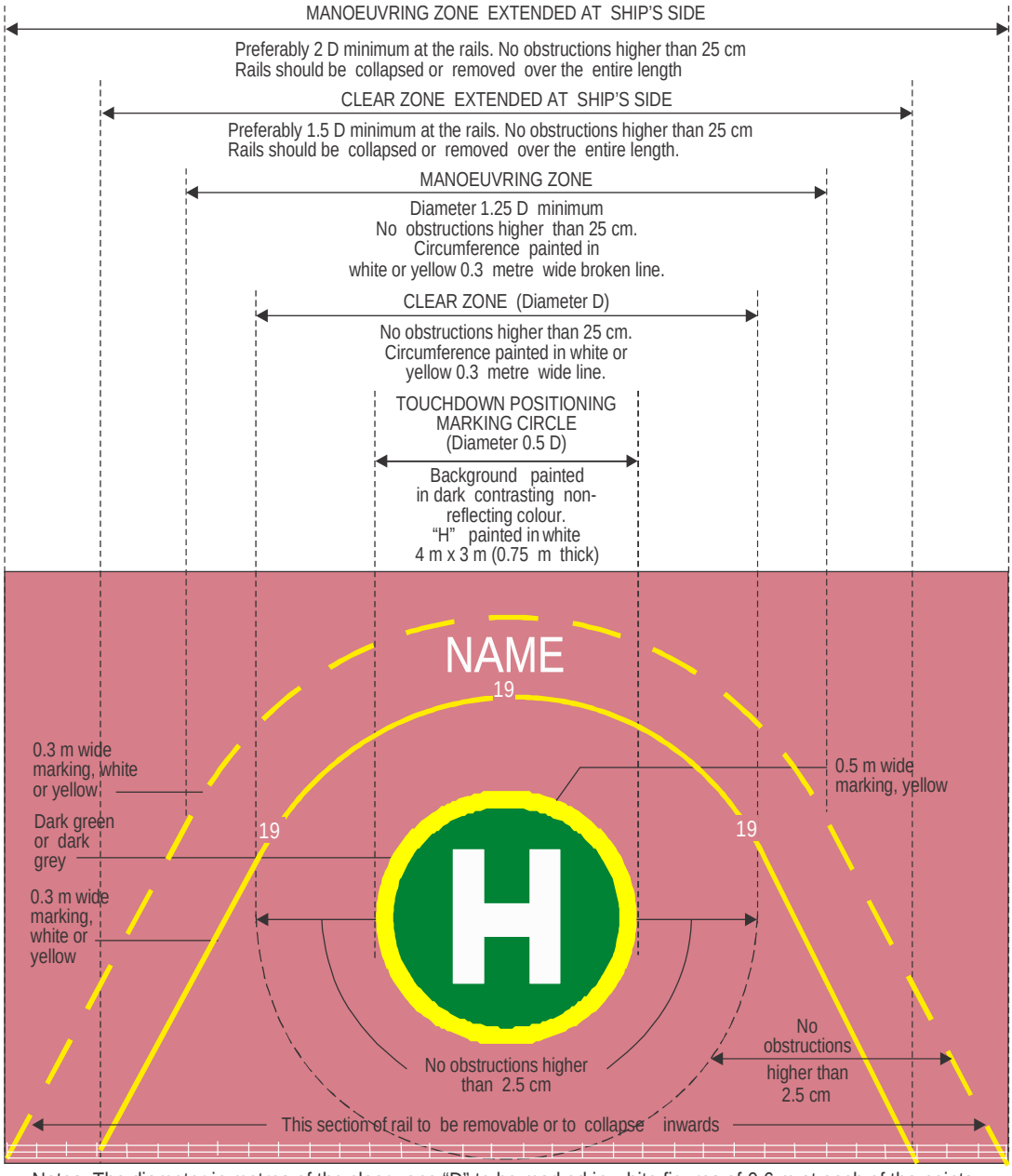
Figure I-5-9. Chevron for a 0.83 D helideck



Figure I-5-10. Examples of an alternative prohibited landing sector (PLS) marking







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

Figure I-5-11. Heliport markings — special considerations for non-purpose-built shipboard heliports

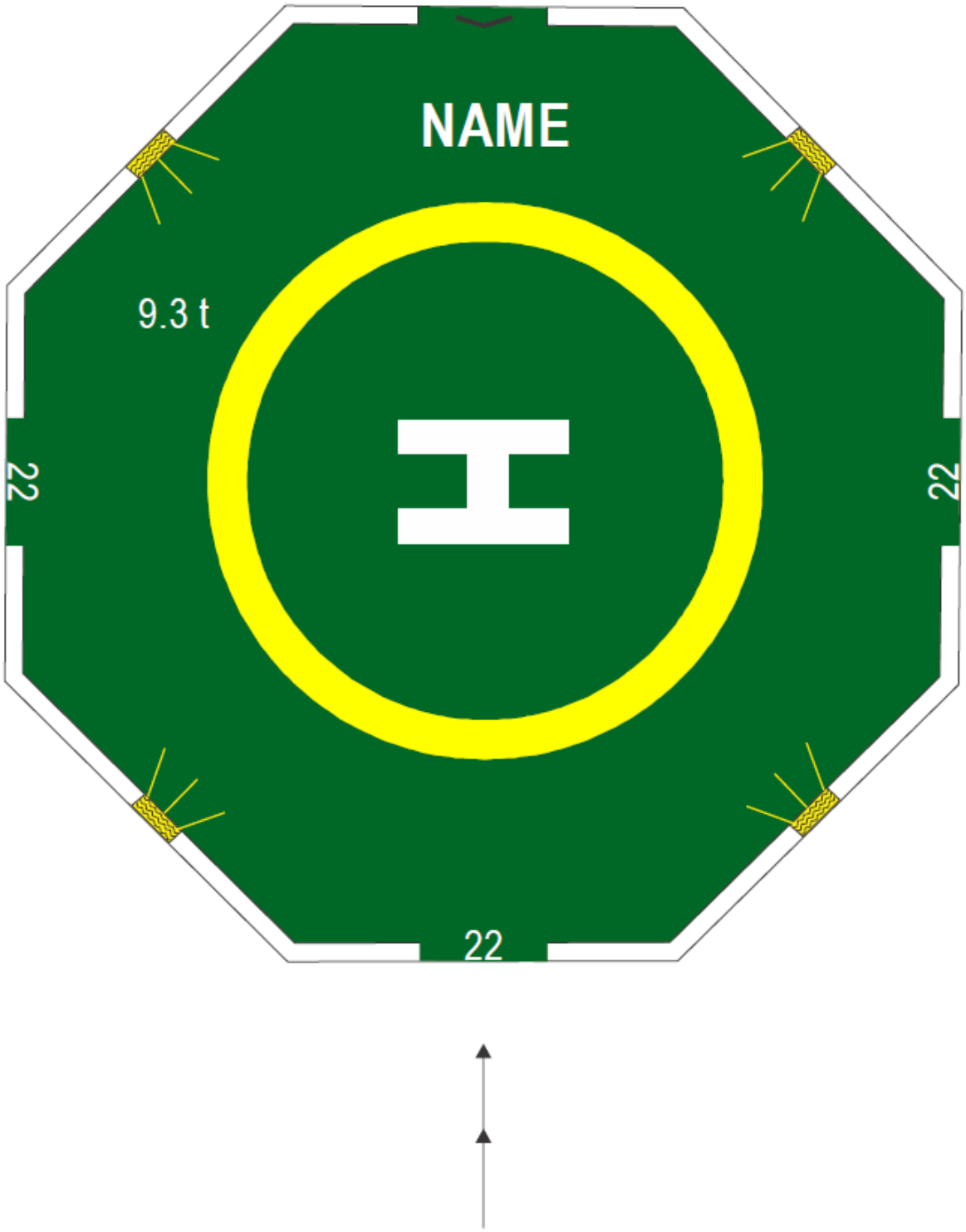


Figure I-5-12. Typical floodlighting arrangement for an octagonal helideck



Figure I-5-13. Fixed platform (left) with the lit TD/PM and the lit heliport identification marking scheme. Mobile offshore drilling unit (right) with deck-mounted floodlighting system

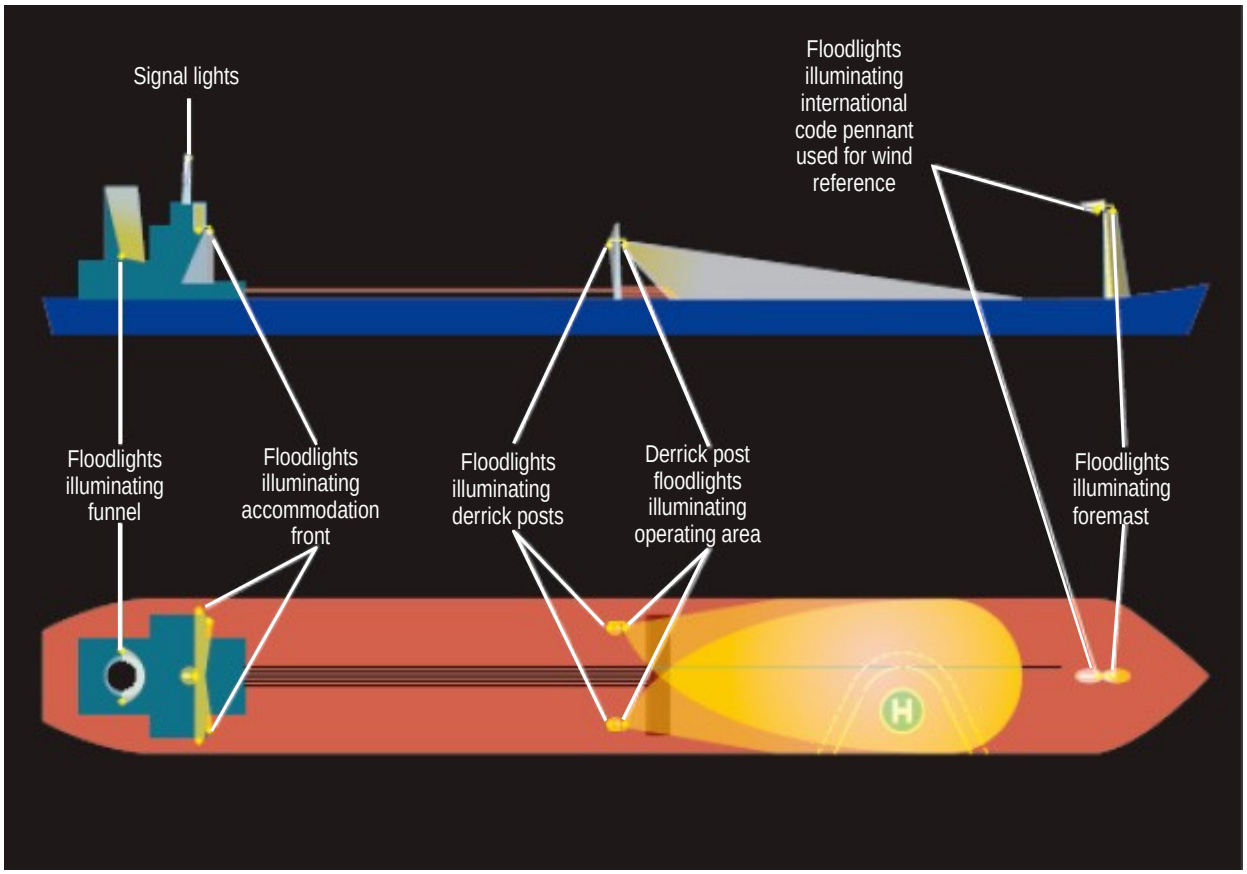


Figure I-5-14. Lighting systems — special considerations for non-purpose-built shipboard heliports

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6. HELIDECK RESCUE AND FIREFIGHTING FACILITIES

6.1. INTRODUCTION

6.1.1. This chapter provides guidance regarding the provision of equipment, extinguishing media, personnel, training, and emergency procedures for offshore helidecks and shall be read in conjunction with the guidance material presented in this manual, to support AAR-AGA-002, Section 6.2 Rescue and Firefighting. Unless specifically stated, it shall be assumed that all sections apply to an offshore facility regardless of the manning policy (i.e. whether a permanently attended installation (PAI) or a not permanently attended installation (NPAI)). For editorial convenience, when it fits the context, the generic term “landing area” is used and may be assumed to include both attendance models (PAIs and NPAIs) for fixed offshore heliports.

6.1.2. Rescue and firefighting (RFF) requirements for purpose-built shipboard heliports on ships constructed before 1 January 2020 shall at least comply with paragraphs 5.1.3 to 5.1.5 of SOLAS regulation II-2/18 and, for ships constructed on or after 1 January 2020, with the provisions of Chapter 17 of the Fire Safety Systems Code. For non-purpose-built shipboard heliports on ships constructed before 1 January 2020, RFF arrangements shall at least be in accordance with Part C of SOLAS II-2, Helicopter Facilities, and for ships constructed on or after 1 January 2020, with the relevant provisions of Chapter 17 of the Fire Safety Systems Code. It may therefore be assumed that this chapter does not include RFF arrangements for purpose-built or non-purpose-built heliports or for shipboard winching areas.

6.1.3. The principal objective of an RFF response is to save lives. For this reason, the provision of a means of dealing with a helicopter accident or incident occurring at or in the immediate vicinity of the landing area assumes primary importance because it is within this area that there are the greatest opportunities for saving lives. This shall assume at all times the possibility of, and need for, bringing under control and then extinguishing a fire which may occur either immediately following a helicopter accident or incident (e.g. crash and burn) or at any time during rescue operations.

6.1.4. The most important factors having a bearing on effective rescue in a survivable helicopter accident are the speed of initiating a response and the effectiveness of that response. Requirements to protect accommodation beneath or in the vicinity of the landing area, a fuel installation (where provided) or the support structure of the offshore heliport are not taken into account in this chapter, nor are any additional considerations that may arise from the presence of a second helicopter located in a parking area (see Chapter 8). In the case of a parking area, consideration may be given for providing a passive fire-retarding surface supplemented with hand-held extinguishers.

6.1.5. Due to the nature of offshore operations, usually taking place over large areas of open sea, an assessment will need to be carried out to determine if specialist rescue services and firefighting equipment are needed to mitigate the additional risks and specific hazards of operating over open sea areas. These considerations will form a part of the heliport emergency plan.

6.2. KEY DESIGN CHARACTERISTICS — PRINCIPAL AGENT

6.2.1. A key aspect in the successful design for providing an efficient, integrated rescue and firefighting 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 to preclude the use of some passenger escape routes.

6.2.2. Delivery of firefighting media to the landing area at the appropriate application rate shall be achieved in the quickest possible time. The method for delivery of the primary agent is best achieved through a fixed foam application system (FFAS) with an automatic or semi-automatic method used for the distribution of extinguishing agent to knock down and bring a fire under control in the shortest possible time, while protecting the means of escape for personnel to quickly and easily alight clear of the landing area to a place of safety. An FFAS may include, but is not necessarily limited to: a fixed monitor system (FMS), a deck integrated firefighting system (DIFFS), or, for a helideck with a D-value of 20 m (65.6 ft) or less, a ring main system (RMS). The purpose of this chapter is to discuss in detail the specification for an FMS and, as the alternative means of compliance, the preferred method of delivery now widely used in the offshore sector; a DIFFS. The specification for an RMS, or any other alternative means of compliance present or future, is not discussed in detail in this chapter. However, the critical area calculations illustrated in Section 6.2.8.1 are the recommended minimum objectives for any FFAS. An FMS, RMS or DIFFS shall therefore be regarded as different methods by which the uniform distribution of foam, at the required application rate and for the required duration, may be efficiently distributed to the whole of the landing area (an area that is based on the D-circle of the critical (design) helicopter). For an FMS, where, due to its location around the periphery of the helideck, a good range of application is essential, foam is initially applied in a solid stream (jet) application. A dispersed pattern is applied through a DIFFS or an RMS where the requirement is to deliver media at shorter ranges to combine greater coverage and a more effective surface application of primary media. Where a solid plate helideck is provided, i.e. a helideck having a solid plate surface design set to a fall or camber which allows fuel to drain across the solid surface into a suitable drainage collection system, primary media will always consist of foam (see Note below and Section 6.2.8). However, where the option is taken to install a passive fire-retarding surface constructed in the form of a perforated surface or grating which contains numerous holes that allow burning fuel to rapidly drain through the surface of the helideck, the use of water in lieu of foam is accepted. Where water is used the critical area calculation applicable for Performance Level C foam is applied (see Section 6.2.8).

Note: *From time to time, new technologies may come to market which, providing they are demonstrated by rigorous testing to be at least as effective as solutions described elsewhere in this chapter, with the approval of the SCAA, may be considered for helideck firefighting. For example, compressed air foam systems (CAFS) may be considered, with foam distributed through a DIFFS. CAFS has the ability to inject compressed air into foam to generate an effective solution to attack and suppress a helideck fire. This type of foam has a tighter, denser bubble structure than standard foams, which allows it to penetrate deeper into the fire before the bubbles are broken down. CAFS is able to address all sides of the fire triangle by smothering the fire (preventing oxygen from combining with the fuel), by diminishing the heat, using trapped air within the bubble structure, and by disrupting the chemical reaction required for a fire to continue. Hence the application rate for a DIFFS using Performance Level B compressed air foam may be accordingly reduced — see calculation of application rate in Section 6.2.8.*

6.2.3. Given that the effectiveness of any FFAS is the speed of initiating a response in addition to the effectiveness of that response, it is recommended that a delay of less than 15 seconds, measured from the time the system is activated to actual production at the required application rate, shall be the objective. The operational objective of an FFAS shall ensure that the system is able to bring under control a helideck fire associated with a crashed helicopter within 1 minute measured from the time the system is activated and producing foam at the required application rate for the range of weather conditions prevalent for the helicopter operating environment.

Note: *A fire is deemed to be under control at the point when the initial intensity of the fire is reduced by 90 per cent.*

6.2.4. An FFAS shall 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 shall also be given to the loss of a (downwind) foam monitor either due to limiting weather conditions or as a result of a crash situation occurring. The design specification for an FMS (usually consisting of 2, 3 or 4 fixed monitors) shall 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 landing area 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 further below.

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

6.2.6. The minimum capacity of the fixed foam application system will depend on the D-value of the design helicopter, the required foam application rate at the helideck, the discharge rates of installed equipment (i.e. capacity of main fire pump) and the expected duration of application. It is important to ensure that the capacity of the main offshore heliport 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 monitors are being discharged simultaneously.

6.2.7. 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 categorizes the foam concentrate. Foam concentrate manufacturers will be able to advise on the performance of their concentrates against these tests. It is recommended that foam concentrates compatible with seawater and meeting at least performance level 'B' or performance level 'C' are used. Level 'B' foams shall be applied at a minimum application rate of 5.5 litres per square metre per minute. Level 'C' foams shall be applied at a minimum application rate of 3.75 litres per square metre per minute. Where seawater is used in lieu of foam (see Section 6.2.2) the application rate shall be the same as for performance level 'C' foam.

6.2.8. Calculation of the application rate

6.2.8.1. Example based on the D-circle for an S92 (for the purpose of illustration assumed to be the design helicopter with a D = 20.88):

For an performance level B foam:

Application rate = 5.5 x π x r^2 (5.5 x 3.142 x 10.44 x 10.44) = 1 883 litres per minute

For an performance level C foam (or seawater):

Application rate = 3.75 x π x r^2 (3.75 x 3.142 x 10.44 x 10.44) = 1 284 litres per minute

For an performance level B compressed air foam:

Application rate = 3.00 x π x r^2 (3.00 x 3.142 x 10.44 x 10.44) = 1 027 litres per minute

6.2.8.2. Given the often remote location of offshore heliports, the overall capacity of the foam system shall exceed that which is necessary for the initial suppression and extinction of the fire. Five minutes of foam application capability for a solid plate helideck is generally considered to be reasonable. In the case of a passive fire-retarding surface with a water-only DIFFS the discharge duration may be reduced to no less than three minutes.

6.2.9. Calculation of minimum operational stocks

6.2.9.1. Using the 20.88 m example as shown in Section 6.2.8.1 above, a 1 per cent performance level 'B' foam solution discharged over five minutes at the minimum application rate will require: 1 883 x 0.01 x 5 = 94 litres of foam concentrate.

6.2.9.2. A 3 per cent performance level 'C' foam solution discharged over five minutes at the minimum application rate will require 1 284 x 0.03 x 5 = 193 litres of foam concentrate

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

6.2.10. Low expansion foam concentrates can generally be applied in either aspirated or non-aspirated form. It shall be recognized that while non-aspirated foam may provide a quick knockdown of any fuel fire, aspiration, i.e. the induction of air into the foam solution discharged by monitor or by hand controlled foam branch (see below), gives enhanced protection after extinguishment. Wherever a non-aspirated FFAS is selected during design, additional hose lines capable of producing aspirated foam for post-fire security/control shall be provided on solid-plate helidecks.

6.2.11. Not all fires are capable of being accessed by monitors, and in some scenarios their use may actually endanger passengers. Therefore, in addition to foam monitor systems, there shall 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 to 250 litres/minute through each hose line. A single hose line, capable of delivering aspirated foam at a minimum application rate of 225 to 250 litres/minute, 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 shall be capable

of being fitted with a branch pipe able to apply water in the form of a jet or spray pattern for cooling, or for other specific firefighting tactics.

6.2.12. As an effective alternative means of compliance to an FMS, offshore heliports are encouraged to consider the provision of a DIFFS. These systems typically consist of a series of pop-up nozzles with both a horizontal and vertical component, designed to provide an effective spray distribution of foam to the whole of the landing area and protection for the helicopter suitable for a range of weather conditions. A DIFFS on a solid-plate helideck shall 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 Section 6.2.3 achieving an average (theoretical) application rate over the entire landing area (based on the D-circle) of 5.5 litres per square metre per minute for performance level 'B' foams and 3.75 litres per square metre per minute for performance level 'C' foams, for a duration which at least meets the minimum requirements stated in Section 6.2.8.2 above.

6.2.13. When an FFAS consisting of a DIFFS capable of delivering foam and/or seawater in a spray pattern to the whole of the landing area (see previous paragraphs and Note below) is selected in lieu of an FMS, full scale testing has confirmed that 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 Chapter 4).

6.2.14. The precise number and lay out of pop-up nozzles will be dependent on the specific landing area design, particularly the dimensions of the landing area. However, nozzles shall not be located adjacent to helideck egress points as this may hamper quick access to the helideck by trained rescue crews and/or impede occupants of the helicopter from escaping to a safe place away from the landing area. Notwithstanding this, the number and layout of nozzles shall 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 recognized in meeting the objective for the average (theoretical) application rate specified above for performance level 'B' or level 'C' foams that there may be some parts of the landing area, particularly where the spray pattern of nozzles significantly overlap, where the average (theoretical) application rate is exceeded in practice. Conversely, for other areas the application rate in practice may fall slightly below the average (theoretical) application rate specified in Section 6.2.12. 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 application rates specified.

Note: *Where a DIFFS is used in tandem with a passive fire-retarding system demonstrated to be capable of removing significant quantities of unburned fuel from the surface of the offshore heliport, 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 shall meet the same application rate as specified for a performance level 'C' foam DIFFS in Section 6.2.12 and duration as specified in Section 6.2.8.2. (See also Section 6.5 for not permanently attended installations (NPAIs).)*

6.2.15. 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 deck surface. Any local damage to the DIFFS nozzles and distribution system, caused by a helicopter crash, shall not hinder the system's overall ability to deal effectively with a fire situation. To this end, a DIFFS supplier shall be able to verify that a system where at least one of the nozzles is rendered inactive remains fit-for-purpose, and is able to bring a fire associated with a crashed helicopter under control within one minute measured from the time the system is producing foam at the required application rate.

6.2.16. A variation on the basic design performance level 'B' or level 'C' foam DIFFS is a DIFFS CAFS (see the Note below Section 6.2.2). If lifesaving opportunities are to be maximized, it is essential that all equipment shall be ready for immediate use on, or in the immediate vicinity of, the landing area whenever helicopter operations are being conducted. All equipment shall be located at points having immediate access to the landing area. The location of the storage facilities shall be clearly indicated.

6.3. USE AND MAINTENANCE OF FOAM EQUIPMENT

6.3.1. Mixing different concentrates in the same tank, i.e. different either in make or strength, is generally unacceptable. Many different strengths of concentrate are on the market, but the most common concentrates found offshore are 1 per cent, 3 per cent or 6 per cent. Any decision regarding selection shall take into account the design characteristics of the foam system. It is important to ensure that foam containers and tanks are correctly labelled.

6.3.2. Induction equipment ensures that water and foam concentrate are mixed in the correct proportions. The settings of adjustable inductors, if installed, shall correspond with the strength of concentrate in use.

6.3.3. All parts of the foam production system, including the finished foam, shall be tested by qualified personnel upon commissioning and annually thereafter. The tests shall assess the performance of the system against original design expectations while ensuring compliance with any relevant pollution regulations.

6.4. COMPLEMENTARY MEDIA

6.4.1. While foam is considered the principal agent for dealing with fires involving fuel spillages, the wide variety of fire incidents likely to be encountered during offshore helicopter operations — e.g. engine, avionic bays, transmission areas, hydraulics — may require the provision of more than one type of complementary agent. Dry powder and gaseous agents are generally considered acceptable for this task. The complementary agents selected shall comply with the appropriate specifications of the International Organization for Standardization (ISO). Systems shall be capable of delivering the agents through equipment which will ensure its effective application.

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

6.4.2. Dry chemical powder is recommended as the primary complementary agent. For helidecks up to and including 16 m (52.5 ft) the minimum total capacity shall be 23 kg (50 lbs) delivered from one or two extinguishers. For helidecks above 16 m (52.5 ft) and up to 24 m (78 ft), the minimum total capacity shall be 45 kg (99 lbs) delivered from one, two or three extinguishers. For helidecks above 24 m (78 ft) the minimum total capacity shall be 90 kg (198 lbs) delivered from two, three or four extinguishers. The dry powder system shall have the capability to deliver the agent anywhere on the landing area and the discharge rate of the agent shall be selected for optimum effectiveness of the agent. Containers of sufficient capacity to allow continuous and sufficient application of the agent shall be provided.

6.4.3. A quantity of gaseous agent is recommended in addition to the use of dry powder as a secondary complementary agent. A quantity of gaseous agent shall be provided with a suitable applicator for use on engine fires. The appropriate minimum quantity delivered from one or two extinguishers is 9 kg (19 lbs) for helidecks up to and including 16.00 m (52.5 ft), 18 kg (39 lbs) for helidecks above 16.00 m (52.5 ft) and up to 24.00 m (78 ft), and 36 kg (78 lbs) for helidecks above 24.00 m (78 ft). The discharge rate shall be selected for optimum effectiveness of the agent. Due regard shall be given to the requirement to deliver gaseous agents to the seat of the fire at the recommended discharge rate. Due to the windy conditions prevalent in many offshore sectors, complementary agents may be adversely affected during application and if considering gaseous media the ambient conditions shall be taken into account.

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

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

6.4.6. Dry chemical powder shall be of the foam-type compatible.

6.4.7. The complementary agents shall be sited so that they are readily available at all times.

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

6.4.9. Complementary agents shall be subject to annual visual inspection by qualified personnel and pressure tested in accordance with manufacturers' recommendations.

6.5. NOT PERMANENTLY ATTENDED INSTALLATIONS (NPAI)

6.5.1. In the case of NPAIs, where RFF equipment will be unattended during certain helicopter movements, the application 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 best achieved by means of a fullyautomated DIFFS. See Sections 6.2.12 to 6.2.15 for specification.

6.5.2. For NPAIs, other combination solutions where these can be demonstrated to be effective in dealing with a running fuel fire may be considered. 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 landing area in the event of a fuel spill from a ruptured aircraft tank. In this

case the minimum discharge duration shall meet the appropriate requirements specified in Section 6.2.8.2.

6.5.3. DIFFS on NPAIs shall be integrated with platform safety systems such that pop-up nozzles are activated automatically in the event of an impact of a helicopter where a post-crash fire (PCF) results. The overall design of a DIFFS shall incorporate a method of fire detection and be configured to avoid spurious activation and shall be capable of manual override. Similar to a DIFFS provided for a PAI, a DIFFS provided on an NPAI 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 Section 6.2.12 to 6.2.15 shall also apply for a DIFFS located on an NPAI.

6.6. THE MANAGEMENT OF EXTINGUISHING MEDIA STOCKS

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

6.6.2. The mixing of different types of foam concentrate may cause serious density issues and result in the possible malfunctioning of foam production systems. Unless evidence is given to the contrary, it shall be assumed that different types are incompatible. In the event of mixing it is essential that the tank(s), pipe work and pump (if fitted) are thoroughly cleaned and flushed prior to the new concentrate being introduced.

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

6.7. RESCUE EQUIPMENT

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

6.7.2. The provision of minimum equipment is required as listed in Table I-6-1. Sizes of equipment are not detailed in this table, but shall be appropriate for the types of helicopters expected to use the facility.

6.7.3. Appropriate personnel shall be appointed to ensure that the rescue equipment is checked and maintained regularly.

6.7.4. Rescue equipment shall be stored in clearly marked and secure watertight cabinets or chests. An inventory checklist of equipment shall be held inside each equipment cabinet/chest.

6.8. PERSONNEL LEVELS

6.8.1. The facility or vessel shall have a sufficient number of trained firefighting personnel immediately available whenever helicopter movements are taking place. A determination of what constitutes sufficient resources may be made on a case-by-case basis by use of a task resource analysis. When conducting this assessment, it is recommended that the following be taken into account, at minimum:

a) helicopter types using the helideck, including maximum passenger seating configuration, composition, fuel loads (and whether fuel can be uplifted on site);
b) expectations for the rescue of helicopter occupants, e.g., assisted rescue model;
c) design and complexity of the firefighting arrangements, e.g., equipment to address worst case PCF with rescue of occupants; and

d) availability of additional emergency support personnel to assist dedicated helideck personnel.

6.8.2. Dedicated helideck personnel shall be deployed to allow the appropriate, efficient operations of firefighting and rescue systems and to maximum advantage, so that any helideck incident can be managed effectively. The helicopter landing officer (HLO) shall be readily identifiable to the helicopter crew as the person in charge of operations. The preferred method of identification is a brightly coloured 'HLO' tabard/waistcoat.

6.9. PERSONAL PROTECTIVE EQUIPMENT (PPE)

6.9.1. All responding RFF personnel shall be provided with appropriate personal protective equipment (PPE) and respiratory protective equipment (RPE) to allow them to carry out their duties in an effective manner.

6.9.2. Sufficient personnel to operate the RFF equipment effectively shall be dressed in protective clothing prior to helicopter movements taking place. In addition, equipment shall only be used by personnel who have received adequate information, instruction and training. PPE shall be accompanied by suitable safety measures e.g. protective devices, markings and warnings. The specifications for PPE shall meet one of the following international standards:

	NFPA	***EN***	***BS***
Helmet with visor	NFPA 1971	EN443	BS EN 443
Gloves	NFPA 1971	EN659	BS EN 659
Boots (footwear)	NFPA 1971	EN ISO 20345	BS EN ISO 20345
Tunic and trousers	NFPA 1971	EN469	BS EN ISO 14116
Flash-hood	NFPA 1971	EN 13911	BS EN 13911

6.9.3. Appropriate personnel shall be appointed to ensure that all PPE is installed, stored, used, checked and maintained in accordance with the manufacturer's instructions. Facilities shall be provided for the cleaning, drying and storage of PPE when crews are off duty. Facilities shall be well-ventilated and secure.

6.9.4. In addition, equipment shall only be used by personnel who have received adequate information, instruction and training. PPE shall be accompanied by suitable safety measures e.g. protective devices, markings and warnings. Appropriate PPE is included in Table I-6-1. Specific outcomes from the task-resource analysis may determine a requirement for additional PPE, or that, given the specific rescue model employed, certain items may not be required.

6.10. TRAINING

6.10.1. If they are to effectively utilize the equipment provided, all personnel assigned to RFF duties on the landing area shall be fully trained to carry out their duties to ensure competence in role and task. It is recommended that personnel attend an established helicopter firefighting course.

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

6.11. EMERGENCY PROCEDURES

6.11.1. The heliport emergency plan shall specify the actions to be taken in the event of an emergency involving a helicopter on or near the installation or vessel. The heliport emergency plan sets out the procedures for coordinating the response of agencies or services that could be of assistance in responding to an emergency at an offshore heliport.

6.11.2. Details of the scope and content for heliport emergency planning are addressed in detail in AAR-AGA-002, Chapter 6, 6.1.

Table I-6-1. Rescue equipment

Adjustable wrench	1
Rescue axe, large (non-wedge or aircraft type)	1
Cutters, bolt	1
Crowbar, large	1
Hook, grab or salving	1
Hacksaw (heavy duty) and six spare blades	1
Blanket, fire resistant	1
Ladder (two-piece)*	1
Life line (5 mm circumference x 15 m in length) plus rescue harness	1
Pliers, side cutting (tin snips)	1
Set of assorted screwdrivers	1
Harness knife and sheath or harness cutters**	**
Man-made mineral fibre (MMMF) filter masks**	**
Gloves, fire resistant**	**
Power cutting tool***	1

* For access to casualties in an aircraft on its side.
** This equipment is required for each helideck crew member.
*** Requires additional approved training by competent personnel only specified for helicopters above 24 m (78 ft).

7. WINCHING AREAS ON SHIPS

7.1. GENERAL CONSIDERATIONS INCLUDING LOCATION, PHYSICAL CHARACTERISTICS AND OBSTACLE PROTECTION

7.1.1. Where practicable, the helicopter shall always land rather than winch (an operation commonly referred to as helicopter hoist operation (HHO)) because safety is enhanced when the time spent hovering is reduced. However, certain types of ships, which need to engage helicopter support but are unable to provide the space and/or obstacle limitation surfaces needed to meet the requirements for a shipboard heliport, may need to consider a shipboard winching area in lieu of a shipboard heliport landing area.

7.1.2. The optimum position for a winching area will be determined primarily by the availability of a suitable space on the ship. However, a winching operation shall be located over an area to which the helicopter can safely hover while winching to or from the ship. Its location shall allow the pilot an unimpeded view of the whole of the winching area clear zone and the ship's topside layout. Where more than one area capable of accommodating a winching area exists, preference shall be given to the location that best minimizes aerodynamic and wave motion effects. In addition, the winching area shall preferably be clear of accommodation spaces and provide adequate deck areas adjacent to the manoeuvring zone to allow for safe access to the winching area from at least two different directions. In selecting a suitable winching area, the desirability for keeping the winching (hoist) height to a minimum shall also be borne in mind, such that the area chosen will allow a helicopter to hover at a safe height above the highest obstacle that may be present in the manoeuvring zone.

7.1.3. The winching area clear zone shall comprise a circular area with a minimum diameter of 5 m (16 ft). This clear zone shall be a solid surface capable of accommodating personnel and/or stores for which the winching area is intended. In addition the clear zone shall be entirely obstacle-free.

7.1.4. The manoeuvring zone, divided into an inner and outer area, shall encompass and extend beyond the clear zone to a minimum overall diameter of 2 D. The inner manoeuvring zone, having a diameter of not more than 1.5 D, may contain objects which are no higher than 3 m (9 ft) above the surface of the clear zone, while the outer manoeuvring zone, having an overall diameter of at least 2 D, may contain objects that are no higher than 6 m (20 ft) above the surface of clear zone. It is not essential for the entire manoeuvring zone to be a solid surface, and a portion may be located beyond the ship's side over the water (the same obstacle height limitations would apply as for a solid surface).

7.2. MARKING OF A WINCHING AREA

7.2.1. Winching area markings shall be located in order for their origin to coincide with the centre of the clear zone.

7.2.2. The clear zone of the winching area, a circle with a minimum diameter of 5 m (16 ft), shall be painted in a conspicuous colour to contrast with the surrounding deck surface of the ship. Ideally the clear zone shall be painted yellow. It is usually necessary to apply a paint scheme that provides a high friction coating to prevent personnel from slipping in the clear zone and/or stores from sliding due to the motion of the ship.

7.2.3. The edge of the circular outer manoeuvring zone of the winching area, having a diameter of at least 2 D, shall be marked by a broken circle with a line width of at least 30 cm (1 ft) painted in a conspicuous colour to contrast with the adjacent ship's deck. For standardization, it is recommended wherever possible that the outer manoeuvring zone marking is painted yellow. As a guide the mark to space ratio of the broken circle shall be approximately 4:1 (80 per cent coverage of the markings).

7.2.4. Within the inner manoeuvring zone, but outside the solid clear zone, "WINCH ONLY" shall be painted in characters which are easily visible to the helicopter pilot. The size and location of the marking may be dictated by the available surface on which to apply the marking (see 7.1.4) but the individual letters shall ideally be at least 2 m (6.5 ft) high with a line width of approximately 33 cm (13 in). "WINCH ONLY" shall be painted in a conspicuous colour to contrast with the adjacent deck. For standardization, it is recommended wherever possible that the marking is painted white.

7.2.5. While it is not a specific requirement to mark the periphery of the inner manoeuvring zone (with a diameter not greater than 1.5 D), it may be helpful, for the mapping of obstacles relative to the two obstruction segments in the manoeuvring zone, to do so. In this case, it is recommended that a thin unbroken circle be painted around the periphery of the inner manoeuvring zone in a colour which contrasts with the adjacent ship's deck, but which is different from the colour used to define the outer manoeuvring zone. For standardization, it is recommended wherever possible that the inner manoeuvring zone circle, where marked, is painted white, with a line width of approximately 10 cm (4 in).

7.2.6. Obstructions within, or immediately adjacent to, the manoeuvring zone which may present a hazard to the helicopter need to be readily visible from the air and shall be conspicuously marked. There is a scheme for marking of obstacles described in AAR-AGA-002, Chapter 5. However, a protocol also exists internationally which ship's Masters may find helpful to adopt, particularly as it harmonizes with colour schemes being proposed for a ship's helicopter landing area plan in this manual (see Chapter 4, 4.5 for details of how to complete a helicopter landing area/operating area plan). For objects within the height constraints specified for the two segments of the manoeuvring zone, to which it is necessary to draw the attention of the helicopter pilot, it is recommended that a yellow paint scheme be applied to highlight the position of these objects. Where, exceptionally, objects within the manoeuvring zone exceed the height constraints specified in Section 7.1.4, it is suggested that a paint scheme consisting of red and white stripes, in lieu of yellow, be applied to the object. In all cases it is necessary that the marking of objects contrasts effectively with the surface of the ship and therefore, some latitude may be required for precise colour schemes to be used. The suggestions given in this paragraph are intended to achieve standardization of markings wherever possible.

7.2.7. The marking scheme for a shipboard winching area is shown in Figure I-7-1.

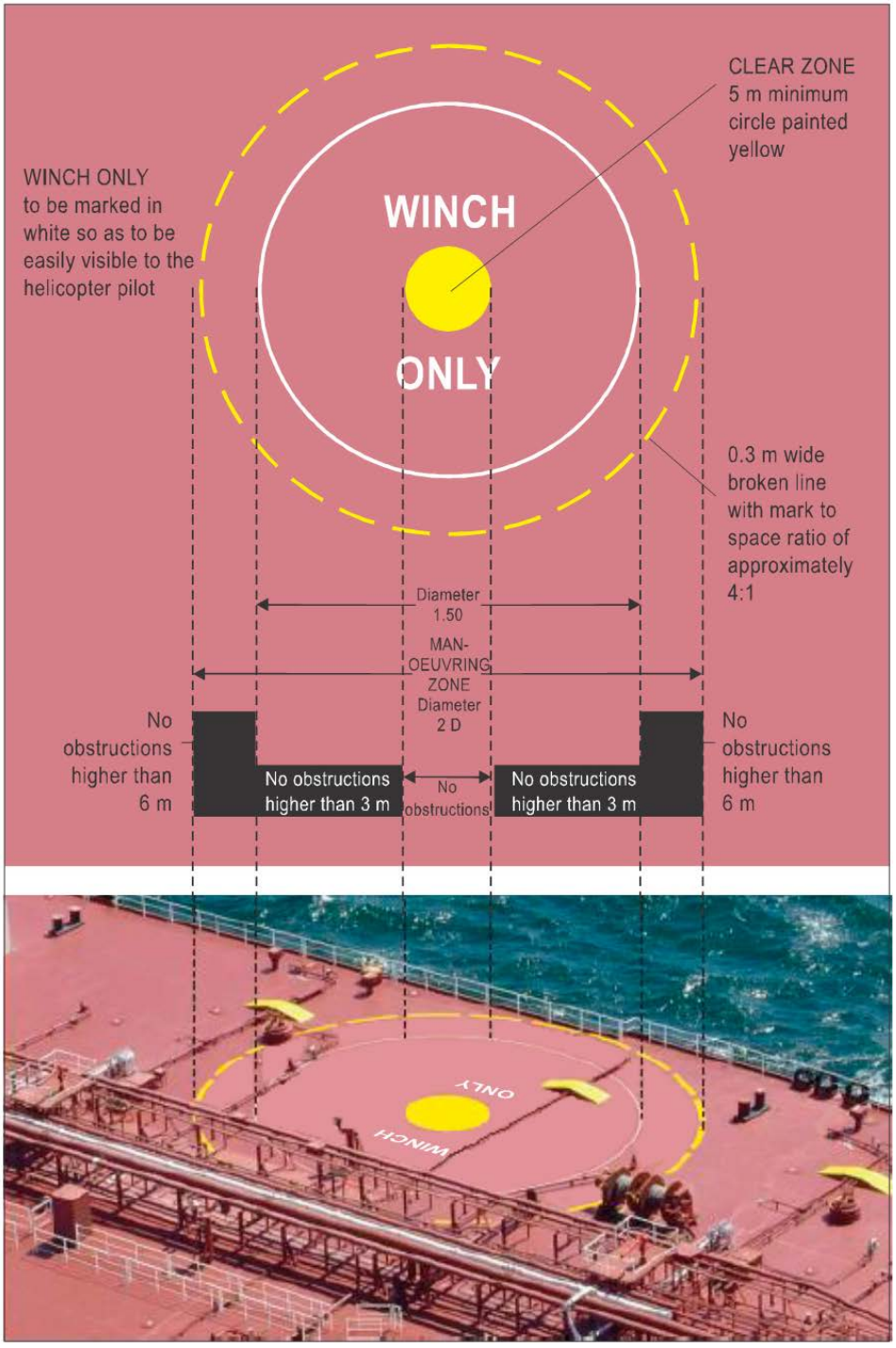


Figure I-7-1 Marking scheme for a shipboard winching area

7.3. LIGHTING OF A WINCHING AREA FOR NIGHT HELI-HOIST OPERATIONS

7.3.1. Where winching area operations are required to be conducted at night, winching area floodlighting shall be provided to illuminate the clear zone and the manoeuvring zone areas. Floodlights shall be arranged and adequately shielded so as to avoid glare to pilots operating in the hover and to personnel who may be working on the area during periods of non-operation. For a winching area, with its associated obstacle limitation surfaces, it is most likely that this will be achieved using a system of area (high-mounted) floodlighting, rather than a dedicated surface-mounted floodlighting system.

7.3.2. However illumination of the winching area is achieved, it is important to ensure that the spectral distribution of winching area floodlights is such that the surface markings and obstacle markings can be clearly identified. The floodlighting arrangement shall ensure that shadows are kept to a minimum.

7.3.3. Obstructions within or immediately adjacent to the manoeuvring zone which may present a hazard to the helicopter conducting winching operations at night, need to be made readily visible from the air during night operations and shall be conspicuously illuminated.

7.4. ADDITIONAL OPERATIONAL CONSIDERATIONS

7.4.1. 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 shall, as far as possible, be either removed, lowered or securely stowed. In addition, personnel shall be kept well clear of any space immediately beneath the operating area. All doors, portholes, skylights, hatch-covers etc. in the vicinity of the operating area shall be closed. This may also apply to deck levels that are below the operating area.

7.4.2. RFF personnel shall be deployed in a ready state but sheltered from the helicopter operating area. RFF service requirements for landing areas are addressed in Chapter 6 of this manual. Winching areas shall comply with the relevant SOLAS regulation for winching areas.

8. MISCELLANEOUS ITEMS

8.1. CRITERIA FOR PARKING AREAS AND PUSH-IN PARKING AREAS

8.1.1. The ability to park a helicopter on an offshore facility or vessel and still be able to use the landing area for other helicopter operations provides greater operational flexibility. A parking area, where provided, shall be located within the 150-degree limited obstacle sector (LOS) equipped with markings to provide effective visual cues for flight crews needing to use the parking area.

8.1.2. It is therefore necessary for a parking area to be clearly distinguishable from the touchdown and lift-off area (TLOF). By day, this is achieved by ensuring a good contrast between the surface markings of the landing area and the surface markings of the parking area. For a standard dark green helideck, as described in Chapter 5, 5.10.1, a parking area which is painted a light grey colour utilising a high friction coating will provide suitable contrast (an aluminium surface may be left untreated). For an untreated aluminium landing area, as described in Chapter 5, 5.1.3 and 5.10.2, it will be necessary to select a different colour finish for the parking area (preferably a darker colour than the landing area but avoiding dark green) to achieve a good contrast. (The Figures in this chapter assume that a dark green minimum 1 D final approach and take-off area (FATO) is provided. When an untreated aluminium landing area is selected the underlying colour of the parking area will need to be varied to achieve good contrast).

8.1.3. Ideally, the dimensions of the parking area shall accommodate a circle with a minimum diameter of 1 x the D-value of the design helicopter. A minimum clearance between the edge of the parking area and the edge of the landing area of 1/3 (0.33 D) based on the design helicopter shall be provided. The 1/3 D clearance area represents the parking transition area (PTA) (see Section 8.1.6) and shall be kept free of obstacles when a helicopter is located in the parking area. Figure I-8-1 defines the basic scheme for a 1 D FATO/TLOF with associated 1 D parking area:

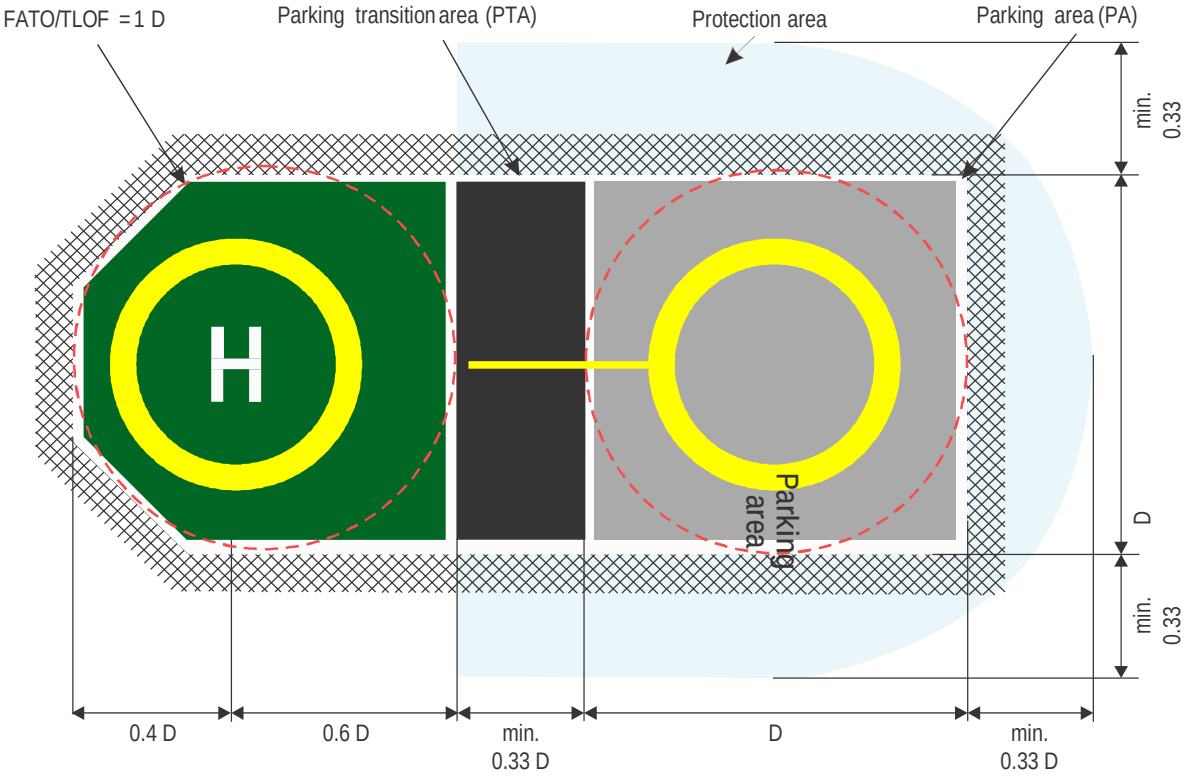


Figure I-8-1. General arrangement — 1 D helideck landing area with associated 1 D parking area separated by a parking transition area (PTA)

8.1.4. Markings shall be incorporated on the parking area surface to provide visual cues to the flight crew to enhance safe operations. Where space (the physical surface) is limited for the parking area, it is permissible to reduce the parking area to be no less than the rotor diameter (RD) of the design helicopter. In this case the touchdown/positioning marking (TD/PM) circle is offset away from the landing area to ensure a parked helicopter is a safe distance away from the landing area and is contained in the parking area within a hypothetical circle of dimension D. With a reduction in the load-bearing surface of the parking area from D to RD, it is accepted that parts of the helicopter, e.g. the tail rotor or main rotor, may overhang the physical parking area (inboard). The general arrangement for a helideck parking area with offset TD/PM circle is shown in Figure I-8-2.

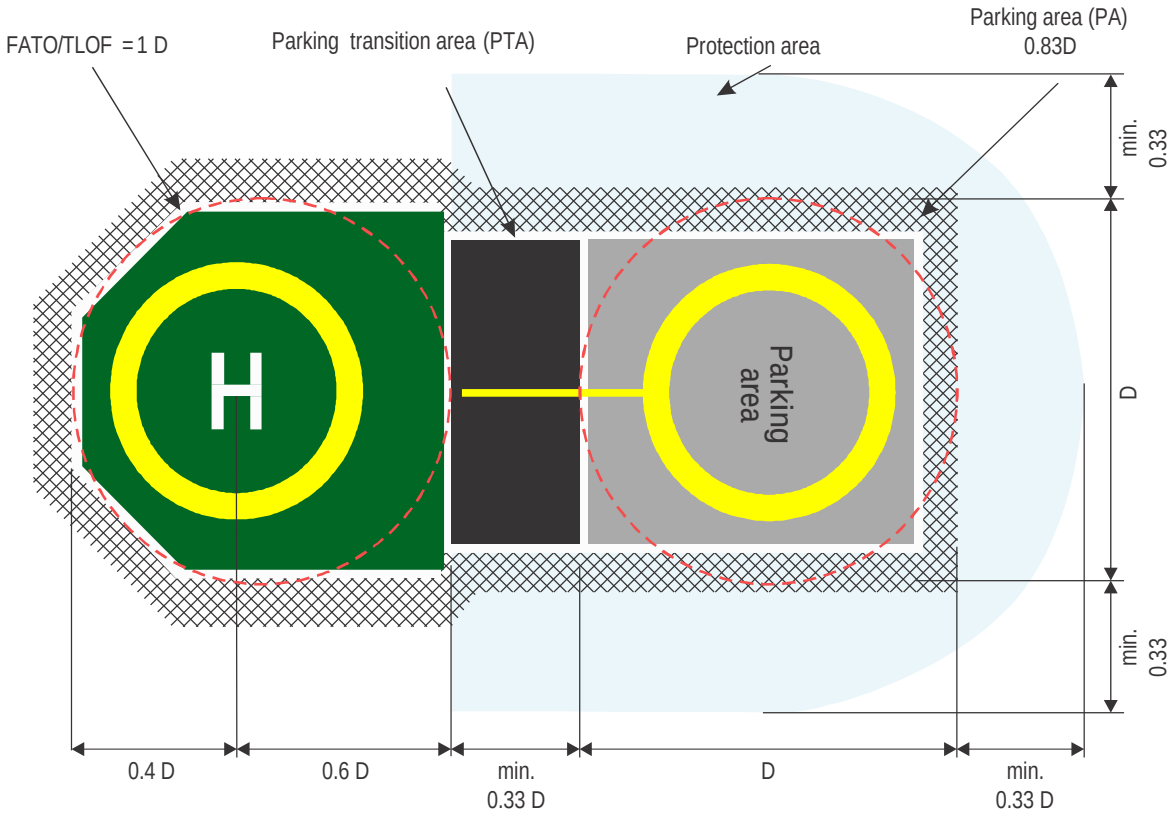


Figure I-8-2. General arrangement for a helideck parking area with offset TD/PM circle

8.1.5. For some offshore facilities, it may not be practical to accommodate a full helideck parking area adjacent to the landing area. In this case, consideration may be given to providing an extension to the landing area, known as a limited parking area (LPA) or push-in parking area (PIPA), separated from the landing area by a PTA (see Section 8.1.6) and designed to accommodate only a fully shutdown helicopter. In this case it is intended helicopters shall be shut down on the landing area and ground handled to and from the LPA/ PIPA. The arrangement for an LPA/PIPA is shown in Figure I-8-3. Similar to a parking area, the LPA/PIPA is bounded by a solid white edge buffer line, and shall be painted in a colour that contrasts effectively with the landing area (and the PTA).

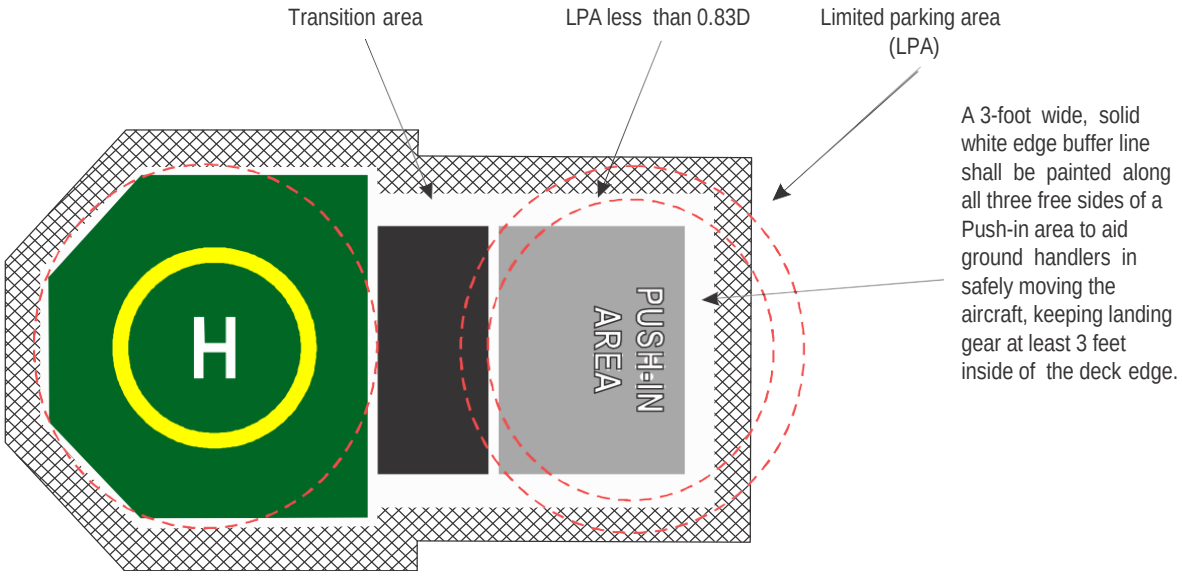


Figure I-8-3. General arrangement for a helideck limited parking area (LPA)/ push-in parking area (PIPA)

8.1.6. In all cases, the PTA provides a sterile area between the edge of the TLOF and the edge of the parking area or LPA/PIPA, and is used to transition the helicopter to and from the parking or LPA/PIPA, whether performing an air taxiing or ground taxiing manoeuvre to the parking area or, in the case of a disabled helicopter, towing or pushing the helicopter clear of the landing area (for an LPA/PIPA the helicopter will always be pushed-in). The PTA provides a minimum 1/3 (0.33) D clearance between a static (parked) helicopter and a helicopter taking off or landing at the TLOF, and shall be painted in black for the area between the TLOF perimeter marking and the inboard perimeter of the parking (or push-in parking) area (both defined with 30 cm (1 ft) white lines). During normal operations no part of either helicopter, whether parked in the parking or LPA/push-in parking area, or operating into the landing area, shall intrude into the PTA. Assuming the parking area can accommodate the same size (design) helicopter as is assumed for the landing area, there will be no requirement to provide additional markings in the PTA. The parking transition area is shown in Figure I-8-4.

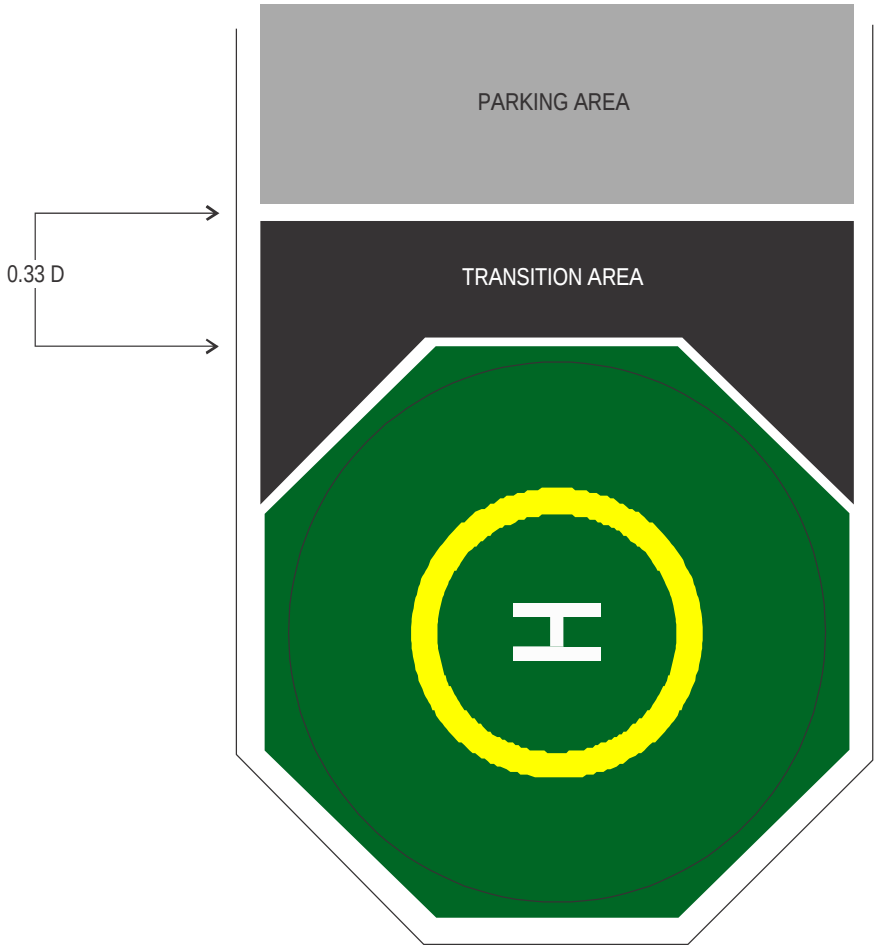
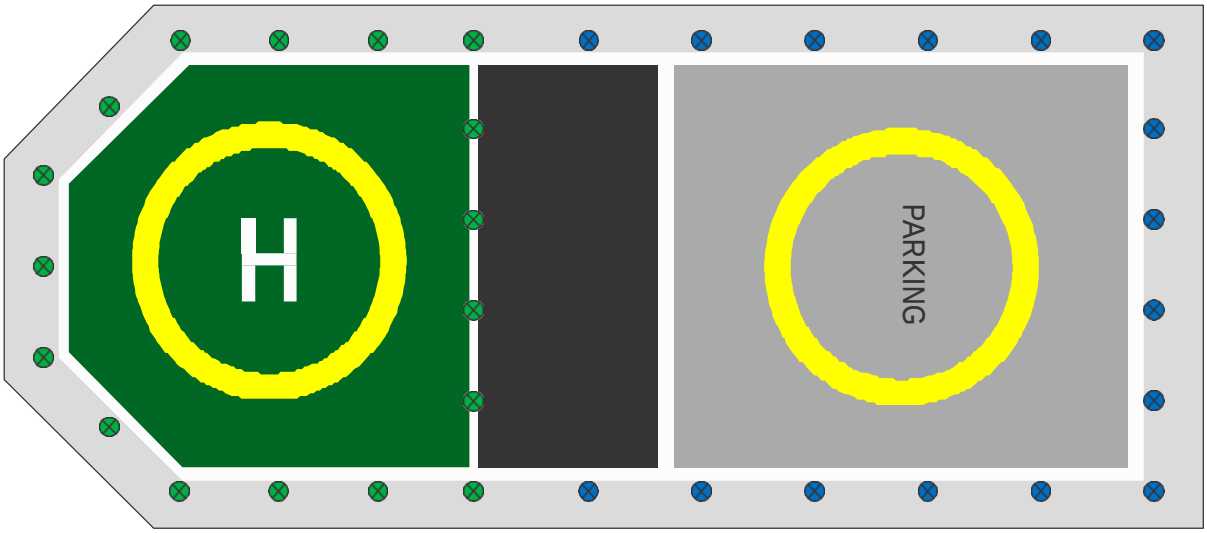


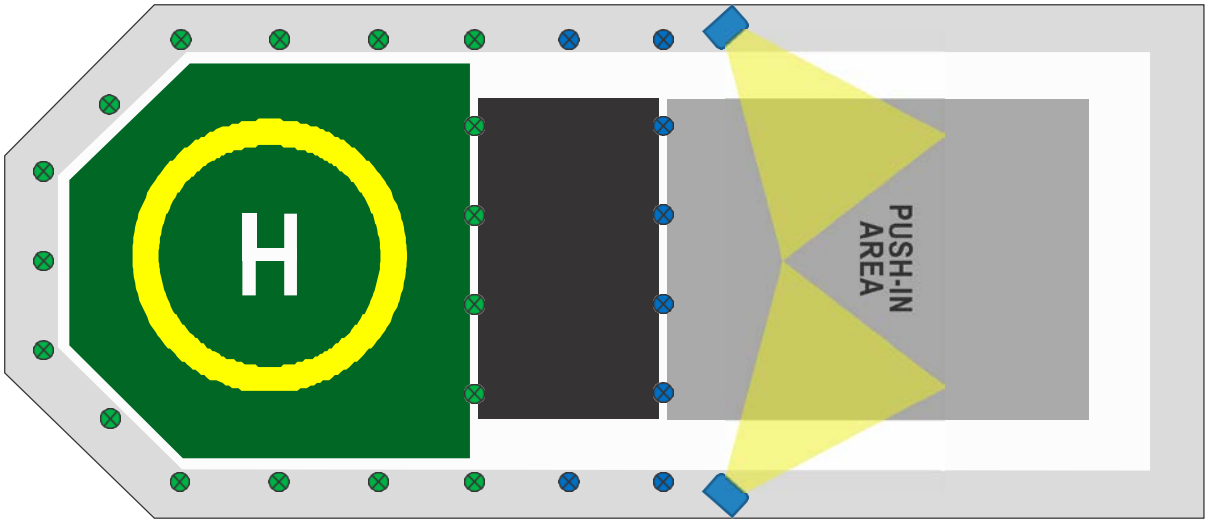
Figure I-8-4. Parking transition area (PTA)

8.1.7. To provide illumination to a parking area at night, and to ensure a pilot is able to differentiate between the parking area and the landing area, it is recommended that deck-mounted floodlights, with louvers, be arranged along either side of the parking area (for guidance on the number and use of floodlighting see Chapter 5, 5.13). Alternatively, where point source (coloured) lights are preferred, or are utilized in addition to floodlights, then the colour green shall be avoided for the parking area and the associated PTA — instead blue lights are preferred. The perimeter lights on the parking area do not need to be viewed at range, as do the TLOF perimeter lights (see Chapter 5, 5.12) and therefore parking area perimeter lights shall be a blue low intensity light — no less than 5 cd at any angle of elevation (and subject to a maximum of 60 cd at any angle of elevation). Lighting arrangements for parking areas and PIPAs are illustrated in Figures I-8-5 and I-8-6 respectively.



Note.— For parking areas and limited parking areas (LPA) where hover taxi and/or ground taxi is authorized, blue lights shall extend along the transition area and the (L)PA.

Figure I-8-5. Landing and parking area deck lighting scheme



Note.— The PIPA shall be provided with floodlighting. If hover taxi and/or ground taxi is still allowed in the transition area (TA), the TA perimeter lights should be in a blue colour. If no taxiing is allowed in the TA, then floodlights would also be recommended.

Figure I-8-6. Floodlighting scheme for a helideck push-in parking area (PIPA) connected via a PTA to a 0.83 D TLOF

8.1.8. The following sections, supported by Figures I-8-7 and I-8-8, address how a helicopter may be taxied from the landing area to the parking area, by reference to the 15 cm (6 in) yellow taxiway alignment line (see Figures I-8-7 and I-8-8) and then shut down on a heading which keeps the tail clear of any obstructions that may be present in the vicinity of the parking area. Where an obstacle is in close proximity to, or infringes the parking protection area, a “no nose” marking may be necessary to prevent the helicopter tail rotor from coming into line with an object, as illustrated by Figure I-8-8.

8.1.9. Manoeuvring (360 degrees) in the PA as a hover or ground taxi operation is acceptable. The nose of the helicopter shall be located over the yellow portion of the PCOM when shutdown, i.e., the nose of the helicopter shall not be located over the white portion of the PCOM circle during or while shutdown.

8.1.10. A PCOM marking can be used to avoid the tail rotor being positioned in the vicinity of an exit or emergency exit.

8.1.11. The coverage of the white portion of the PCOM will depend on the size of the obstacle to be avoided but, when used, it is recommended the minimum (angular) size shall be no less than 30 degrees.

8.1.12. A “no nose” marking shall be used to avoid the tail rotor being positioned in the vicinity of an obstacle that is very near to, or infringes the 0.33 D parking protection area.

8.1.13. A “no nose” marking provides visual cues for aircrew indicating that the “helicopter’s nose” shall not be manoeuvred or parked in a particular direction. Figure I-8-8 shows a helicopter manoeuvring and parking orientation restriction, to avoid infringement of a tail rotor hazard.

8.1.14. A “no nose” marking shall be on a white background with a red border and the words “no nose” located on the touchdown parking circle (TDPC) as shown in (Figure I-8-8). The “no nose” marking size will depend on the size of the area or obstacle to be avoided by

the tail rotor/tail boom. It is recommended that the minimum (angular) size shall not be less than 30 degrees. One or multiple obstacles may be covered by this sector.

Note: *Consistent with the arrangements for the landing area (see Chapter 3, 3.5 for helidecks and Chapter 3, 3.6 for shipboard heliports) provisions shall be put in place for parking or limited parking/ push-in areas/parking transition areas to ensure adequate surface drainage arrangements and a skid-resistant surface for helicopters and persons operating on the parking or limited parking/push-in parking areas/parking transition areas. When tying down helicopters in the parking area, it is prudent to ensure sufficient tie-down points are located about the touchdown/positioning marking circle (see Chapter 3, 3.5.6 and 3.6.6). A method to secure a helicopter in the push-in area shall also be considered. Where necessary a safety device, whether netting or shelving, shall be located around the perimeter of the parking area or limited parking/push-in area (and the parking transition area). Parking areas may be provided with one or more access points to allow personnel to move to and from the parking area without having to pass through the PTA to the landing area.*

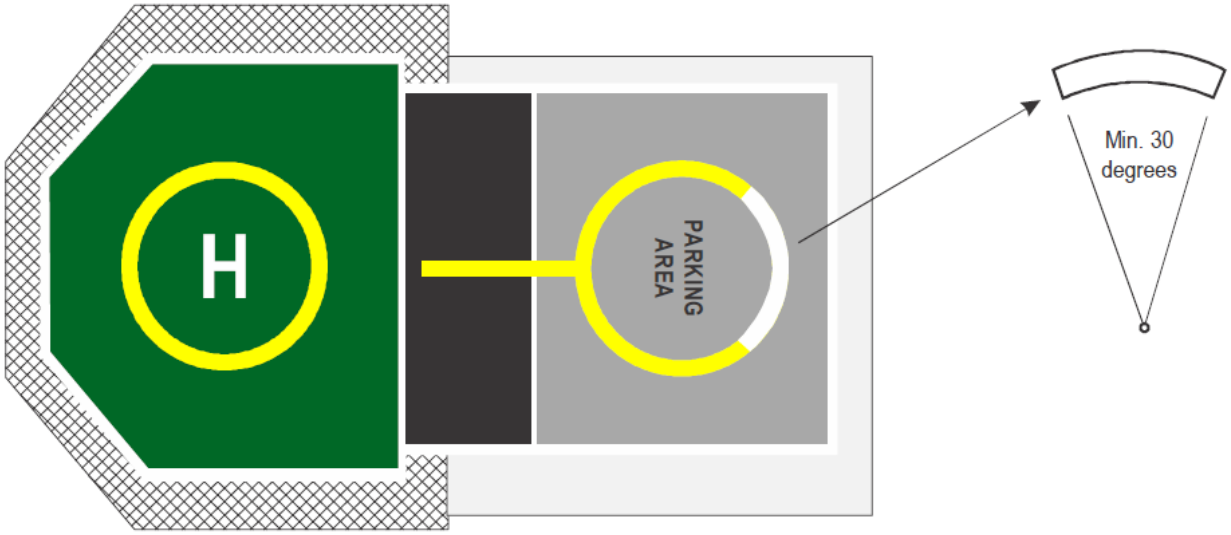


Figure I-8-7. Touchdown parking circle (TDPC) and parking circle orientation marking (PCOM)

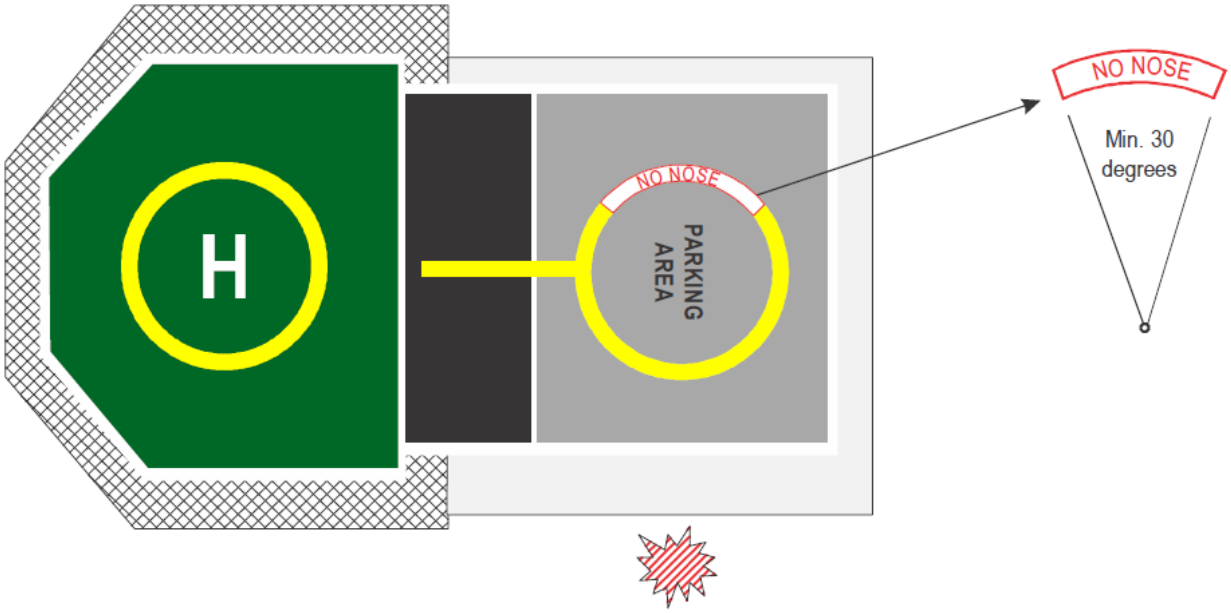


Figure I-8-8. No nose marking

8.2. METEOROLOGICAL EQUIPMENT PROVISION

8.2.1. Accurate, timely and complete meteorological observations are necessary to support safe and efficient helicopter operations. It is strongly recommended that manned, fixed and floating facilities and vessels 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 cloud base (above mean sea level (AMSL));
e) visibility; and
f) present weather.

8.2.2. Where a fixed, manned facility is in close proximity to another fixed, manned facility, close as determined by the SCAA, it may not be deemed necessary for every facility to be provided the above equipment, as long as those facilities which are equipped are given to make their information routinely available to the others. For other facilities, a manual means of verifying and updating the visual elements of an observation, i.e., cloud amount and height of base, visibility and present weather, may be used. For not permanently attended installations (NPAIs) and for those fixed and floating facilities and vessels deemed to have a low movement rate, as determined by the SCAA, it may be acceptable just to provide the basic elements of wind, pressure, air temperature and dew point temperature information.

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

8.2.4. Equipment sensors used to provide the data listed in Section 8.2.1. a) to f) shall be periodically calibrated in accordance with manufacturers' recommendations in order to

demonstrate continuing adequacy for purpose. Procedures for calibration of meteorological equipment shall be documented in the offshore duty holder's/vessel operator's management system (as applicable).

8.2.5. Additional guidance relating to the provision of meteorological information from offshore facilities and vessels may be contained in Azerbaijan Aviation Rules- Aeronautical Meteorological Provision.

8.2.6. Personnel who carry out meteorological observations on offshore installations should undergo formal meteorological observer training and be certificated by a SCAA approved training organisation for this role. Observers should complete refresher training provided by a SCAA approved training organisation every two years to ensure they remain familiar with any changes to meteorological observing practices and procedures.

8.2.7. Training on the use of contingency meteorological equipment and procedures should be provided to enable a suitable level of accuracy and regularity of observations to be maintained in case of the failure or unavailability of automated sensors.

8.3. DECK MOTIONS REPORTING AND RECORDING

8.3.1. Floating facilities and vessels experience dynamic motions due to wave action, which represent a potential hazard to helicopter operations. Although the ability of a floating facility or vessel to sometimes manoeuvre may be helpful in providing an acceptable wind direction in relation to the helideck/shipboard heliport location, it is likely that floating facilities and vessels will still suffer downtime due to excessive deck motions. Downtime can be minimized by careful consideration of the location of the landing area at the design stage (see Chapter 3, 3.2.5). However, to a greater or lesser degree floating facilities and vessels remain subject to movement at the helideck/heliport in pitch and roll, in deck inclination and in heave (usually measured as rate of heave).

8.3.2. It is necessary for these motions to be recorded by the use of an electronic helideck motion system (HMS) and reported as part of the overall offshore weather report (see Section 8.2.5), prior to landing and during helicopter movements. An HMS shall be equipped with a colour-coded display which allows a trained operative to easily determine whether the landing area is in-limits, or is out-of-limits, or is moving towards a condition where it may soon be out-of-limits. Motions at the helideck/heliport shall be reported to the helicopter operator to an accuracy of one decimal place. The helicopter pilot, in order to make vital safety decisions, is concerned with the degree of inclination 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 created, for example, by a list created by anchor patterns or displacement.

8.3.3. Research indicates that the likelihood of a helicopter tipping or sliding while touched down on a helideck or shipboard heliport (especially with rotors running, turning and burning on the landing area) is directly related to helideck/heliport accelerations and to the prevailing wind conditions. Ideally an HMS shall incorporate additional software which allows for on deck motion severity and wind severity index limits to be recorded and communicated to aircrew; in a similar way that pre-landing limits are disseminated to a pilot.

8.3.4. To provide aircrew with a visual indication of the current status of a helideck/shipboard heliport it may be helpful to employ a traffic light system consisting of three lights mounted at three to four locations around the edge of a helideck/heliport. These lights shall avoid the use of the colour green (green is used for TLOF perimeter lights), but could consist of blue/amber and red, where blue is safe within limits, amber is moving out of limits towards an unsafe condition and red is out of limits: unsafe condition.

8.4. COMMUNICATIONS AND NAVIGATION EQUIPMENT

8.4.1. On most facilities, fixed and floating, and on vessels, the radio operator (RO) is the initial and final point of contact between flight crew and the facility/vessel. However, as continuous line of sight to the landing area is often not possible to provide from the radio room, it is advisable to equip helideck/heliport personnel (e.g. HLOs and helideck assistants (HDAs)) with portable aeronautical headsets, the use of which they shall be suitably trained in.

8.4.2. A major advantage of having a radio-equipped person on the helideck/heliport is that they can maintain visual as well as radio communication during the circuit, final approach and landing, therefore providing the helicopter crew with further positive identification of the facility (or vessel) and thereby reducing the incidence for a wrong deck landing (see also Chapter 5, 5.1.5). A radio-equipped person is also in a good position to warn of any developing issues while the helicopter is on deck.

8.4.3. Hand-over and general R/T procedures employed shall be standard R/T phrases and vocabulary only, to avoid misunderstandings. Communications shall be kept brief, avoiding any unnecessary chatter on the selected aeronautical frequency and shall be confined to essential dialogue between flight crew and the HLO.

8.4.4. Offshore fixed and floating facilities and vessels that have aeronautical radio equipment and/or aeronautical non-directional beacons (NDBs) on them shall hold a valid approval issued by the SCAA in which they operate.

8.5. HELICOPTER REFUELLING OPERATIONS

8.5.1. It is essential to ensure at all times that aviation fuel delivered to helicopters from offshore facilities and vessels is of the highest quality. A major contributor towards ensuring that fuel quality is maintained, and contamination prevented, is the provision of clear, 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 codes. Markings shall be applied initially during systems manufacture and routinely checked for clarity during subsequent maintenance inspections.

8.5.2. It shall be noted that an offshore fuelling system may vary according to the particular application for which it was designed. Nevertheless the elements of all offshore fuelling systems are similar and will include:

a) storage tanks;
b) static storage facilities, and if installed, a sample reclaim tank;
c) a pumping system; and
d) a delivery system.

8.5.3. When preparing a layout design for aviation fuelling systems on offshore facilities and vessels, it is important to make provisions for suitable segregation and bunding of the areas set aside for the tankage and delivery system. Facilities for containing possible fuel leakage and providing fire control shall be given full and proper consideration, along with adequate protection from potential dropped objects. The design of the elements of an offshore fuelling system is not addressed in detail in this manual. For detailed guidance, refer to the Air Transport Association Specification 103 (Standard for Jet Fuel Quality Control at Airports).

8.5.4. 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 refuelling responsibilities

shall be certified as properly trained and competent to undertake systems maintenance, inspection and fuelling of helicopters.

8.5.5. Throughout the critical processes of aviation fuel system maintenance and fuelling operations, routine fuel sampling is required to ensure delivered fuel is scrupulously clean and free from contamination that may otherwise enter helicopter fuel tanks and could ultimately result in engine malfunctions.

8.5.6. Fuel samples drawn from transit/static storage tanks and the fuel delivery system shall be retained in appropriate containers for a specified period. The containers shall be kept in a secure light-excluding store and kept away from sunlight until they are disposed of.

8.5.7. Guidance on the design of containers is provided by the International Air Transport Association (IATA). The IATA fuel guidelines provide an essential set of standards designed to ensure safe and efficient aircraft fuel handling and contribute to training of fuelling operatives for oil companies or into-plane service providers.

8.6. BIRD CONTROL AT NORMALLY UNATTENDED OFFSHORE FACILITIES

8.6.1. Bird guano infestations may be routinely encountered, particularly at NPAIs, and especially at certain times of the year for facilities located in proximity to bird migratory routes. (The problem is most severe at not permanently attended facilities since, at attended facilities, on-board activities will tend to scare the birds away). The effects of bird guano infestation are many and include threats to safe flight operations (e.g. potential for a bird strike during an approach), the obliteration of essential markings (so making touchdown/positioning inaccuracies more likely), a reduction in the friction qualities of the surface (leading to a helicopter sliding over the deck surface) and effects on personnel health and safety due to the highly toxic and slippery nature of guano (e.g. effect on the lungs due to inhalation of dried guano dust, slips on wet guano surfaces). Also to consider are the additional costs incurred through a requirement for more regular maintenance of static equipment on a facility, of damage caused to the interior of the helicopter (guano is trodden onto floor surfaces) and the need to perform high-pressure cleaning on a regular basis to restore the integrity of markings, etc.

8.6.2. Problems caused by the presence of sea birds and guano infestation on or around the landing area shall be noted and reported by flight crews. Significant surface contamination is likely to incur flight restrictions where, for example, the build-up of guano has a detrimental effect on the interpretation of surface markings and an inability to maintain an adequate friction surface. Routinely, for affected facilities, flight crew shall be encouraged to complete and file helideck condition reports that indicate the current condition of the surface, of helideck lighting (including any outages) and of the windsock (including illumination).

8.6.3. Experience over time in various sectors would suggest that finding permanent solutions to the guano/bird problem can be challenging, and consequently, determining an optimum solution to the problem has proven elusive. In the past, active measures taken to discourage sea birds from roosting on helidecks has included visual deterrents, different audio deterrents (e.g. distress calls) and even combined audio/visual deterrents that build in random changes. However, over time, birds have tended to habituate to any of these solutions that involve audio and/or visual deterrents, even where these incorporate random changes.

8.6.4. One possible solution that has been found to be more effective than most of the aforementioned is the application of pressurised water-spray systems, to which birds do not appear to readily habituate (pressurized water could be delivered from an automated firefighting deck integrated firefighting system (DIFFS) or a ring-main system (RMS)

where bird activities are being monitored, from the beach or from a normally attended platform, via a remotely operated TV system (ROTS)). When water combined with an effective bird-scaring device is activated automatically as birds are detected around the landing area, the combination has proven to be relatively effective in dispersing birds that may have encroached onto the helideck. However, it is fair to conclude that current bird-exclusion methods have at best been only partially successful, so there is room for more innovative approaches to bird control measures at helidecks.

APPENDIX 1-A – SAMPLE RISK ASSESSMENT FOR HELICOPTER OPERATIONS TO HELIDECKS AND SHIPBOARD HELIPORTS WHICH ARE SUB-1 D

Table I-A-1 could form the basis of an aeronautical study (risk assessment) conducted by, or on behalf of, an offshore helicopter operator when intending to service helidecks or shipboard heliports with limited touchdown directions using helicopters with an overall length (D) greater than the design D of the touchdown and lift-off area (TLOF) (referred to in this document as a sub-1 D operation). The assumption is made that sub-1 D operations will be considered only in the following circumstances and when applying the following conditions:

a) for a helideck that provides a load-bearing surface (represented by the TLOF) of between 0.83 D and 1 D, a minimum 1 D circle (representing the final approach and take-off area (FATO)) shall be assured for the containment of the helicopter. From the periphery of the FATO (not the TLOF) the limited obstacle sector (LOS) extends; the non-load-bearing area between the TLOF perimeter and the FATO perimeter shall be entirely free of 'non-permitted' obstacles, while ensuring that any permitted objects present for the safety of operation that are located on or around the TLOF perimeter shall not exceed the obstruction height criteria set out in d) below;

b) this assessment may be considered for any helideck on a fixed offshore installation. A floating installation or vessel that is subject to dynamic motions may be considered provided deck motions are maintained within benign limits as determined of operation, e.g. stable deck conditions – specified criteria in pitch roll and heave;

c) this assessment, when applied to helidecks completed on or before 1 January 2012, or shipboard heliports completed on or before 1 January 2015, may take advantage of an AAR-AGA-002 alleviation permitting the outboard edge of the (approximately) 1.5 m (5 ft) helideck perimeter netting to extend above the level of the landing area by no more than 25 cm (10 in). However, for helidecks completed on or after 1 January 2012 and shipboard heliports completed on or after 1 January 2015, AAR-AGA-002 requires that the height of the helideck safety net shall be no greater than the adjacent helideck load-bearing surface (TLOF);

d) for helidecks that are less than 1 D and/or having a D-value which is 16.00 m (52.5 ft) or less, AAR-AGA-002 prescribes the height limit for essential objects around the edge of the TLOF, and in the first segment of the LOS, to be 5 cm (2 in). "Essential objects" permitted around the edge of the TLOF are notified in Chapter 3 of this manual and include helideck guttering with raised kerb, helideck lighting systems and foam monitors (or ring-main system) where provided;

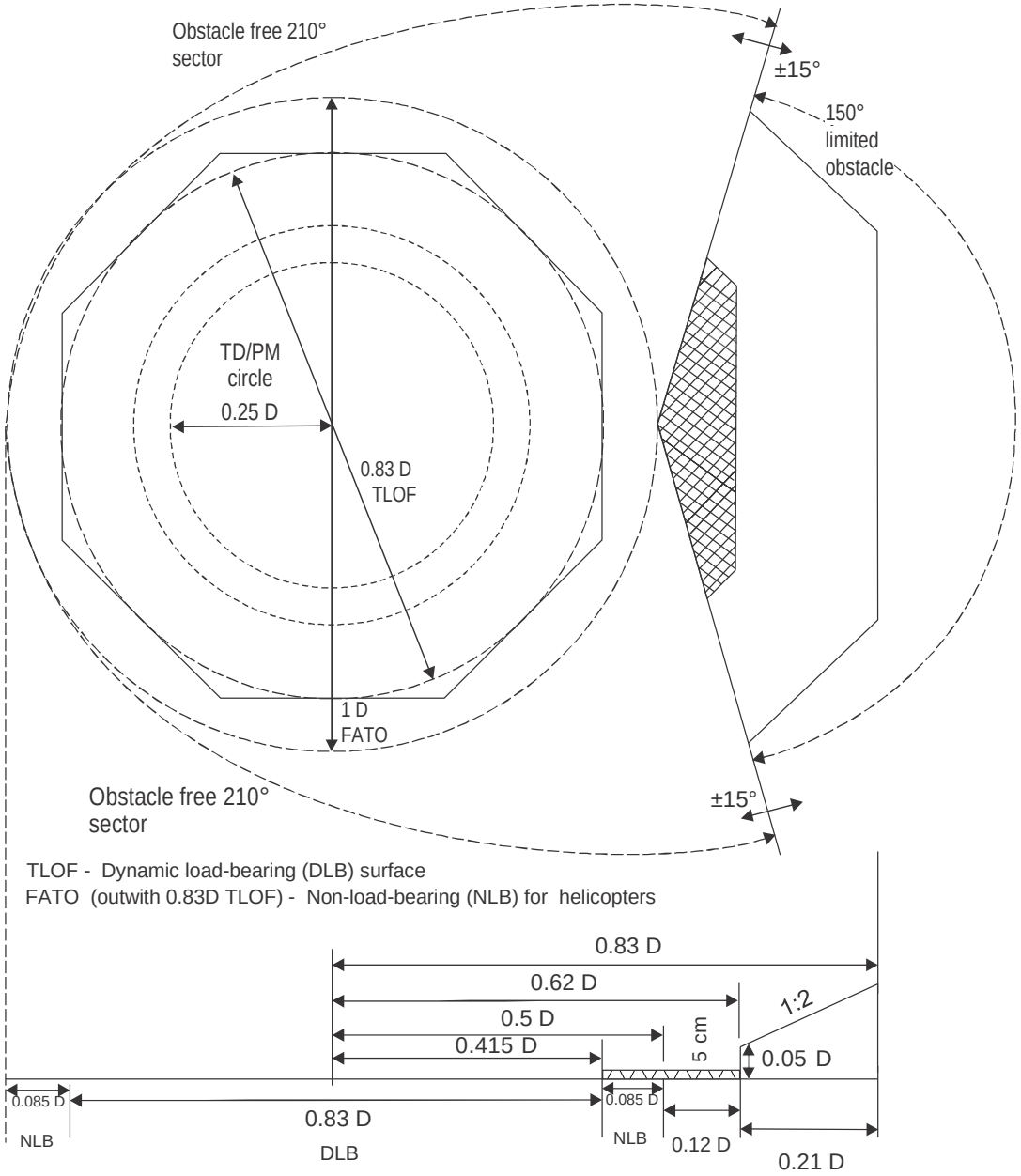
e) Figure I-A-1 illustrates a 0.83 D minimum size TLOF. The inner circle bounded by the octagon-shaped helideck represents the sub-1 D TLOF (in the illustration a 0.83 D load-bearing surface). The outer circle illustrates the 1 D FATO which provides containment of the helicopter and from which is derived the origin of the LOS. Where practical, the chevron denoting the origin of the LOS shall be physically marked at the periphery of the FATO, (see Chapter 5, 5.9.5 and Figure I-5-8). The diameter of the FATO is the declared D-value, marked at the chevron; and

f) operations to sub-1 D helidecks and shipboard heliports shall not be considered below 0.83 D.

Table I-A-1

Issues to be addressed	*Considerations/mitigations accounting for compromise*
Reduction of the distance from helideck (TLOF) centre to the limited obstacle sector (LOS) (denoting the origin of the 1st and 2nd segments)	It is essential that clearance from obstacles in the LOS is maintained; for this reason, the sub-1 D TLOF should be surrounded by a 1 D circle (the FATO) that is (with the exception of permitted objects) free of any obstacles. To ensure that obstacle clearances are maintained for the helicopter, the touchdown/ positioning marking circle (TD/PM) should be 0.5 of the notional 1 D FATO (not of the TLOF), and located at the centre of the TLOF; never offset.
Reduction of suitable and sufficient visual references required for the pilot during all flight phases.	Adequate visual cues provided for aircrew are essential for the conduct of safe operations to helidecks. On a sub-1 D helideck, or shipboard heliport with limited touchdown directions, these will, to some degree, be compromised. An aeronautical study should ensure that visual cues, within the field of view (FOV) are adequate for aircrew to perform the following visual tasks: a) identification of helideck location early on in the approach; b) visual cues to help maintain the sight picture during approach; c) visual cues on final approach to hover position; d) visual cues for landing; and e) visual references on lift-off and hover It is important that helideck markings and deck mounted lighting (where provided) remain uncontaminated at all times (e.g. deposits of guano on the surface of a helideck, or shipboard heliport, may compromise markings and/or deck-mounted lighting). A windsock should be provided to facilitate an accurate indication of wind direction and strength over the helideck. For night operations, lighting systems should include effective obstruction lighting in addition to helideck lighting and an illuminated windsock.
Reduction of the space available for passengers and crew to safely alight and embark the helicopter and to transit to and from the operating area safely.	A reduction of the operating area entails that clearances between passengers/crew moving around the helideck or shipboard heliport avoiding the helicopter's rotor systems by a safe margin are reduced. This reduction should be considered on a helicopter-type specific basis. It should be ensured that sufficient access points are available to avoid the situation where passengers and crew have to pass close to helicopter 'no-go' areas (e.g. in relation to main and tail rotor systems). Where personnel are required to transit close to the deck edge, procedures should be considered to assure the safe movement of passengers.
Reduction of the space available for securing helicopters for the conduct of safe and efficient refuelling operations (where provided) and for post-crash teams to provide effective fire and rescue intervention in the event of an incident or accident occurring.	The surface area available should accommodate a sufficient tie-down pattern arrangement to allow the most critical helicopter(s) to be tied-down (where required). Where refuelling operations are required, the area available around the helicopter should allow this to occur safely and efficiently at all times. Sufficient access points should be provided to allow helideck fire and rescue teams to move to the scene of an incident or accident from an upwind location and to allow passengers to escape downwind to safety.

Issues to be addressed	*Considerations/mitigations accounting for compromise*
Helicopter elements will be over permitted essential objects at the edge of the TLOF.	According to Annex 14 Volume II, 3.3.13, the permitted height for essential objects located around the TLOF in the 210° obstacle-free sector and in the 1st segment of the 150° limited obstacle sector was reduced from 25 cm (10 in) to 5 cm (2 in) for a TLOF which is less than 1 D and/or 16 m (52.5 ft) or less. For newbuilds this is regarded as adequate mitigation for the reduction of the dimension of the load-bearing area to address the presence of objects which, because of their function, are required to be located immediately around the TLOF.
Reduction of built-in margin to allow for touchdown/positioning inaccuracies during landing.	It should be assumed that even amongst experienced, well trained aircrew there will inevitably be some degree of variability in the actual point of touchdown within the landing area. The TD/PM circle provides an effective visual reference to guide the handling pilot to the point of touchdown, but scatter has potential to occur, particularly when external factors beyond a pilot's control come into play. This may include the influences of prevailing meteorological conditions at the time of landing (e.g. wind, precipitation etc.), and/or any helideck environmental effects encountered (e.g. turbulence, thermal effects). It is essential that a good visual means of assessing wind strength and direction is always provided for the pilot by day and by night. Markings should be kept free of contamination which may reduce a pilot's ability to touchdown accurately. The TD/PM circle and "H" should be lit (or adequately illuminated) for night operations.
Reduction of helpful ground cushion effect from rotor downwash	It is a condition of Annex 14 Volume II that the TLOF should provide ground effect. A reduction of the load-bearing area (TLOF) for sub-1 D operations means that the beneficial effect of ground cushion will likely suffer some reduction. The reduction of helpful ground cushion needs to be considered particularly when operating to a sub- 1D helideck with a perforated surface, i.e. helideck designs that incorporate a passive fire-retarding feature which allows unburned fuel to drain away through specially manufactured holes, forming a drain-hole pattern over the surface of the TLOF.



Note: Height of 5 cm high shaded area is not to scale

Figure I-A-1. Obstacle limitation surface and sectors for a 0.83 D TLOF

APPENDIX 1-B – SPECIFICATION FOR HELIDECK LIGHTING SCHEME COMPRISING: PERIMETER LIGHTS, LIT TOUCHDOWN/POSITIONING MARKING AND LIT HELIPORT IDENTIFICATION MARKING

1. OVERALL OPERATIONAL REQUIREMENT

1.1. The lighting configuration shall be designed to be visible over a range of 3600 in azimuth. it is possible, however, that on some offshore installations the lighting may be obscured from the pilots' view by topsides structure when viewed from some directions. the design of the helideck lighting is not required to address any such obscuration.

1.2 The visibility of the lighting configuration shall be compatible with the normal range of helicopter vertical approach paths from a range of 2 NM.

1.3. The purpose of the lighting configuration is to aid the helicopter pilot perform the necessary visual tasks during approach and landing as stated in Table I-B-1.

Table I-B-1. Visual tasks during approach and landing

Phase of Approach	***Visual Task***	***Visual Cues/ Aids***	***Desired Range (NM)***	
			5 000 m met. vis.	***1 400 m met. vis.***
Helideck location and identification	Search within platform structure.	– shape of helideck; – colour of helideck; – luminance of helideck; and – perimeter lighting.	1.5 (2.8 km)	0.75 (1.4 km)
Final approach	Detect helicopter position in three axes. Detect rate of change of position.	– apparent size/shape and change of size/shape of helideck; and – orientation and change of orientation of known features/markings/lights.	1.0 (1.8 km)	0.5 (900 m)
Hover and landing	Detect helicopter attitude position and rate of change of position in three axes (six degrees of freedom).	– known features/markings/ lights; and – helideck texture.	0.03 (50 m)	0.03 (50 m)

1.4. The minimum intensities of the lighting configuration shall be adequate to ensure that, for a minimum meteorological visibility (met. vis.) of 1 400 m and an illuminance threshold of $10^{-6.1}$ lux, each feature of the system is visible and useable at night from ranges in accordance with the following:

a. the perimeter lights are to be visible and usable at night from a minimum range of 0.75 NM;
b. the touchdown/positioning marking (TD/PM) circle on the helideck is to be visible and usable at night from a range of 0.5 NM; and
c. the heliport identification marking ('H') is visible and usable at night from a range of 0.25 NM.

1.5. The minimum ranges at which the TD/PM Circle and 'H' are visible and useable shall still be achieved even where a correctly fitted landing net covers the lighting.

1.6. The design of the perimeter lights, TD/PM Circle and 'H' shall 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'.

1.7. The design of the TD/PM Circle and 'H' shall include a facility to enable their intensity to be increased by up to approximately two times the figures given in this specification to permit a once-off (tamperproof) adjustment at installation; the average intensity over 360^0 in azimuth at each elevation shall not exceed the maximum figures. The purpose of this facility is to ensure adequate performance at installations with high levels of background lighting without risking glare at less well-lit installations. The TD/PM Circle and 'H' shall be adjusted together using a single control to ensure that the balance of the overall lighting system is maintained in both the 'standard' and 'bright' settings.

2. DEFINITIONS

2.1 The following definitions shall apply:

2.1.1 *Lighting Element.* A lighting element is a light source within a segment or subsection and may be discrete (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 and may include a lens/diffuser.

2.1.2 *Segment.* 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, including any lenses/diffusers.

2.13 *Subsection.* A subsection is an individual section of the 'H' lighting. For the purposes of this specification, the dimensions of a subsection are the length and width of the smallest possible rectangular area that is defined by the outer edges of the lighting elements, including any lenses/diffusers.

3. THE PERIMETER LIGHT REQUIREMENT

3.1 CONFIGURATION

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

3.2 MECHANICAL CONSTRAINTS

For any helideck 1 D or greater, where the D-value is also greater than 16 m (52.5 ft), the perimeter lights shall not exceed a height of 25 cm (10 in), but ideally 15 cm (6 in), above the surface of the helideck. Where a helideck has a D-value of 16 m (52.5 ft) or less and/or is less than 1 D, the perimeter lights shall not exceed a height of 5 cm above the surface of the helideck.

3.3 LIGHT INTENSITY

3.3.1 The minimum light intensity profile is given in Table I-B-2 below:

Table I-B-2. Minimum light intensity profile for perimeter lights

Elevation	*Azimuth*	*Intensity (min)*
0^0 to 10^0	-180^0 to $+180^0$	30 cd
$>10^0$ to 20^0	-180^0 to $+180^0$	15 cd
$> 20^0$ to 90^0	-180^0 to $+180^0$	3 cd

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

3.4 COLOUR

3.4.1 The colour of the light emitted by the perimeter lights shall be green, as defined in paragraph 3.4.2, whose chromaticity lies within the following boundaries:

Yellow boundary x = 0.310

White boundary x = 0.625 y – 0.041

Blue boundary y = 0.400

3.4.2 The above assumes that solid state light sources are used. Filament light sources shall be within the following boundaries:

Green
Yellow boundary x=0.360-0.080y
White boundary x=0.650y
Blue boundary y=0.390-0.171x

3.5 SERVICEABILITY

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

4. THE TOUCHDOWN/POSITIONING MARKING CIRCLE REQUIREMENT

4.1 CONFIGURATION

The lit TD/PM circle shall be superimposed on the yellow painted marking, such that it is concentric with the painted circle and contained within it. It shall comprise one or more concentric circles of at least sixteen discrete lighting segments, of at least 40 mm (1.5 in) minimum width. The segments shall either be straight or curve in sympathy with the painted circle. A single circle shall be positioned such that the radius of the circle formed by the centre line of the lighting segments is within 10 cm (4 in) of the mean radius of the painted circle. Multiple circles shall be symmetrically disposed about the mean radius of the painted circle, each circle individually meeting the specification contained in this Appendix. The lighting segments shall be of such a length as to provide coverage of between 50 per cent and 75 per cent of the circumference and be equidistantly placed with the gaps between them not less than 0.5 m (1.6 ft). A single non-standard gap up to 25 per cent larger or smaller than the remainder of the circle is permitted at one location to facilitate cable entry. The mechanical housing shall be coloured yellow.

4.2 MECHANICAL CONSTRAINTS

4.2.1 The height of the lit TD/PM circle fixtures (e.g. segments) and any associated cabling shall be as low as possible and shall not exceed 25 mm (1 in). The overall height of the system, taking account of any mounting arrangements, shall be kept to a minimum. So as not to present a trip hazard, the segments shall not present any vertical outside edge greater than 6 mm (0.2 in) without chamfering at an angle not exceeding 30^0 from the horizontal.

4.2.2 The overall effect of the lighting segments and cabling on deck friction shall be minimized. Wherever practical, the surfaces of the lighting segments shall meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.

4.2.3 The TD/PM circle lighting components, fitments and cabling shall be able to withstand a pressure of at least 1 655 kPa (240 lbs/in^2) and ideally 3 250 kPa (471 lbs/in^2) without damage.

4.3 INTENSITY

4.3.1 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 I-B-1), shall be as defined in Table I-B-3.

Table I-B-3. Light intensity for lighting segments on the TD/PM circle

Elevation	*Intensity*	
	Min	*Max*
0^0 to 10^0	As a function of segment length as defined in Figure I-B-2.	60 cd
> 10^0 to 20^0	25% of min intensity > 0^0 to 10^0	45 cd
> 20^0 to 90^0	5% of min intensity > 0^0 to 10^0	15 cd

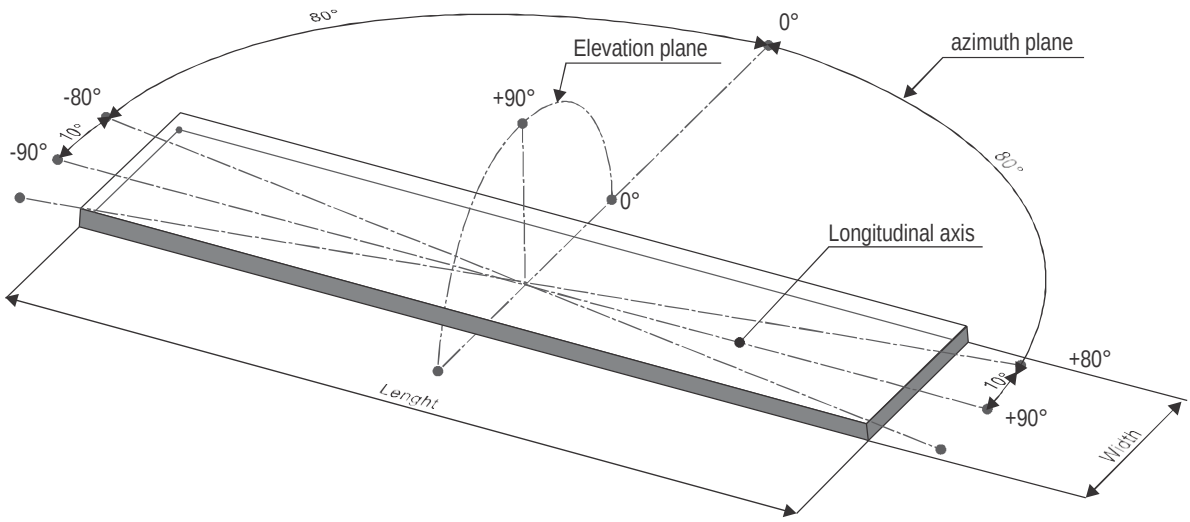


Figure I-B-1. TD/PM segment measurement axis system

4.3.2 For the remaining angles of azimuth on either side of the longitudinal axis of the segment, the maximum intensity shall be as defined in Table I-B-3.

4.3.3 The intensity of each lighting segment shall be nominally symmetrical about its longitudinal axis. The design of the TD/PM circle shall be such that the luminance of the TD/PM circle segments is equal to or greater than the subsections of the ‘H’.

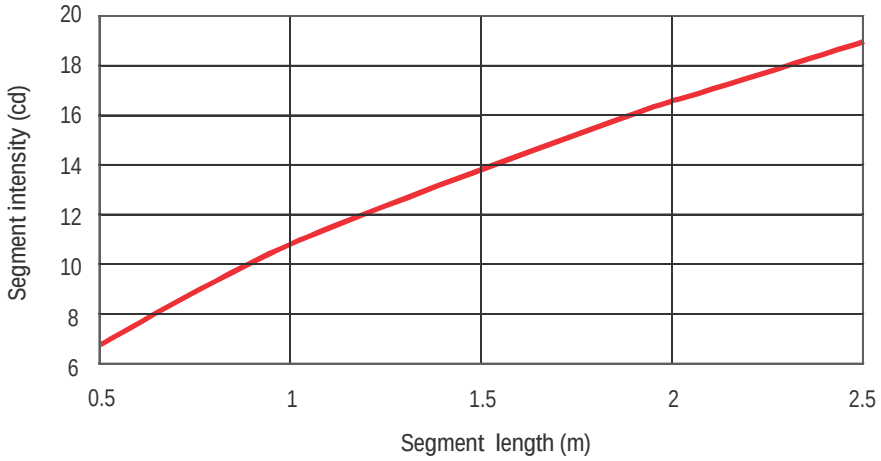


Figure I-B-2. TD/PM Segment intensity versus segment length

Note: *Given the minimum gap size of 0.5 m (1.6 ft) and the minimum coverage of 50 per cent, the minimum segment length is 0.5 m (1.6 ft). The maximum segment length depends on deck size but is given by selecting the minimum number of segments (16) and the maximum coverage (75 per cent).*

4.3.4 If a segment is made up of a number of individual lighting elements (e.g. LEDs) then they shall be of the same nominal performance (i.e. within manufacturing tolerances) and be equidistantly spaced throughout the segment to aid textural cueing. Minimum spacing between the illuminated areas of the lighting elements shall be 3 cm (1.2 in) and maximum spacing 10 cm (4 in).

4.3.5 On the assumption that the intensities of the lighting elements will add linearly at longer viewing ranges where intensity is more important, the minimum intensity of each lighting element (i) shall be given by the formula:

$$i = I / n$$

where: I = required minimum intensity of segment at the ‘look down’

(elevation) angle (see Table I-B-3).

n = the number of lighting elements within the segment.

Note:*The maximum intensity of a lighting element at each angle of elevation shall also be divided by the number of lighting elements within the segment.*

4.3.6 If the segment comprises a continuous lighting element (e.g. fibre optic cable, electro luminescent panel), then to achieve textural cueing at short range, the element shall be masked at 3 cm (1.2 in) intervals on a 1:1 mark-space ratio.

4.4 COLOUR

4.4.1 The colour of the light emitted by the TD/PM circle shall be yellow, as:

Yellow
Red boundary y=0.382
White boundary y=0.790-0.667x
Green boundary y=x-0.120

whose chromaticity is within the following boundaries:

Red boundary y = 0.387
White boundary y = 0.980 – x
Green boundary y = 0.727x + 0.054

4.4.2 The above assumes that solid state light sources are used. Filament light sources shall be within the following boundaries:

Green
Yellow boundary x=0.360-0.080y
White boundary x=0.650y
Blue boundary y=0.390-0.171x

4.5 SERVICEABILITY

The TD/PM circle: At least 90 per cent of the lighting elements shall be operating for the TD/PM circle to be considered serviceable.

5. THE HELIPORT IDENTIFICATION MARKING REQUIREMENT

5.1 CONFIGURATION

5.1.1 The lit heliport identification marking ('H') shall be superimposed on the 4 m x 3 m (13 ft x 10 ft) white painted 'H' (limb width 0.75 m (2.5 ft)). The lit 'H' shall be 3.9 m to 4.1 m (13 ft x 13.5 ft) high, 2.9 to 3.1 m (9.5 ft x 10 ft) wide and have a stroke width of 0.7 m to 0.8 m (2.3 ft x 2.6 ft). The centre point of the lit 'H' may be offset from the centre point of the painted 'H' in any direction by up to 10 cm (4 in) in order to facilitate installation (e.g. avoid a DIFFS nozzle on the helideck surface). The limbs shall be lit in outline form as shown in Figure I-B-3.

5.1.2 An outline lit 'H' shall comprise subsections of between 80 mm (3 in) and 100 mm (4 in) wide around the outer edge of the painted 'H' (see Figure I-B-3). There are no restrictions on the length of the subsections, but the gaps between them shall not be greater than 10 cm (4 in). The mechanical housing shall be coloured white.

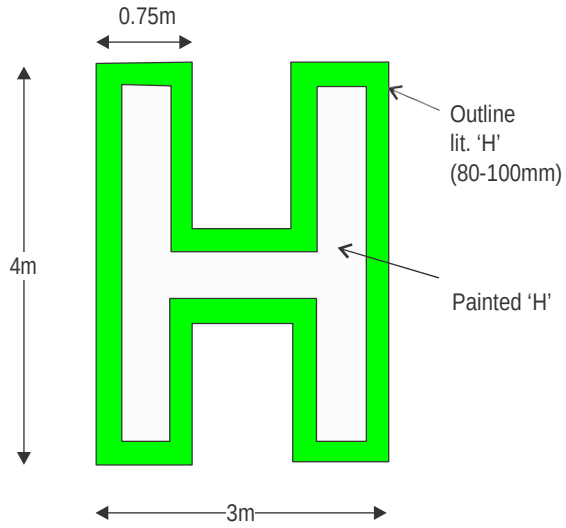


Figure I-B-3. Configuration and nominal dimensions of heliport identification marking 'H'

5.2 MECHANICAL CONSTRAINTS

5.2.1 The height of the lit 'H' fixtures (e.g. subsections) and any associated cabling shall be as low as possible and shall not exceed 25 mm (1 in). The overall height of the system, taking account of any mounting arrangements, shall be kept to a minimum. So as not to present a trip hazard, the lighting strips shall not present any vertical outside edge greater than 6 mm (0.2 in) without chamfering at an angle not exceeding 30^0 from the horizontal.

5.2.2 The overall effect of the lighting subsections and cabling on deck friction shall be minimized. Wherever practical, the surfaces of the lighting subsections shall meet the minimum deck friction limit coefficient (μ) of 0.65, e.g. on non-illuminated surfaces.

5.2.3 The 'H' lighting components, fitments and cabling shall be able to withstand a pressure of at least 1 655 kPa (240 lbs/in^2) and ideally 3 250 kPa (471 lbs/in^2) without damage.

5.3 INTENSITY

5.3.1 The intensity of the lighting along the 4 m (13 ft) edge of an outline 'H' over all angles of azimuth is given in Table I-B-4 below.

Table I-B-4. Light Intensity of the 4 m edge of the 'H'

Elevation	***Intensity***	
	Min	Max
2^0 to 12^0	3.5 cd	60 cd
$>12^0$ to 20^0	0.5 cd	30 cd
$>20^0$ to 90^0	0.2 cd	10 cd

***Note**:For the purposes of demonstrating compliance with this specification, a subsection of the lighting forming the 4 m (13 ft) edge of the 'H' may be used. The minimum length of the subsection shall be 0.5 m (1.6 ft). When testing a subsection, the light intensities defined in Table I-B-4 apply only when viewed at angles of azimuth over the range $+80^0$ to -80^0 from the normal to the longitudinal axis of the strip (see Figure 1). For the remaining angles of azimuth on either side of the longitudinal axis of the subsection, the maximum intensity shall be as defined in Table I-B-4.*

5.3.2 The outline of the H shall be formed using the same lighting elements throughout.

5.3.3 If a subsection is made up of individual lighting elements (e.g. LED's) then they shall be of nominally identical performance (i.e. within manufacturing tolerances) and be equidistantly spaced within the subsection to aid textural cueing. Minimum spacing between the illuminated areas of the lighting elements shall be 3 cm (1.2 in) and maximum spacing 10 cm (4 in).

5.3.4 With reference to paragraph 4.3.5, due to the shorter viewing ranges for the 'H' and the low intensities involved, the minimum intensity of each lighting element (i) for all angles of elevation (i.e. 20 to 900) shall be given by the formula:

$$i = I / n$$

where: I = required minimum intensity of subsection at the 'look down'

(elevation) angle between 2^0 and 12^0 (see Table I-B-4).

n = the number of lighting elements within the subsection

***Note:**The maximum intensity of each lighting element at any angle of elevation shall be the maximum between 2^0 and 12^0 (see Table I-B-4) divided by the number of lighting elements within the subsection.*

5.3.5 If the 'H' is constructed from a continuous light element (e.g. fibre optic cables or panels, electroluminescent panels), the luminance (B) of the 4 m (13 ft) edge of the outline 'H' shall be given by the formula:

$$B = I / A$$

where: I = intensity of the limb (see Table I-B-4).

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

5.3.6 If the subsection comprises a continuous lighting element (e.g. fibre optic cable, electro luminescent panel), then to achieve textural cueing at short range, the element shall be masked at 3 cm (1.2 in) intervals on a 1:1 mark space ratio.

5.4 COLOUR

5.4.1 The colour of the 'H' shall be green, as defined in paragraph 5.4.2, whose chromaticity is within the following boundaries:

Yellow boundary x = 0.310
White boundary x = 0.625y – 0.041
Blue boundary y = 0.400

5.4.2 The above assumes that solid state light sources are used. Filament light sources shall be within the following boundaries:

Green
Yellow boundary x=0.360-0.080y
White boundary x=0.650y
Blue boundary y=0.390-0.171x

5.5 SERVICEABILITY

5.5.1 The 'H': At least 90 per cent of the lighting elements shall be operating for the 'H' to be considered serviceable.

6. GENERAL CHARACTERISTICS

The general characteristics detailed below apply to perimeter lighting as well as the TD/PM circle and 'H' lighting except where otherwise stated.

6.1 REQUIREMENTS

6.1.1 The following items are fully defined and form firm requirements.

6.1.2 All lighting components shall be tested by an independent test house. The photometrical and colour measurements performed in the optical department of this test house shall be accredited according to the version of EN ISO/IEC 17025 current at the time of the testing. The angular sampling intervals shall be: every 10^0 in azimuth; every 1^0 from 0^0 to 10^0; every 2^0 from 10^0 to 20^0 and every 5^0 from 20^0 to 90^0 in elevation.

6.1.3 As regards the attachment of the TD/PM circle and 'H' to the helideck, the failure mode requiring consideration is detachment of components of the TD/PM circle and 'H' lighting due to shear loads generated during helicopter landings. The maximum horizontal load may be assumed to be the maximum take-off mass (MTOM) of the largest helicopter for which the helideck is designed multiplied by 0.5, distributed equally between the main undercarriage legs. This requirement applies to components of the circle and H lighting having an installed height greater than 6 mm (0.2 in) and a plan view area greater than or equal to 200 cm^2 (6.6 ft^2).

Note 1: *Example — for a helicopter MTOM of 14 600 kg (32 187 lbs), a horizontal load of 35.8 kN shall be assumed.*

Note 2: *For components having plan areas up to and including 1 000 cm^2 (33 ft^2), the horizontal load may be assumed to be shared equally between all fasteners providing they are approximately equally spaced. For larger components, the distribution of horizontal loads shall be considered.*

6.1.4 Provision shall be included in the design and installation of the system to allow for the effective drainage of the helideck areas inside the TD/PM circle and the 'H' lighting. The design of the lighting and its installation shall be such that, when mounted on a smooth flat plate with a slope of 1:100, a fluid spill of 200 litres inside the 'H' lighting will drain from the circle within 2 minutes. The maximum drainage time applies primarily to aviation fuel, but

water may be used for test purposes. The maximum drainage time does not apply to firefighting agents.

Note: Drainage may be demonstrated using a mock-up of a one quarter segment of a helideck of Dvalue at least 20 m, configured as shown in Figure I-B-4, and a fluid quantity of 100 litres. The surface of the test helideck shall have a white or light-coloured finish and the water (or other fluid used for the test) shall be of a contrasting colour (e.g. by use of a suitable dye) to assist the detection of fluid remaining after 2 minutes.

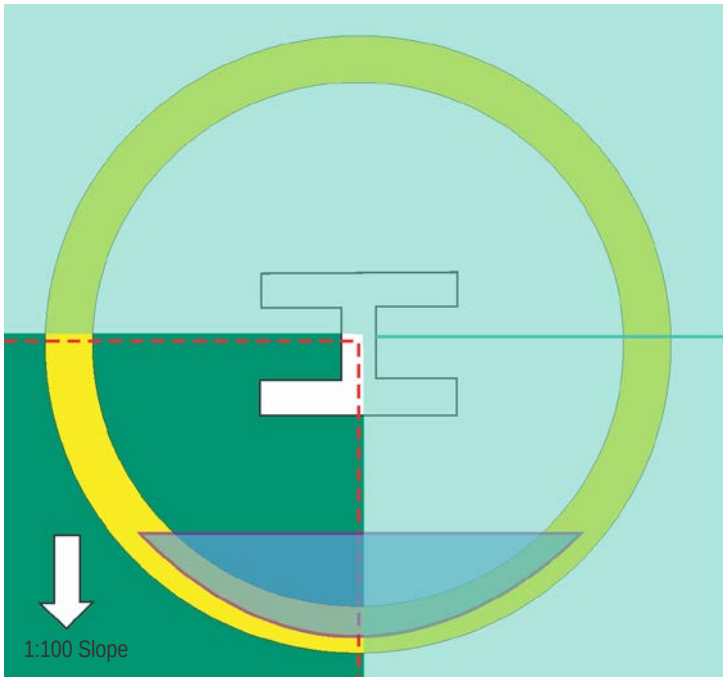


Figure I-B-4. Configuration of quarter segment drainage test mock-up

6.2 OTHER CONSIDERATIONS

6.2.1 The considerations detailed in this section are presented to make equipment designers aware of the operating environment and customer expectations during the design of products or systems. They do not represent formal requirements but are desirable design considerations of a good lighting system.

6.2.2 All lighting components and fitments shall meet safety regulations relevant to a helideck environment, such as explosion proofing (Zone 1 or 2 as appropriate) and flammability, and be tested by a notified body in accordance with the equipment for potentially explosive atmospheres (ATEX) directive or equivalent locally applicable hazardous area certification standards.

6.2.3 All lighting components and fitments installed on the surface of the helideck shall be resistant to attack by fluids that they will likely or inevitably be exposed to, such as: fuel, hydraulic fluid, helicopter engine and gearbox oils; those used for de-icing, cleaning and firefighting; any fluids used in the assembly or installation of the lighting, e.g. thread locking fluid. In addition, they shall be resistant to ultraviolet (UV) light, rain, sea spray, guano, snow and ice. Components shall be immersed in each of the fluids individually for a period representative of the likely exposure in-service and then checked to ensure no degradation of mechanical properties (i.e. surface friction and resistance to contact pressure), any discolouration, or any clouding of lenses/diffusers. Any other substances that may come into contact with the system that may cause damage shall be identified in the installation and maintenance documentation.

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

6.2.5 All cabling shall utilize low smoke/toxicity, flame retardant cable. Any through-the-deck cable routing and connections shall use sealed glands, of a type approved for helideck use.

6.2.6 All lighting components and fitments shall meet International Electrotechnical Commission (IEC) Ingress Protection (IP) standards according to the version of IEC 60529 current at the time of testing appropriate to their location, use and recommended cleaning procedures. The intent is that the equipment shall be compatible with deck cleaning activities using pressure washers and local floodlight (i.e. puddling) on the surface of the helideck. It is expected that this will entail meeting at least IP66 (dust tight and resistant to powerful water jetting), IP67 (dust tight and resistant to temporary submersion in water) and/or IP69 (dust tight and resistant to close range high pressure, high temperature jetting) shall also be considered and applied where appropriate.

Note: *Except where flush-mounted (e.g. where used to delineate the landing area from an adjacent parking area), perimeter lights need only to meet IP66. Lighting equipment mounted on the surface of the helideck (e.g. circle and 'H' lighting) shall also meet IP67. Any lighting equipment that is to be subject to high pressure cleaning shall also meet IP69.*

6.2.7 Control panels that may be required for helideck lighting systems are not covered by this Appendix. It is the responsibility of the duty holder/engineering contractor to select and integrate control panels into the installation safety and control systems and to ensure that all such equipment complies with the relevant engineering standards for design and operation.

APPENDIX 1-C – DRAINAGE CALCULATION

Helideck Drainage Capacity Check and Calculation

For 20.88m Octagonal Helideck

The following calculation is performed to check on the adequacy of the gutters and drainage header pipes when the firefighting equipment is activated.

- The calculation is based on ICAO requirements of a minimum 5.5 litres per minute per m^2 application rate.
- This calculation is based on a typical regular octagon helideck encompassing a 20.88m D-value diameter designed for the Sikorsky S-92A Helicopter.
- The calculation considers the worst case scenario of combined fuel leakage, rainfall and firewater.

HELIDECK SIZE:	20.88m Octagonal
DESIGN HELICOPTER:	Sikorsky S-92A
ASSUMED FUEL CAPACITY:	1130 US Gallons
=	4.28 m^3

Item		Helicopter
	Unit	S92A
Assumed Fuel Load	ltrs	4278
	US Galls	1130
Min. Foam/ Water application rate	ltrs/ min	1883

A) CONVERSION:

1 Gallon = 0.0379 m^3

1 Hectare = 10 000 m^2

1 m^3 = 1 000 litres

B) NOTATIONS:

Qr = run-off of fluid in m^3/sec

C = run-off coefficient based on the Rational Method.

I = average rainfall intensity in mm/hr

A = Helideck octagonal surface catchment area in m^2

A1 = Sectional area of gutter

Q = Vertical pipe discharge capacity

c = Coefficient of contraction from orifice

H = sectional height of gutter

Qd = gutter uniform flow in m^3/sec

n = roughness coefficient

p = wetted perimeter of gutter

S = bed gradient

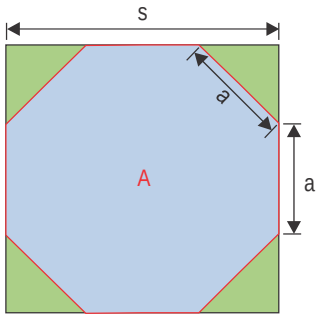
R = Hydraulic radius

g = Specific wt. of water

h = Water head

W = sectional width of gutter

C) DUE TO RAINFALL RUN-OFF FOR HELIDECK SURFACE AREA:



Rational formula: Qr = C * I * A

C = 0.65

I = 120 mm/hr (rainfall intensity = 120mm/hr)

= 3.278E-05 m/s

Area of Helideck = S * S - a * a

Where S is the span of the octagon and a the length of one of the sides

= 361.17 m^2

Therefore, Qr	=	0.0077 m^3/sec
	=	462 Litres/min

D) COMPUTATION OF DISCHARGE CAPACITY OF THE GUTTER HEADER PIPES (SCUPPERS):

No. of perimeter pipe for the scuppers = 6 nos. Considering 6 nos. of pipe effective Considering 6 nos. of pipe effective and taking the gutter header pipe as an Orifice,

$$= c * Ap * \sqrt{(2 * g * h)}$$

Discharge Q

c = 0.5 (Value achieved when the area of choke is divided by the area of the pipe)

g = 9.81 m/s^2

h = 0.180 m

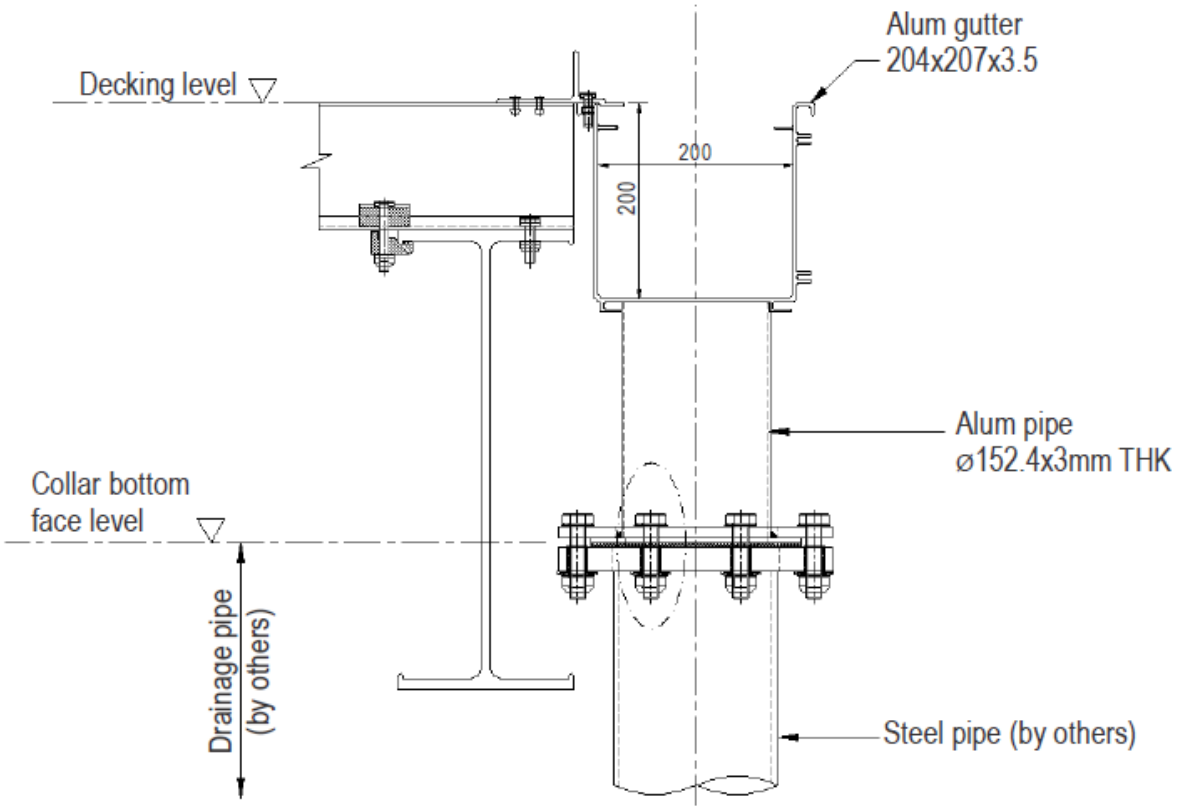
(The total height of gutter is 0.2m. Consider 90% full, h = 0.18m)

Pipe dia. (Inside) = 0.146 m (φ152mm aluminium pipe having thickness of 3mm)

No. of eff. Pipe, N = 6 (Assumed effective pipe nos)

Area of one pipe, Ap = 0.017 m^2

Therefore, Q = 0.01573 m^3/ sec (for 1 pipe)



TYP. Gutter/Scupper detail

Total discharge,

Qt = (Q*N)

0.09 m^3/sec

= 5663 Litres/min

E) VERIFICATION THAT DISCHARGE OF GUTTER HEADER PIPES SUFFICIENT FOR RAINFALL OF 120MM/HR:

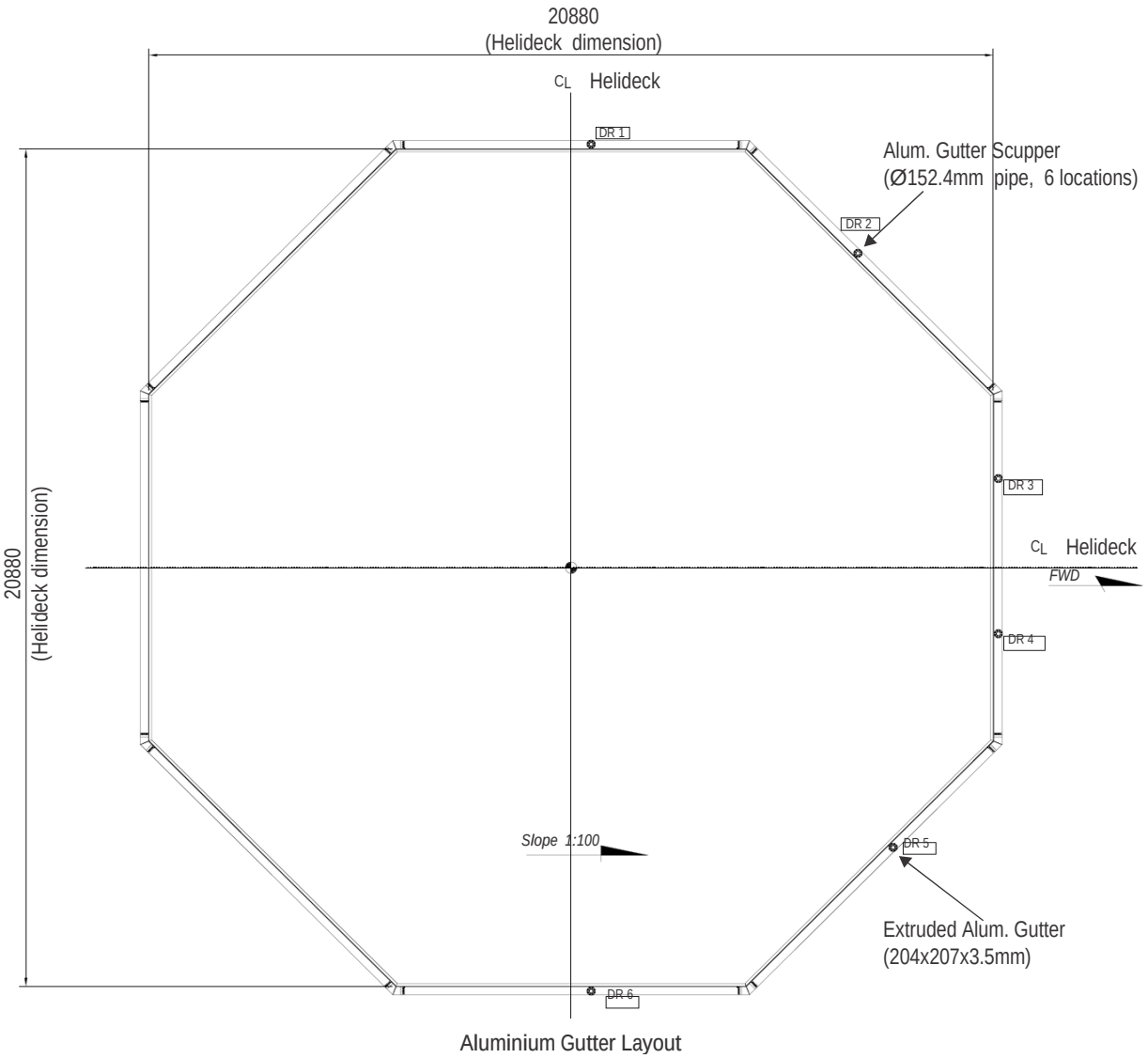
Since discharge for one gutter header pipe, Q = 0.01573 m^3/sec (discharge for one pipe)

Therefore, for discharge of 3 pipes, Q3 = 0.0472 m^3/sect (discharge for 3 pipes)

Q3 = 2832 Litres / min Q3 > Qr satisfactory

This shows that 3 gutter header pipes are already satisfactory to cater for the rainfall intensity flow, Qr.

Note: Vertical pipes considered for design = 6 nos. See below for the locations of each scupper.



Aluminium Gutter Layout

F) COMPUTATION OF DISCHARGE CAPACITY OF THE GUTTER DRAINS:

Use Manning formula for steady uniform flow: Qd = (1/n) * (A * R^(2/3) * S^(1/2))

H = 0.20 m (cross sectional height of the gutter drains)

W = 0.20 m (internal width of the gutter drains)

A1 = 0.036 m^2 (assumed only 90% of sectional area is full)

p = 0.56 m (wetted perimeter of the cross sectional area of

gutter, assumed only 90% effective)

R = A1/p = 0.064 m

n = 0.015 (aluminium material roughness based on

Manning's roughness coefficient)

S1 = 0.01 (Slope 1:100)

Qd1 = 0.038 m^3/sec (for one way flow direction)

S2 = 0.001 (assumed to be almost flat)

Qd2 = 0.024 m^3/sec (for two way flow direction)

By considering 3 Gutters effective at each flow side of decking edge, the total discharge, Qdt, will be;

Qdt = (Qd_1)*(2 gutters) + (Qd_2)*(1 gutter)

= 0.101 m^3/sec

= 6078 Litres/min

G) TIME REQUIRED TO DISCHARGE ANY SPILLED FUEL IN THE HELICOPTER TANK:

V, Fuel capacity = 4.28 m^3

Time = (V/Qt) = 0.70 mins. (Time required to discharge the fuel from tank)

H) DISCHARGE CAPACITY REQUIRED TO FIREFIGHTING APPLICATION RATE OF 5.5 LITRES PER MIN PER SQ:

Helideck surface area, As = 361.17 m^2

Min. application rate, Qa = 5.5 litres per min per sq. m

(AAR-AGA-002, Level B foam)

Min. discharge required per min, Qm = As*Qa = 1986 litres/min

Qdt and Qt > Qm, Satisfactory!

I) WORST CASE SCENARIO - COMBINATION OF RAINFALL, FUEL SPILLAGE & FIREFIGHTING APPLICATION:

Min. discharge required per min, Qr+Qm = 2448 litres/min

Qdt and Qt > Qr + Qm, Satisfactory!

The available discharge capacity for the fuel spillage,

Qa=min(Qdt,Qt) - (Qr+Qm) = 3215 litres/min

Time taken to discharge the fuel, V/Qa = 1.33 min

In conclusion, based on the calculations above, the gutters and downcomer are sized for their intended use.