General: Only parts of the Operating Manual describing the limiting criteria for operation of the vessel (environmental conditions, load and stability limiting requirements) are approved. All other content (e.g. procedures, equipment description etc.) is not subject of class approval but is checked for completeness according to MODU code requirements.

OPERATING MANUAL

For Self Elevating Platforms

GLAAG001325784G

"VICTORIA MATHIAS" & "FRIEDRICH ERNESTINE"

Remarks in the letter and entries in RED to be observed

GL Approved
Kuz THOJAH
Hamburg 2014-07-03 Ref.-No. 14-057992

Revision 8, Dated: 27th June 2014

Created by:	Checked by:	Instructed by:
GL Noble Denton	DSME	RWE
Date: 14th May, 2012	Date: 14th May, 2012	Date: 14th May, 2012

Revision History

Revision	Date	Pages	Description of Changes
0	26 June 2011	All	Draft for First Review
1	26 July 2011	All	Draft for Second Review
2	01 Aug 2011	All	Draft for Third Review
3	27 Aug 2011	All	Draft for Fourth Review
4	1 Nov 2011	All	Draft for Fifth Review
5	8 Dec 2011	All	Draft for Sixth Review
6	18 Apr 2012	All	Draft for Seventh Review
7	14 May 2012	All	Submitted for class approval
8	27 June 2014	0-3	Added abbreviations 'LAT', 'HAT' and 'SWL'
		3-1	Added note for general clarification of 'mean' wind limits
		3-3	'severe storm' replaced with 'storm' (for clarity)
		3-6	New section: Added definition of GAP (and new figure 3-1)
		3-7	New section: Added definition of AIR GAP (and new figure 3-2)
		3-8	New section: Definition of directional conditions (new figure 3-3)
		3-9	Updated definitions of water depth, operational elevation calculation and gap / air gap in line with definitions in sect. 3.4.1
		3-9	Altered minimum air gap from 1.2m to 1.5m (this is consistent with air gap used for calculation of storm survival limits).
		3-9	Deleted definition of air gap, as this is now covered by section 3.4.1.
		3-9	Clarified wind limits (10 min mean at 10 m height)
		3-10	Full revision of severe storm elevated survival limits (section 3.4.4), including new figures 3-4 to 3-7.
		3-20	Revised table 3-1 to include new elevated storm survival limits, other changes to table: - Added '10 minute mean at 10m height' to wind speed column - Added clarification to note 13: 'maximum gust boom stowed' - Correction to reference of notes 10, 11 and 12 - Added notes 14-19 - Added columns for min. gap, max. gap and deleted max air gap - Updated note 5 from 'max. operational water depth' - Corrected water depth entries for 'engaging', 'elevating' and 'elevated' to 48 m - in line with max. water depth stated in relevant OM sections.
		6-59	Added definition of storm survival limits for suction mast - in line with rev.7 elevated storm survival limits (suction mast has not been validated to rev.8 limits)
		6-64	Re-drew figures 6-22 and 6-23 (were corrupted)
		7-1	Changed 'severe storm survival - elevated condition' to 'elevated storm survival condition' - for consistency with section 3.4.4
		7-4	Changed 'severe storm survival - floating condition' to 'floating storm survival condition' - for consistency with section 3.2.2

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Figures

The approval of the limiting environmental conditions defined in §3 are based on the statement in §3.1.2 of "clean" legs. In case of existing marine growth on the legs there is a risk of overloads in the jacking system.

0 INTRODUCTION

0.1 Purpose

The purpose of this Operating Manual (OM) is to provide the Master and Crew with essential information to operate the vessel in a safe & efficient manner and within its design limitations.

The OM contains information, guidelines and procedures that are sufficient to ensure the safety of vessel and crew under normal and envisaged emergency conditions. It may however be noted that the OM cannot address all eventualities or give answers to all questions that may arise.

The descriptions and technical information given in this manual are for the RWE Innogy SEABREEZE type vessel designed by a joint venture between Wärtsilä Ship Design, Germany GmbH, Hamburg & IMS Ingenieurgesellschaft, built by Daewoo Shipbuilding & Marine Engineering (DSME), Korea and approved by Germanischer Lloyd (GL).

The other manuals and instructions used in conjunction with the OM are mentioned as REF DOC/REF DWG at the beginning of each section.

Specific cross references to these manual have been given in specific sections of this manual. Should the procedures given in this OM conflict with those given in Operator's IMS (Integrated Management System) documentation like Quality Manuals and Fleet Instructions, the IMS documentation shall take precedence and be followed.

The guidelines provided are to assist the Master and Crew in making decisions. Such guidelines are meant to supplement the experience, good marine practice and good judgment on the part of those involved in operating the vessel. The guidelines are not intended to be a substitute for such experience and judgment. The Master is left with the power of discretion to exercise his judgment and apply good marine practice as he sees fit.

Referenced documents in §10 must exist on board of the vessel to be consulted by the crew. (old comment from rev. 7 of OM)

0.2 Organization of Operating Manual

This Operating Manual is divided into seven (7) 'Volumes' and one Annex. Each volume has several Chapters and each chapter has several 'Sections' and 'Sub-Sections'.

0.2.1 Volume I – GENERAL

This volume covers the General information of the vessel. It also gives the limitations of the vessels design for various operating modes.

0.2.2 Volume II – OPERATIONS

This volume covers the various key operations that the vessel can be used for and describes the normal procedures for these operations.

0.2.3 Volume III – ABNORMAL & EMERGENCY PROCEDURES

This volume covers the procedures to be followed in abnormal and emergency situations.

0.2.4 Volume IV – TECHNICAL

This volume covers the description of key technical equipment and systems provided on the vessel.

0.2.5 Volume V – DRAWINGS

This volume contains a copy of key drawings of the vessel.

0.2.6 Volume VI – MAINTENANCE

This volume covers the maintenance guidelines for the vessel's equipment and systems.

0.2.7 Volume VII – TRAINING

This volume covers guidelines for the training for the vessel's crew.

0.2.8 Annex 1

Annex 1 consolidates temporary modifications done on the vessel related to national regulations, construction site and/ or specific requirements

0.3 Abbreviations

AC	:	Alternating Current
AP	:	AFT Port
ACB	:	Air Circuit Breaker
AFT	:	Vessel Aft
AIS	:	Automatic Identification System
AMCS	:	Alarm Monitoring Control System
ARPA	:	Automatic Radar Plotting Device
ATOW	:	Automatic Thruster Operator Workstation
BHAB	:	British Helicopter Advisor Board
BS	:	British Standard
BSP	:	British Standard Pipe Thread
CAA	:	Civil Aviation Administration
CAP	:	Civil Air Publication
CB	:	Circuit Breaker
CG	:	Centre of Gravity
CKL	:	Check List
CL	:	Centre Line
COLREG	:	Convention on International Regulation for Preventing Collision at Sea
CP	:	Centre Port
CPU	:	Central Processing Unit
CS	:	Centre Starboard
CW	:	Control Valve
DC	:	Direct Current
DG or D/G	:	Diesel GenSet
DGPS	:	Differential Global Positioning System
DIFFS	:	Deck Integrated Fire Fighting System
DOC	:	Documents
DPO	:	Dynamic Positioning Operators
DPOW	:	DP Operators Workstation
DWG	:	Drawings
DIN	:	Deutsche Industry Normen
DNV	:	Det Norske Veritas
DO	:	Diesel Oil
DP	:	Dynamic Positioning
DSME	:	Daewoo Shipbuilding & Marine Engineering
ECR	:	Engine Control Room
EMC	:	Electro Magnetic Compatibility
EPIRB	:	Emergency Position Indication radio Beacon
ESD	:	Emergency Shutdown System
FAT	:	Factory Acceptance Test
FOC	:	Fuel Oil Consumption
FRP	:	Fibre Reinforced Plastic
FSE	:	Free Surface Effect
FO	:	Fuel Oil
FWD	:	Forward
GM	:	Metacentric Height
HAT	:	Highest Astronomical Tide
HDA	:	Heli Deck Assistant
HHP	:	High Holding Power

HPU	:	Hydraulic Power – pack Unit
HTFW	:	High Temperature Fresh Water
HVAC	:	Heating, Ventilation and Air-Conditioning
HLO	:	Helicopter Landing Officer
HOC	:	Helicopter Operating Company
HRC	:	High Rupturing Fuse
GL	:	Germanischer Lloyd
IACS	:	International Association of Classification Societies
ICAO	:	International Civil Aviation Organization
ICLL	:	International Convention of Load Lines
IEC	:	International Electro Technical Commission
IMCA	:	International marine Contractors Association
IMO	:	International Maritime Organization
IMS	:	Integrated Management System
ILO	:	International Labour Organization
IS	:	Intact Stability
ISM	:	International Safety Management
ISO	:	International Standard Organization
ISPS	:	International Ships and Port Facility Security
ITU	:	International Telecommunication Union
LAN	:	Local Area Network
LAT	:	Lowest Astronomical Tide
LED	:	Light Emitting Diode
LO	:	Lube Oil
LAT	:	Lowest Astronomical Tide
LCG	:	Longitudinal Centre of Gravity
LTA	:	Line Throwing Apparatus
LTFW	:	Low Temperature Fresh Water
L/B	:	Launching Barge
MGO	:	Marine Gas Oil
MODU	:	Mobile Offshore Drilling Unit
MIC		Men In Charge
MOU	:	Mobile Offshore Units
MSB	:	Main Switch Board
MTH	:	Meter Total Head
MTOW	:	Manual Thruster Operator Workstation
NIU	:	Network Interface Unit
NMA	:	National Maritime Administration
NMD	:	Norwegian Maritime Directorate
NOx	:	Oxides of Nitrogen
NPSH	:	Net Positive Suction Head
NS	:	Norwegian Standard
OM	:	Operation Manual
OOW	:	Officer of the Watch
OW	:	Operators Workstation
OD		Outside Diameter
OFE	:	Owner Furnished Equipment
OPITO	:	Offshore Petroleum Industry Training Organization
PA	:	Public Address
PAGA	:	Pubic Address and General Alarm
PS or P	:	Port Side
PIC	:	Person In Charge

P & ID	:	Piping & Instruments Diagram
P/D	:	Piping & Instruments Diagrams
PMS	:	Power Management System.
PLC	:	Programmable Logic Controller
POB	:	Persons on Board
PPM	:	Parts Per Million
QMS	:	Quality Management System
REF		Reference
RAO	:	Response Amplitude Operator
RH	:	Relative Humidity
ROV	:	Remotely Operated Vehicle
S.GP	:	Refer to Sub Group Number in the SF1 System
SART	:	Search & Rescue Radar Transponder
SCH	:	Schedule
SFI	:	Group system, the Ship Research Institute of Norway
SIMOPS	:	Simultaneous Operations
SOLAS	:	Safety of Life at Sea
SOPEP	:	Shipboard Oil Pollution Emergency Plan
SBM	:	Special Bearing Monitor
SPS	:	Special Purpose Ships
SPU	:	Signal Processing Unit
SSB	:	Single Side Band radio telephone
STBD/Stbd	:	Starboard
SW	:	Sea Water
SWL	:	Safe Working Load / Still Water Level
THD	:	Total Harmony Distortion
TCG	:	Transverse Centre of Gravity
TCS	:	Thruster Control System
TFT	:	Thin Film Transistor
UHF	:	Ultra High Frequency
UK-CAA	:	United Kingdom Civil Aviation Authority
UKOOA	:	United Kingdom Offshore Operators Association
UPS	:	Uninterrupted Power Supply
USCG	:	United States Coast Guard
VAS	:	Vessel Automation System
VFD	:	Variable Frequency Drive
VHF	:	Very High Frequency
VCG	:	Vertical Centre of Gravity
VDR	:	Voyage Data Reorder
VDU	:	Video Display Unit
VSAT	:	Very Small Aperture Terminal
WT	:	Water Tight / Weather Tight
WTIV	:	Wind Turbine Installation Vessel
W.B.TK	:	Water Ballast Tank
XS	:	Extra Strong

0.4 Units

The metric system is used as the primary units to describe physical quantities.

Common commercial designations, when used in a descriptive manner not involving calculations, may be expressed in the customary units.

The following units have been used in this manual:

Length	meter	m
	Millimeter	mm
Time	second	s
	Minute	min
	Hour	hr
	Year	yr
Temperature	degree Celsius	°C / deg.C
Volume	meter cube	m^3 / cu.m
	centimeter cube	cc
	Liter	L
Area	square meter	m^2 / sq.m
Mass	gram	gm
	kilogram	kg
	metric ton (1,000 kg)	t
Plane angle	radian	rad
	Degree	deg. / °
Speed (velocity)	meters per second	m/s
	meters per minute(mpm)	m/min
	Meter per hour	m/hr
	Knots	kts
Angular velocity	radian per second	rad/s
Acceleration	meters per square second	m/s^2
Force	Newton	N
	Metric Ton	t
Pressure	bar	bar (gauge)
	milli bar	m bar
	kilonewton per square metre	kN/m^2
	pascal	Pa

Density	kilogram per cubic meter	kg/m^3
	Metric ton per cubic meter	t/m^3
Rate of flow	kilogram per second	kg/s
	kilogram per minute	kg/min
	kilogram per hour	kg/hr
	Cubic meter per hour	m^3/hr
	Cubic meter per second	m^3/s
	cubic meter per minute	m^3/min
	Liter per second	L/s
	Liter per minute	L/min
	Liter per hour	L/hr
Light	lux	lux
Rotating Speed	rotations per minute	rpm
	Hertz	Hz
Power	watt	W
	Kilo watt	kW
	Mega watt	MW
	Horse power	HP
Potential Difference	volt	V
	kilo volt	kV
Current	ampere	A
	milli ampere	mA

0.5 Numerical Representations

English denomination of decimal point and comma is used thus:

- 1.00 = 1 (one)
- 1,000.00 = 1000 (One Thousand)

Significant figures for decimal shall be based on specific values and requirements.

0.6 Unit Conversions

To convert from A to B	A	B	To convert from B to A
0.0394	millimeter	inch	25.4
0.001	millimeter	meter	1,000
3.28	meter	foot	.3048
0.001	gram	kilogram	1,000
0.001	kilogram	metric ton	1,000
0.017	second	minute	60
0.017	minute	hour	60
0.001	cent. cube / liter	meter cube	1,000
.0175	degree	radian	57.296
0.5144	knots	meter per sec.	1.944
9.81	metric ton	kilo newton	0.102
0.00001	Pascal	bar	1,00000
1.341	kilo watt	horse power	0.7456
Multiply by			**Multiply by**

VOLUME I – GENERAL

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Figures

1 GENERAL INFORMATION

REF REG: MODU-CODE 14.1.2.1

1.1 Description of Vessel

RWE Innogy SEABREEZE is a self propelled and self elevating vessel, with four (4) cylindrical legs and a hydraulic jacking system, equipped with heavy lift crane used for the offshore wind farm installation. The vessel is designed to carry out lifting operations in both afloat and jacked up mode for water depth of up to 45 meter and also serve as transport and storage unit carrying wind farm structures and consumables. It can operate independently stationary at sea for at least 21 days and has accommodation facility for 60 persons. For effective positioning using its retractable thrusters the vessel has DP2 capabilities. A helicopter landing platform is provided for air borne crew changes and supplies.

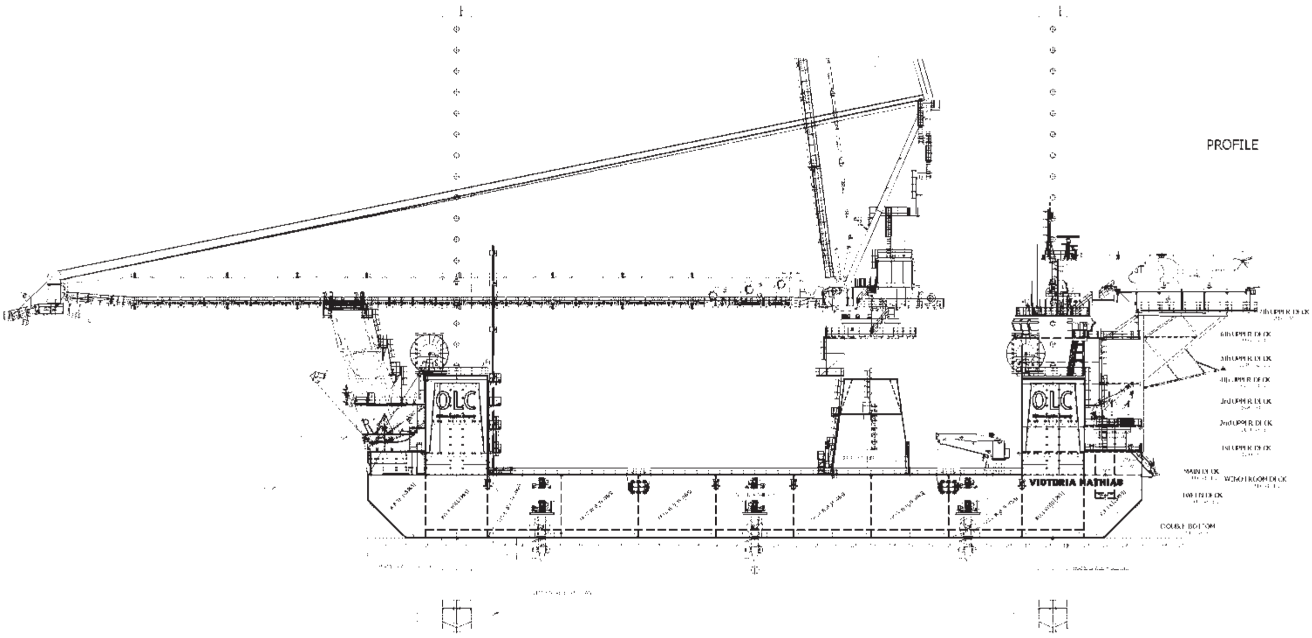

Figure 1-1 Profile View of Vessel

CAUTION!

The vessel's operation with special personnel onboard is allowed only for operations related to the wind farm construction including transit operation from shore to a wind farm. ~~When the vessel is engaged in long journey (transit greater than 1500 nautical miles) by ocean going transition, the special personnel are not allowed onboard.~~

Special personnel are all persons who are not passenger or member of the crew or children of under one year of age and who are carried onboard in connection with the special purpose of the ship (wind farm installation).

When the vessel is engaged in other or ocean going journeys special personnel is not allowed on board. (old comment from rev. 7 of OM)

1.2 Registration & Classification

1.2.1 Registration & Classification- Victoria Mathias

Type of Vessel	Self Propelled Elevating Platform
Vessel's Names	Victoria Mathias
Owner/ Operator	RWEI Seabreeze I GmbH & Co. KG
	Geo-Plate Straße 1; 27568 Bremerhaven
Flag State	Germany
Port of Registry	Bremerhaven
Registration Number	23043
Registered Tonnage	Gross: 11,730 t
	Net: 3,519 t
Call Sign	DIPB2
IMO Number	9578244
Class and Notation	GERMANISCHER LLOYD
	✠100 A5 DP2, Self Elevating Unit, Special Purpose Ship, Operation according to operating manual, ✠ MC-AUT
GL Registration Number	114417
Builder / Yard	Daewoo Shipbuilding & Marine Engineering Co. Ltd.
Place & Year Built	Okpo, South Korea, 2011
Yard Hull Numbers	H No. 3303

1.2.2 Registration & Classification- Friedrich Ernestine

Type of Vessel	Self Propelled Elevating Platform
Vessel's Names	Friedrich Ernestine
Owner/ Operator	RWEI Seabreeze II GmbH & Co. KG Geo-Plate Straße 1; 27568 Bremerhaven
Flag State	Germany
Port of Registry	Bremerhaven
Registration Number	23044
Registered Tonnage	Gross: 11,730 t Net: 3,519 t
Call Sign	DIPC2
IMO Number	9578256
Class and Notation	GERMANISCHER LLOYD ✠ 100 A5 DP2, Self Elevating Unit, Special Purpose Ship, Operation according to operating manual, ✠ MC-AUT
GL Registration Number	116029
Builder / Yard	Daewoo Shipbuilding & Marine Engineering Co. Ltd.
Place & Year Built	Okpo, South Korea, 2011
Yard Hull Numbers	H No. 3304

1.3 Main Particulars

REF REG: MODU-CODE 14.1.2.1

REF DWG: General Arrangement Plan DA101Z029 Rev 3

1.3.1 General / Hull

The vessel's hull is of rectangular shape and framed aft to fwd. The hull houses all the tanks, the engine and pump rooms, transformers, switchgear. The hull is subdivided into watertight compartments by longitudinal and transverse bulkheads and by horizontal decks as shown on the 'General Arrangement Plan'. The actual welded hull has been divided into five (5) main compartments:

Compartment I: Aft ship section, crane boom support and aft ballast tank area.

Compartment II: Aft jack-house-compartment with engine room, ECR, aft thrusters, hydraulic system, pump room, machinery workshop and store compartment.

Compartment III: Mid void, mid ship frame structure, mid thruster compartment, counter ballast area and main crane compartment.

Compartment IV: Forward thruster compartment and below deck service rooms, forward jack-house with forward jack-up legs, medical treatment room, service rooms, workshops and accommodation deckhouse.

Compartment V: Fore ship section with forecastle, helicopter platform, statuary winches and forward ballast tank area.

Length moulded	100.0 m
Length extreme	120.78 m (incl. Heli-deck & Crane Boom Rest)
Length extreme	138.42 m (incl. Heli-deck & Short Boom Crane)
Length extreme	162.42 m (incl. Heli-deck & Long Boom Crane)
Length extension of helideck	14.865 m
Length extension of crane boom rest	5.916 m
Breadth moulded	40.0 m
Breadth overall	40.2 m
Depth of hull	8.0 m

For hull drafts and displacements refer to section 4.1.

1.3.2 Legs & Spudcans

REF DWG: Leg Structure Drawing 10-B4040_41-001 Rev 4

REF DWG: Spudcan Structure Drawing DA330H001 Rev 3

1.3.2.1 Legs

The vessel has four (4) cylindrical legs placed in the longitudinal direction. Each leg has 25 pin locations provided for the jacking pins which are evenly distributed at definite vertical intervals of 2,700 mm. The legs have a 7.8 m buoyancy chamber towards its bottom which can be accessed through a manhole. A fixed cruciform shapes conical shaped footing of approx. 2.4 m has been provided on the legs for normal operation. However detachable spudcan can be optionally mounted to legs for soft sea bed operations. The leg footing does not protrude below the keel (leg tip is level with the keel) when in its fully retracted position (without spudcans attached).

No. of jack up legs	Four (4)
Leg type	Circular Cylindrical
Leg diameter	3.75 m
Leg length including footing	78.682 m (Including Lifting Eyes and operating without sfudcan)
Longitudinal centre to centre dist. of legs	77.0 m
Transverse centre to centre dist. of legs	31.42 m
Footing protrusion below hull bottom	Nil (operating without spudcan)
Leg length including footing	78.6 m (operating with spudcan)
Footing protrusion below hull bottom	3.0 m (operating with spudcan)
Length of leg section inside spudcan	2.3 m (operating with spudcan)
Leg length including footing & top light	79.85 m (operating without spudcan)
Leg weight excluding leg buoyancy	626.9 t
Leg buoyancy due to buoyancy chamber	91.6 t
Leg weight with spud-can excl. Buoyancy	770.0 t
Leg weight with spud-can incl. Buoyancy	634.5 t

Leg Weight (Fully Retracted) in Afloat Condition		
Draft	Weight in Afloat without Spudcan	Weight in Afloat with Spudcan
3.6	612.2	593.7
3.8	609.9	591.5
4.0	607.7	589.2
4.2	605.4	587.0
4.4	603.1	584.7
4.6	600.9	582.4
4.8	598.6	580.2
5.0	596.3	577.9

Leg Pin Hole Distances

Total No. of Pin Hole Locations	25
Vert. dist. b/w leg top & 1st pin hole	Approx.1,694 mm
Vert. C to C dist. b/w 1st & 2nd pin hole	Approx. 2,850 mm
Vert. C to C dist. b/w pin holes	Approx. 2,700 mm (top 2nd pin hole onwards)
Last pin hole centre to leg bottom	Approx. 11,506 mm, without Spudcan Approx. 12,106 mm, with Spudcan

For Leg limitations for leg strength & penetration limitations refer to Section 3.4.5

For leg penetration limitations refer to Section 3.1.3

1.3.2.2 Manual Calculation Table for Leg Length below Hull Using Visible Pin Holes above Jack house:

No. Leg Holes Visible Above Jack house	Leg Length Below Hull in 'm'		Exact Position in 'm'
	Min	Max	
21	0	0.82	Max - D
20	1.56	3.52	Max - D
19	4.26	6.22	Max - D
18	6.96	8.92	Max - D
17	9.66	11.62	Max - D
16	12.36	14.32	Max - D
15	15.06	17.02	Max - D
14	17.76	19.72	Max - D
13	20.46	22.42	Max - D
12	23.16	25.12	Max - D
11	25.86	27.82	Max - D
10	28.56	30.52	Max - D
9	31.26	33.22	Max - D
8	33.96	35.92	Max - D
7	36.66	38.62	Max - D
6	39.36	41.32	Max - D
5	42.06	44.02	Max - D
4	44.76	46.72	Max - D
3	47.46	49.42	Max - D
2	50.16	52.12	Max - D
1	52.86	54.82	Max - D
0	55.56	**56.8 ***	***Max - D_o***

The Table above can be used to estimate the leg length below the hull[1] based on the number of jacking pin holes visible above the jack house. According to this table, the number of holes visible above the jack house will include only fully visible holes, holes that crossing jack house (The bottom edge of the hole has passed the jack house top plate) are not counted. To find exactly how much of leg length is protruded below the hull bottom, the formula (**Max-D**) can be used where

[1] The leg length below hull bottom line to the leg tip,

* The top of the leg can be inside of jack house when the uppermost pinhole is engaged into the upper jacking frame (extreme leg position).

Max: Maximum possible leg length protruded below the hull taken from the table above based on counted number of pin holes above the jack house.

D: Is the measured distance between the jack house top plate and the bottom edge of the nearest pin hole.

D: can be either physically measured or estimated, D ranges from 0 to 1,958 m for all Holes except the case where there are no holes visible.

The **Max-D** rule applies in all cases except of Zero holes situation where **Max- D_o** is used. Where D_o is the distance between the jack house top plate and the leg top edge.

1.3.2.3 Spudcans

For operations in soft sea bed, a detachable, conical profile and semi flooding type spudcan is provided for the vessel. The spudcan can be attached to the leg by using 16 vertical tension bolts.

The use or not use of the spud cans depends on the results of the site specific assessments. It shall be ensured that the required air gap can be fulfilled under consideration of the expected penetration for the location.

Spudcan type	Removable, rectangular welded type
Spudcan depth	3.0 m
Spudcan size	10.0 x 8.74 m
Spudcan projected area	Approx. 87.2 m^2 (Due to rounded edges)
Spudcan weight	143.1 t
Spudcan buoyancy	135.5 t

Spudcan limitations for spudcan design limitations refer to Section 3.4.5

For further details of spud can mounting and de-mounting refer to Section 6.10.

Figure 1-2 Removable Spudcan

1.3.3 Jacking System

REF DOC: Operation Manual for Jack Up System DA101D030 Rev 0

The jacking system of the vessel has upper and lower jacking frames which slide along the leg. The frames are each driven by hydraulic jacks (lifting cylinders) mounted vertically. All hydraulic jacks are connected to vessel at their bottom side.

The frames are connected to leg by means of locking pins. Each frame has locking pins which are driven by three hydraulic cylinders.

Once one frame is securely engaged with the leg the other frame can be disengaged and move freely to the next leg hole position. This way it is possible to have an almost continuous jacking operation.

The legs are positioned horizontally by three horizontal positioning cylinders which are arranged on main deck level.

Jacking System Key Particulars

Supplier Name	MUNS Techniek BV
No. of frames per leg	2 (upper and lower)
Total no. of lifting cylinders per leg	12
No. of horizontal positioning cylinders per leg	3
Total no. of pins per frame	3
Total no. of hydraulic pins per leg	6
Height of jack house from main deck	12.785 m
Height of jack house from base line	20.785 m
Maximum Jacking capacity (Jackable Weight)	15,300 t

1.3.3.1 Available Jacking System Capability

The jacking systems hydraulic cylinders dictates the system available forces, the cylinders specifications can be found in section 9.4.2.7. The cylinder can produce pulling forces more than pushing forces due to buckling limitations on the cylinder rod. Since the cylinders are mounted vertically upward (the piston side is downward and the rod side is upward), cylinder pulling will result in either lowering the leg, moving the hull upward or holding the hull in position against its weight. On the other hand, cylinder pushing will result in leg lifting, Hull lowering or Hull pushing against buoyancy forces. The table below summarizes the maximum forces the jacking system can develop in different modes of operations.

Mode	Force [KN] [t]					Limitation Device
	Per Cylinder	One Jacking ring per leg		Both Rings Engaged		
		Per Leg	Entire Vessel	Per Leg	Entire Vessel	
Cyl Pulling (Lowering Leg or Lifting Hull)	8,080 824	48,480 4,944	1,93,920 19,776	NA	NA	Pump Pressure Setting
Cyl Pulling (Lowering Leg or Lifting Hull) Both rings engaged				66,000 6,728	2,64,000 26,912	Software in Local controller limits the sum forces of both rings
Cyl Pushing (Leg Lifting) in differential pressure Mode @ 323 bar	1,989 203	11,934 1,218	47,736 4,872	23,868 2,386	95,472 9,547	Pump Pressure Setting
Cyl Pushing or Holding (Leg Lifting, Leg pulling from seabed or Heavy Hull lowering) in differential pressure Mode @ 140 bar	4,364 445	26,184 2,670	1,04,736 10,680	52,368 5,340	2,09,472 21,353	Relief Valve in leg manifold
Holding Force (Preload), Cylinder Pulling @ 350 bar	8,755 892	52,530 5,352	2,10,120 21,408	1,05,060 10,704	4,20,240 42,816	Relief function in load holding valve
Holding Force (Pushing Hull against Buoyancy) @ 140 bar Differential Mode	4,364 445	26,184 2,670	1,04,736 10,676	52,368 5,338	2,09,472 21,352	Relief Valve in leg manifold

Note: The given values are only applicable for the hydraulic parts of the jacking system. The yellow marked values are theoretical values as there are other parts of the ship (e.g. legs, jacking frames, koker section etc.) which are determining the applicable limits.

1.3.3.2 Jacking Speeds

Available power dictates the force speed combination of the jacking system. The table below summarizes the speed limitations for the jacking system for single leg operated provided that there are no power limitations and all pumps are running.

Mode	Speed m/Min			Limitation Device
	Engaged Ring	Disengaged Ring	Both Rings Engaged	
Cyl Pulling (Leg Lowering)	1	1.3	NA	Software Setting of flows
Cyl Pulling (Leg Lowering) Both Rings	NA	NA	0.5	
Cyl Pushing (Leg Lifting) in differential Mode	1	1.3	0.5	
Cyl Pushing (Leg Pulling or Hull pushing in water) in High Force Mode	0.2	NA	0.1	

The table below summarizes the speed limitations for the jacking system for multiple legs simultaneously operated provided that there are no power limitations and all pumps are running.

Mode	Speed m/Min		Limitation Device
	One Engaged Ring	Two Engaged Rings	
Cyl Pulling (Leg Lowering)	0.7	NA	Software Setting of flows
Cyl Pulling (Leg Lowering) Both Rings	NA	0.5	
Cyl Pushing (Leg Lifting) in differential Mode	0.7	0.5	
Cyl Pushing (Leg Pulling or Hull pushing in water) in High Force Mode	0.15	0.1	

For further details on speed limits in other modes refer to ‘Operation Manual for Jack Up System’.

1.3.3.3 Control System

Location of jacking controls	Wheelhouse – Jacking Control Panel
	Wheelhouse – Operator's Chair
	At Each Jack house - Local Control
Type of control system	Automatic / Manual mode
Leg control	Individual / Combined leg operation

For further details of Jacking operations refer Section 6.1 and for further details on jacking system equipment specifications refer to Section 9.4.

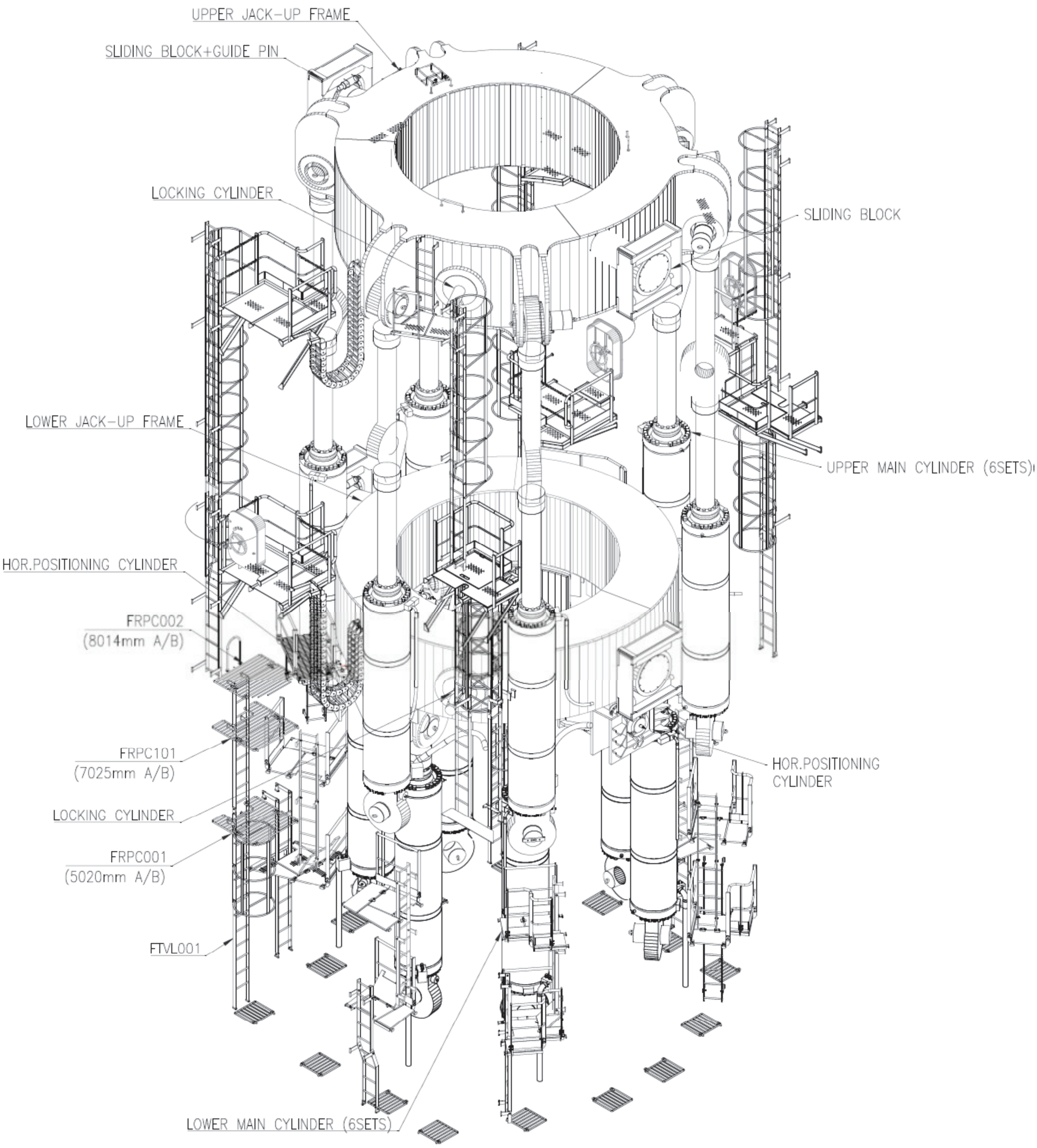

Figure 1-3 Jacking System Overview

1.3.4 Accommodation

REF DWG: Accommodation Arrangement DA105A101 Rev 2

REF REG: International Convention for Safety of Life at Sea (SOLAS) 1974 with Protocol of 1978 and Amendments 1981 Plus Part II "Incombustible Accommodation for Passenger Ships"

REF REG: MARPOL - International Convention for the Prevention of Pollution from Ships 1973, Including Protocol of 1978; and Additional Amendments

REF REG: Code of Safety for Special Purpose Ships (2008 SPS CODE), 2008 Edition

REF REG: International Load Line Convention 1966 with Amendments

REF REG: ILO - Maritime Labour Convention C92 and C133

REF REG: ISPS

REF REG: UVV-See (National)

REF REG: Regulation for the Prevention of Accidents "UVV See"

The accommodation / living quarters consists of a five story structure above main deck at the forward end of the vessel. However some facilities are arranged below main deck like mess room, gymnasium, hospital etc.

The accommodation is capable of accommodating 60 persons. All cabins well insulated and are arranged in a way to minimize the influence of noises created on the working deck area and in the workshops.

Accommodation decks are facilitated with an elevator and stair cases.

The total deck house area is 2,292 m^2 and clear ceiling height at each level is 2.1 m

For 16 nos. crew, cabins are provided as follows:

Master class	2 single cabins
Officer class	2 single cabins
Petty officer class	4 single cabins
Rating class	8 single cabins

For 44 nos. guest/workers, cabins are provided as follows:

Petty officer class with Pullman bed	20 single cabins
Rating class	12 double cabins
Total No. of cabins	**48**

A duty alarm system is provided in the accommodation spaces, for details refer to section 8.1.3.

The facilities provided on each level are as follows:

Deck	Height From BL in 'm'	Deck Height in 'm'	Location (Frame No.)	Facilities
Double Bottom	1.00	4.00	150-185	Sewage Plant Room Laundry & Drying Room Air Handling Unit Refrigerating Plant
Tween	5.00	3.00	150-185	Mess room TV / Video room Gymnasium Galley Vegetables/ Meat/ Fish room Waste storage Provisions & Beverage room
Main	8.00	3.00	169-185	Changing Rooms Patient room Hospital Public toilet Winch Room & Work Shops
First	11.00	3.20	169-200	Four single cabins Six double cabins Cable room Store room Luggage room Air conditioning room
Second	14.20	2.75	169-189	Four single cabins Six double cabins Cable room Store Assembly station
Third	16.95	2.75	169-189	Twelve single cabins Store room Dirty linen locker
Fourth	19.70	2.75	169-189	Twelve single cabins Clean linen locker Battery room Store room
Fifth	22.45	3.10	169-189	Four single cabins Store & Cable room Conference room / Office Heli waiting room

1.3.5 Helideck

REF REG: CAP 437, 6th Edition

REF REG: BS 8118 PART 1 & PART 2

REF REG: GL 2007 IV PART 6 Helicopter Facilities

REF REG: IMO SOLAS

REF REG: IMO MODU CODE

REF DWG: Helideck Arrangement 3303-HL-200-001 Rev B

REF DWG: Aluminium Helideck Lighting Layout 3303-HL-530-001 Rev 0

1.3.5.1 General

An octagonal shape aluminium helicopter deck has been provided at the forward end of the vessel. It is located 31.58 m above the base line of the vessel. Access to helideck is achieved by stairs from accommodation area. Its supporting structure is built of steel and designed to accommodate one “Agusta / Westland 139” type helicopter.

Helicopter refuelling facilities and integrated fire fighting system with pop-up nozzles (water-foam mixture) are also provided.

Helideck is fitted with flush deck securing points for lashing of helicopter and also provided two flush earthing connections.

Key particulars of helideck are:-

Complies with	UK-CAA, CAP 437, 6th Edition
Helideck diameter (max. D-value)	17.0 m
Type of Helicopter	Augusta/Westland 139 (See complete list below)
Maximum gross weight of helicopter	6.4 t
Rotor diameter	13.8 m
Landing net	12 m x 12 m
Tension belt	250 kg

1.3.5.2 Helicopter Types

The helideck is also suitable for landing of the following helicopter types:

Types	'D' marking in 'm'	Rotor dia. in 'm'	Max wt. in 't'
Bolkow Bo 105 D	12	9.9	2.4
Bolkow 117	13	11.	3.2
Augusta A109	13	11	2.6
Daulphin SA 365N2	14	11.93	4.25
EC 155B1	14	12.6	4.85
Sirkosy S76	16	13.4	5.3
Agusta / Bell 139	17	13.8	6.4

1.3.5.3 Helideck Lighting

Helideck is fitted with the helideck lighting system which includes the following type of Lighting fixtures. All helideck lighting fixtures are controlled by the helideck control panel installed in wheel house console.

Flood Light: Four No. of xenon type, explosion proof lighting fixtures operating at 230 V 50/60Hz UPS power supply.

Perimeter Light: 20 No. of LED type, explosion proof lighting fixtures operating at 24 V DC power supply.

High Intensity Status Light: One No. of red colour LED type, explosion proof lighting fixture operating at 24 V DC power supply.

Low Intensity Status Light: 2 nos. of diagonally placed LED type, explosion proof lighting fixtures operating at 24 V DC power supply.

Illuminated Windsock: One no. of illuminated windsock illuminated by LED type, explosion proof lighting fixtures operating at 230 V UPS power supply.

Obstacle Limitation Status Light: One no. of LED type, explosion proof lighting fixture operating at 24 V DC power supply.

Figure 1-4 Helideck Overview

For further details of helicopter limitations, refer Section 6.19

1.3.6 Cranes

1.3.6.1 Main crane

REF DOC: Main Crane (Liebherr) Operating Manual BOS 35000–1000 LITRONIC Serial No.170564, 170565

REF DOC: Main Crane (Liebherr) Technical Data Sheet 170 564 – 565 – 050 Rev 3

REF DOC: Main Crane (Liebherr) Load Charts 170 564 – 565 – 100 Rev 0

REF DOC: Approved – Final Trim & Stability Booklet DA101Z035

REF DOC: Crane Stability Booklet 3303DA101Z034

The vessel is equipped with one heavy lift offshore crane for installation of offshore wind mill foundations and top sides. This crane is located on starboard side of the vessel and referred to as the 'Main crane'. It is a pedestal mounted, fixed boom, fully revolving, electro – hydraulic type crane.

The crane is equipped with main & auxiliary hooks for lifting operations and can be used in two different boom length configurations by removing required pin-connected boom sections.

The crane is primarily designed for cargo handling while the vessel is in elevated condition. However the crane can also be operated in floating condition at harbour. Crane operation offshore in floating mode shall be applicable after verification of stability criteria and approval of class. The boom rest for the crane is located at the aft of the vessel.

Figure 1-5 Main Crane

Key particulars

Maker	Liebherr
Model	BOS 35000–800 / 35000–1000 Litronic
Main hook type	Rams horns
Auxiliary hook	C type
Drive	Electro-hydraulic
Installed Total power	3 x 500 kW - S1 rating
Emergency power pack	1 x 90 kW – S1 rating
Pedestal height	7.3 m
Vertical dist. between pivot & deck barge	22.00 m
Certifying authority (Crane & Pedestal)	Germanischer Lloyd (GL)

Crane Limitations (Elevated Condition)

Common

Maximum static inclination trim/hreel	0.5 / 0.5 degree
Relative humidity	Max. 100%
Ambient temperature	-25 to +45 deg. C
Max. operating wind speed (for crane)	25 m/s
Survival wind speed (for crane)	63 m/s
Vibration on the upper limb of driver	< 2.5 m/s^2
Vibration on the entire body of driver	< 0.5 m/s^2
Permitted pedestal load	5 kN/m^2
Man riding capacity	On auxiliary hoist

Main Hoist (Long Boom)

Boom length	102 m
Maximum hoisting capacity	800 t SWL
Reeving	2 x 8 fall
Minimum operating radius	13.9 m
Maximum operating radius	103 m
Hoisting speed	0-4.3 m/min with SWL, last layer
	0-16.5 m/min with empty hook, last layer
Safe working load (SWL)	800 t @ 25 m
(Offshore lifts @ 15.00 m/s wind speed)	511.4 t @ 38 m
Max. hook height above main deck	115.4 m
Max. lifting height below main deck	89.5 m

Main Hoist (Short Boom)

Boom length	78 m
Maximum hoisting capacity	1,000 t SWL
Reeving	2 x 10 fall
Minimum operating radius	12.2 m
Maximum operating radius	80 m
Hoisting speed	0-3.4 m/min with SWL, last layer
	0-13.2 m/min with empty hook, last layer
Safe working load (SWL)	1,000 t @ 25 m
(Onboard lifts @ 15.00 m/s wind speed)	644.4 t @ 38 m
Max. hook height above main deck	91.2 m
Max. lifting height below main deck	70.8 m

Aux. Hoist 1

Maximum hoisting capacity	50 t SWL
Man riding capacity	5 t @ max 2 m SWH & 10.00 m/s wind
Reeving	1 fall
Hoisting speed	0-61 m/min with full load
	0-140 m/min with empty hook

Long Boom 102.0 m

Minimum radius	15.6 m
Maximum radius	108.1 m
Max. hook ht. above main deck	125.9 m
Max. lifting ht. below main deck	99.4 m

Short Boom 78.0 m

Minimum radius	13.9 m
Maximum radius	85.1 m
Max. hook ht. above main deck	101.9 m
Max. lifting ht. below main deck	130.4 m

Tugger Winch

No. of winches	Two
Nominal line pull	250 kN (25.48 t)
Rope capacity per winch	approx. 200 m
Diameter 1. Layer D_1	1,000 mm
Ratio D_{Sheave}/ d_{Rope}	24

Crane Limitations (Vessel in Floating Condition) – Preliminary Data

Common	
Max. Wind Velocity	15.00 m/s
Trim	0.50/3.00 degree
Heel	3.00/0.50 degree
Lifting	Onboard/Offboard for SWH= 0.55 m
Crane boom tip velocity	0.55/0.55 m/s (Onboard/Offboard)
Vertical deck velocity	0.00/0.27 m/s (Onboard/Offboard)

Main Hoist (Long Boom)

Minimum hoisting capacity	105.00/76.90 t (Onboard/Offboard) @ 103 m
Maximum hoisting capacity	750.00/510.00 t (Onboard/Offboard) @13.90 m
Reeving	16 fall

Main Hoist (Short Boom)

Minimum hoisting capacity	214.1/163.5 t (Onboard/Offboard) @ 80.00 m
Maximum hoisting capacity	1000/690 t (Onboard/Offboard) @ 12.20 m
Reeving	20 fall

NOTE: In case crane limitations exceed vessel limitations then vessel limitations take precedence.

For further details of limiting condition for crane operations refer Section 3.6 and for further details on crane operating procedure refer Section 6.13.

1.3.6.2 Auxiliary (Provision) Cranes

REF DOC: Operation Manual Technical Description Offshore Crane 6.5T - 15M

REF DWG: V/D of Provision Crane DV563D001 Rev 0

The vessel is equipped with two non-continuously operating auxiliary crane located on starboard and port side of the vessel. It is a pedestal mounted, knuckle telescopic boom, limited revolving, electro –hydraulic type crane. All the movements of the crane can be performed simultaneously with portable radio control system.

The auxiliary crane is designed for cargo handling and personnel transfer/ man riding while the vessel is in elevated or floating condition.

Key particulars

Model & maker	HMB LINTEC Marine GmbH
Total length in parking position	< 9 m
Interference radius	~1 m
Hoisting speed	0 – 25 m/min
Hoisting height with extended jib	50 m
Time for luffing / telescoping	~90 / 120 s
Slewing speed	0 – 1 rpm (limited to 360°)
Rated Power	55 kW - S1
Certifying authority	GL

Limitations

Maximum hoisting capacity	
SWL for offshore operation	6 t at maximum out reach of 15 m
SWL for port operation	2.8 t at maximum out reach of 24 m
Man riding @ 2.00 m SWH	
On board lift	0.7 t at maximum out reach of 24 m
Off board lift	0.7 t at maximum out reach of 15 m
Minimum reach	~3 m
Heel	8°
Trim	5°
Ambient temperature	-20 / +45 °C
Relative humidity	90 %

NOTE: In case crane limitations exceed vessel limitations then vessel limitations take precedence.

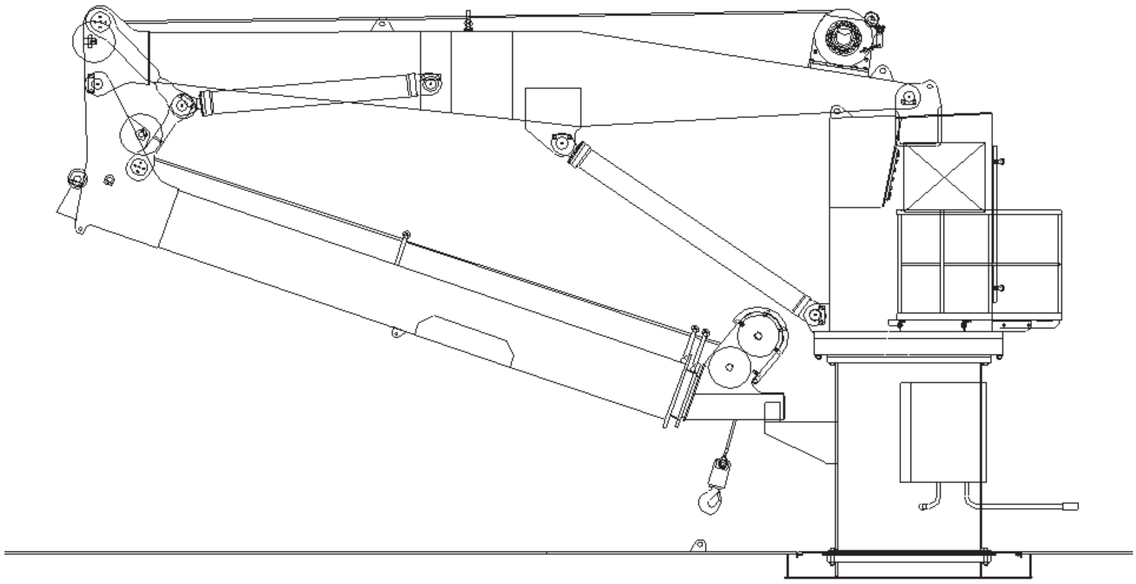

Figure 1-6 Auxiliary Crane Overview

For further details of limiting condition for crane operations refer Section 3.6 and for further details on crane operating procedure refer Section 6.13.

1.3.6.3 Davit Cranes

REF DOC: Fender / Life Raft Davit & Winch LD5042-020000-1011

REF DOC: Life Raft Davit & Winch LD3236-020000-1010

Fender / Life Raft Davit & Winch(5 ton)

The vessel is equipped with two non-continuously operating Fender / Life Raft Davit & Winch located on starboard and port side of the vessel. It is a pedestal mounted, fixed jib, manual slewing.

Davits are designed for fender & life raft handling while the vessel is in elevated or floating condition.

Description	Life Raft Handling	Fender handling
Davit type	Fixed jib type (2 No. Qty)	
Max inclination	20 deg. heel + 10 deg trim	5 deg. heel + 2 deg trim

<table>
<tr><td rowspan="3">Loads</td><td>Max. hoisting</td><td>10 kg @ 3.8 m</td><td rowspan="3">5,000 kg @ 4.2 m
5,060 kg @ 4.2 m (incl. Hook)</td></tr>
<tr><td>Min. lowering</td><td>350 kg @ 3.8 m</td></tr>
<tr><td>Max. lowering</td><td>2,500 kg @ 3.8 m</td></tr>
<tr><td colspan="2">Slewing</td><td colspan="2">165 deg. slewing by manual</td></tr>
<tr><td colspan="2">Max. lowering height</td><td>43.2 m</td><td>39.5 m</td></tr>
<tr><td rowspan="2">Lowering speed</td><td>Empty load</td><td>Min.(0.4 x 0.02 H) x 60 m/min x 0.7</td><td rowspan="3">10 m/min by
15 kW rated motor</td></tr>
<tr><td>Full load
H_{max} = 43.2 m</td><td>Min. (0.4 x 0.02 H) x 60 m/min
Max. (0.4 x 0.02 H) x 60 m/min
< = S <= 60 m/min</td></tr>
<tr><td colspan="2">Hoisting speed</td><td>By manual</td></tr>
</table>

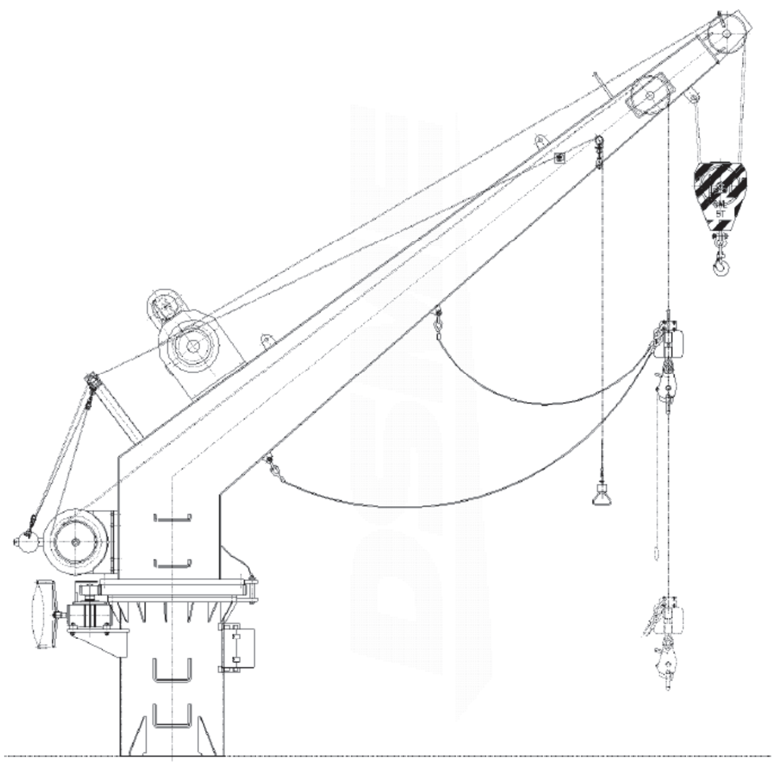

Figure 1-7 Fender / Life Raft Davit

Life Raft Davit & Winch (3 ton)

The vessel is equipped with one non-continuously operating Life Raft Davit & Winch located main deck of the vessel. It is a pedestal mounted, fixed jib, manual slewing type davit.

This davit is designed for life raft handling while the vessel is in elevated or floating condition.

Description		Life Raft Handling
Davit type		Fixed jib type (1 No. Qty)
Max inclination		20 deg. heel + 10 deg trim
Load: Max. lowering		2,500 kg @ 3.6 m
Slewing		90 deg. slewing by manual
Max. lowering height (H)		38.9 m
Lowering speed	Empty load	Min.(0.4 x 0.02 H) x 60 m/min x 0.7
	Full load	Min. (0.4 x 0.02 H) x 60 m/min Max. (0.4 x 0.02 H) x 60 m/min < = S <= 60 m/min
Hoisting		By manual

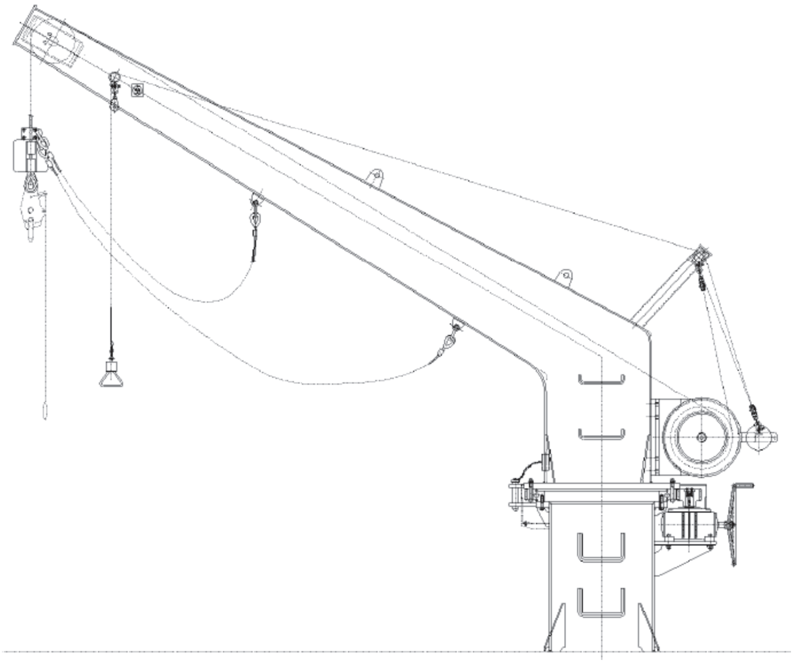

Figure 1-8 Life Raft Davit

1.3.7 Main Machinery & Propulsion

1.3.7.1 Main Engines

REF DOC: Geneset Technical Data 16V400M43S – 12V400P83

The vessels power is supplied by diesel engine driven generators.

Key specification of the main engines is as follows:

Diesel Engine Nos. & Type	5 sets x MTU-SDT 16 V4000M43 at Engine Room
	1 set x MTU-SDT 12V4000P83 at Container on Deck
Diesel Engine Make	MTU
Diesel Engine Max. Rating & RPM	2,280 kW x 1,800 rpm
	1,780kW x 1,800 rpm
Generator Make	LEROY SOMER
Generator Power	2,080 kW
	1,579 kW

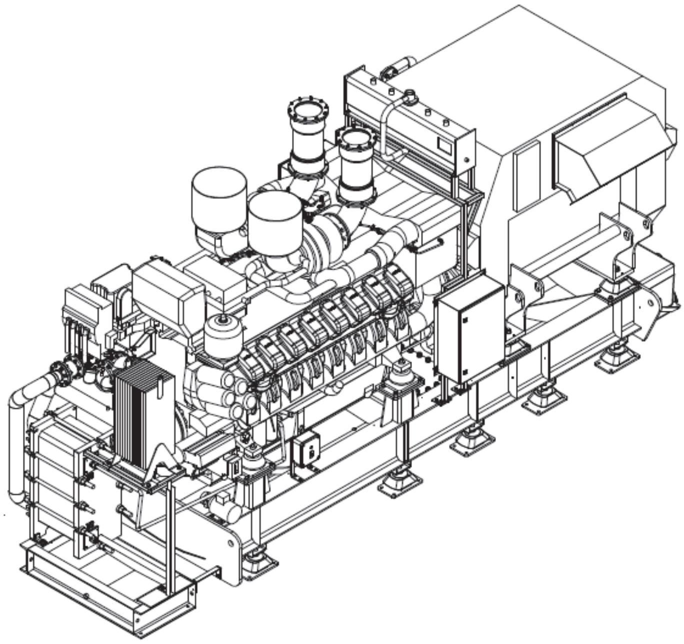

Figure 1-9 Main Genet

For further details on main generator sets refer to Section 9.1.

1.3.7.2 Thrusters

REF DOC: Thruster Drawing AQM UL 2011FP Rev F

REF DOC: Service Manual Mechanical & Hydraulic AQM UL2011FP

REF DOC: Service Manual/User Guide Aquapilot Control System AzT UL2011FP

REF DOC: Operation Manual for Lifting / Lowering of AQUAMASTER Ul Unit

REF DOC: Thruster Interaction Test Manual MARIN Report 24067-3-VT.

The vessel is equipped with Six (6) off Rolls-Royce steerable, retractable, electric driven thrusters. The thruster can be used for propulsion and DP operations.

Key specification of the thrusters is as follows:

Type	Azimuth FPP Retractable Thruster x 6 sets
Make	Rolls-Royce / AQM UL2011FP
Rating	1,600 kW x 1,200 rpm each
Propeller Speed	290 rpm
No. of Blades / Diameter	4 ea / 2,150 mm
Max. depth of thrusters below keel	2.87 m
Average time for thruster retraction	4 min

Figure 1-10 Azimuth FPP Retractable Thruster

For details on use of thrusters in various configurations for propulsion refer to section 6.5.2. For details on use of thrusters in various configurations for DP operations refer to section 6.12. For further technical details of thrusters refer to Section 9.5

1.4 Rules & Regulations

The vessel's design and construction confirms to the following rules and regulations:

- Germanischer Lloyd (GL) Class rules as required for mentioned Class notation of vessel.
- The 2001 MODU Code of IMO so far as applicable for Jack-Up / Crane vessels.
- MARPOL - International Convention for the Prevention of Pollution from Ships 1973, including protocol of 1978 with amendments up to 2010.
- Code of Safety for Special Purpose Ships (SPS), 2008 Edition.
- International Load Line Convention 1966 with amendments.
- International Convention for Prevention of Collisions at Sea 1972.
- ISO 6954:1984(E) - Guidelines for the overall evaluation of vertical and horizontal vibration in merchant ships.
- ILO - Maritime Labor Convention C92 and C133.
- COLREGS
- ISM & ISPS Code
- German Flag state rules as applicable including BGV, Wohnraumverordnung, Krankenfürsorgeverordnung.
- UK CAA - CAP 437, 6th Edition.
- IMO resolution A.855(20) Standards for on-board helicopter facilities (adopted on 27 November 1997).
- Inmarsat Regulations
- International Electro Technical Commission (IEC).
- International Telecommunication Union (ITU) Rules and Recommendations.
- RAL e.V. "Blauer Engel".
- Ships Supply Guideline 96/98/EG (Changes acc. Guideline 2002/75/EG).
- MSC/Circ 982 - Guidelines on Ergonomic Criteria for Bridge Equipment and Layout.

2 CHAIN OF COMMAND

REF REG: MODU-CODE 14.1.2.2

REF REG: MODU-CODE 14.8.1

REF DOC: Roles and Responsibilities in Company IMS Manual.

2.1 Chain of Command for Normal Operations

The Master is the highest authority and heads the Chain of Command on the vessel and has the following key responsibilities:

- The Master has to ensure that the vessel is operated with due regard for the preservation of all life and the environment
- The Master has ultimate responsibility for taking all necessary actions for safe operations of the vessel and its equipment.
- The Master must ensure that the vessel is operated in accordance with this Operating Manual, Company Policy, International Regulations and Client's requirements.

For normal operations, figure 2-1 shows the Chain of Command on the vessel. For routine duties and responsibilities of Master and each personnel refer to Company IMS manual.

2.2 Chain of Command for Special Operations

For specialist operations like heavy lift crane operations during elevated conditions the Master may nominate specific personnel as Person in Charge (PIC) for that particular operation. The Master should ensure that the person acting as PIC should be competent, trained, qualified and fully conversant with the procedures mentioned in the OM to handle the particular operation.

2.3 Chain of Command for Emergency Operations

In certain emergency situation not covered by procedures in this OM, the Master may seek external help from specialist onshore personnel.

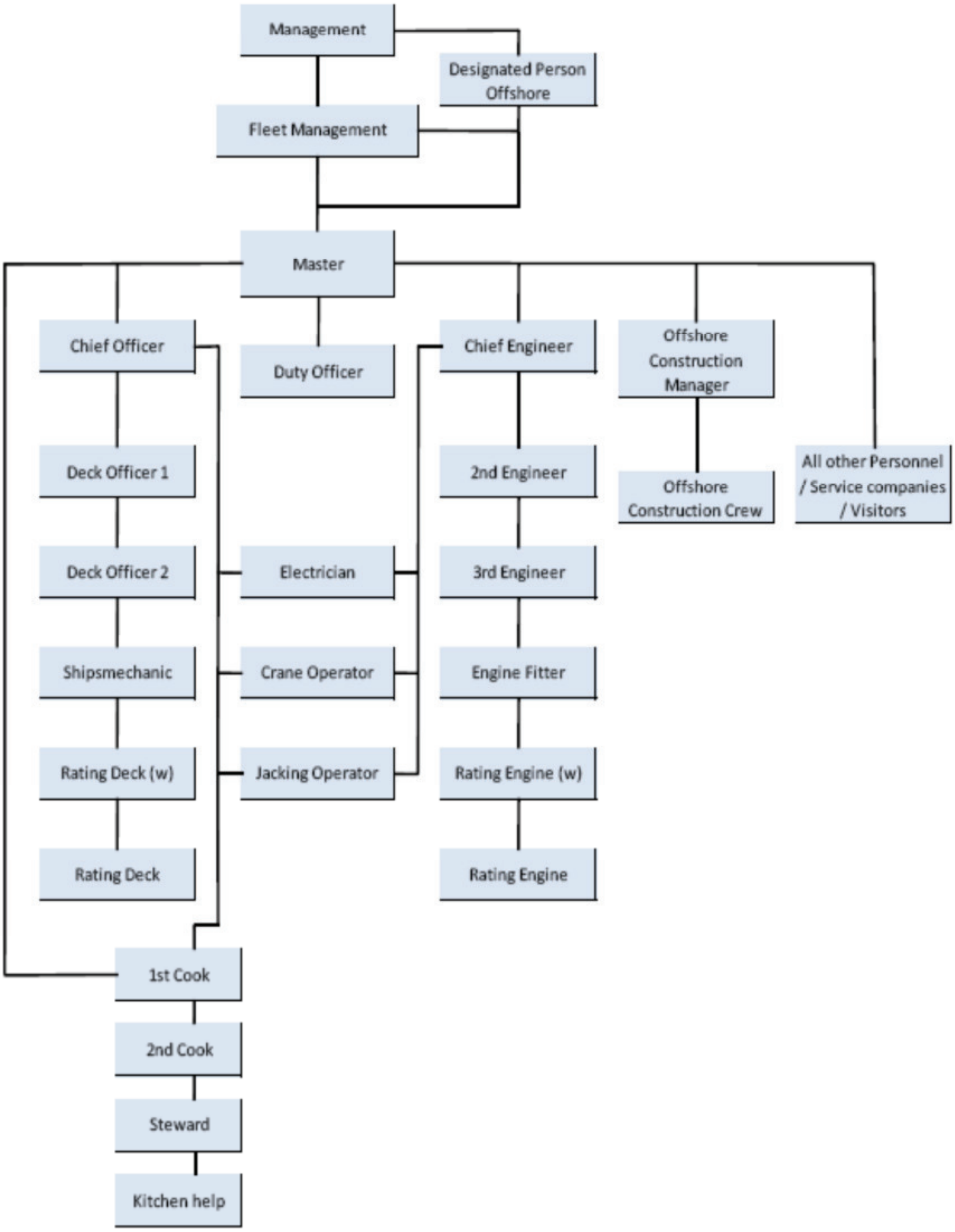

Figure 2-1 Chain of Command

3 LIMITING DESIGN DATA (Except Stability)

NOTE: In terms of limitation relevant for stability, the Master is advised to refer and follow the general instructions and limitation of operation stated in part A of the 'Approved – Final Trim & Stability Booklet'. Any conditions beyond the stability limitations described in the 'Approved – Final Trim & Stability Booklet' shall be verified by class approved stability calculations and strength calculations (if required).

Limitations in this chapter are applicable to the vessel where spud-cans are attached as well as if detached irrespective of any loading conditions.

NOTE: The limiting environmental conditions of the following chapters have been derived during the design stage of the vessel. The limit values of wind, wave and current have been applied simultaneously in the most disadvantage way at a given water depth and full payload i.e. maximum Jackable load of 15,300 t. The environmental limitations can be taken as envelope conditions for any site operations. If at a specific site, one or more parameter is exceeded, a site specific assessment has to be executed to verify the suitability of the vessel.

NOTE: Unless otherwise stated, the mean wind speed definition refers to a 10 minute mean at a reference height of 10 m above ground level or mean sea level.

3.1 General Environmental Limitations

3.1.1 Ambient Temperatures

3.1.1.1 Air Temperatures

Standby conditions	(-) 15 °C
Operating conditions	(-) 10 °C

NOTE: Some components of the jacking system are rated for 0°C. If the ambient temperature falls below 0°C, heating system for jack houses should be used.

3.1.1.2 Sea Water Temperatures

Minimum Temp.	(-) 2 °C
Maximum Temp.	32 °C in Transit Condition
	25 °C in Jacked Up Condition

In case of seawater temperature exceeds 25°C, a cooling water balance calculation shall be performed.

3.1.2 Other Environmental Conditions

Snow & ice accumulation	Considered not to apply
Sea ice	Considered not to apply
Marine growth	None envisaged, legs will stay clean due to frequent field move

NOTE: In case marine growth on legs occurs it should be cleaned before starting any operations or accounted for while making site specific assessments. Excessive marine growth on hull & leg should be considered in maximum jackable weight, DP capability and transit speed calculations while making specific operational assessments.

3.1.3 Soil Condition

The vessel is designed as a mobile offshore unit and it can be installed over many types of seabed conditions. In areas where deep leg penetrations are expected Spudcans may be attached to the legs in order to limit leg penetrations. This shall be assessed by carrying out site specific assessments for the location.

Before penetration operations (with or without spudcan), it shall be ensured that the required air gap can be fulfilled under consideration of the expected penetration for the location.

To avoid ingress of soil into the leg through pin holes, penetrations greater than the first pin hole from bottom should be avoided. Refer to below table for maximum penetrations to avoid soil ingression into legs:

Range of Leg Penetration to avoid soil Ingression to leg

Without Spudcan	Approx. 11.18 m
With Spudcan	Approx. 11.88 m

NOTE: In case, leg penetration goes beyond the above mentioned limitations, appropriate cleaning measures should be employed during the leg lifting operation to avoid contamination of koker section. For further details on methods of cleaning inside the leg due to soil ingression refer to section 6.3.6.2.

Min/max leg penetration and information of soil data will be provided for final revision of Operating Manual.

3.2 Limitations for Floating Condition

REF DOC: Approved - Final Trim & Stability Booklet DA101Z035

3.2.1 Normal Floating Condition (Transit or On Location)

For the normal floating condition with all legs fully retracted up during transit (Field or Ocean) and while floating on location without cargo/deck load, the limiting environment for the vessel is:

Wind speed	up to 28 m/s (Bft 10)
Significant wave height	up to 6.5 m
Average zero-crossing period	3 to 12 s
Tidal and wind driven current	As per thrusters capability

3.2.1.1 Min. Floating Water Depth

Operation Mode		Reqd. Min. Depth	Draft	Protrusion	Bottom Clearance
Thruster Operation	Extracted	8.86 m	3.96 m (Min. Ballast Draft)	2.9 m	2.0 m (can be reduced to 1.0 m with slow speed)
	Retracted	5.96 m		0 m	
Suction Mast Operation		10.60 m	2.5 m (Min. Ballast Draft)	5.5 m	2.5 m

3.2.2 Floating Storm Survival Condition (Transit or On Location)

For survival condition lowering the leg by approx. 15 m is recommended in order to give the vessel roll damping effect as well as increase of the vessel stability (vessel VCG will be lowered 2.89 m by lowering all the leg by 15 m) during transit (Field or Ocean) and while floating on location the limiting environment for the vessel is:

Wind speed	up to 40 m/s (Bft 12)
Significant wave height	up to 10 m
Average zero-crossing period	10 to 14 s
Tidal and wind driven current	As per thrusters capability
Max. allowable rolling	16 deg.

NOTE: For details about the limitation of the significant wave height relevant for stability, the Master is advised to refer to the ‘Approved - Final Trim & Stability Booklet’. The limitations described in 3.2.1 and 3.2.2 above is partly higher and partly lower than the limitations for stability. Any conditions beyond the stability limitations described in the ‘Approved - Final

Trim & Stability Booklet' shall be verified by class approved stability calculations and strength calculations (if required).

3.2.3 Dynamic Positioning

REF DOC: L-3 DP Operation Manual DV943E00 Rev 1

REF DOC: DP Capability Plots Rev A

For the limitations of dynamic positioning refer to DP capability plots.

3.3 Limitation for Transient Conditions

3.3.1 Engaging Bottom

Water depth	45 m (LAT),48 m (Including Tide & Wind Surge)
Wind speed (Mean)	up to 15m/s (Bft 7)
Significant wave height	up to 2.5 m
Average zero-up-crossing period:	3 to 7 s
Current for water depths up to 20 m:	
Tidal current	up to 1.48 m/s at surface
Wind driven current	up to 0.2 m/s at surface
Current for water depths up to 45 m:	
Tidal current	up to 1.14 m/s at surface
Wind driven current	up to 0.2 m/s at surface

For the limitations of dynamic positioning refer to DP capability plots

3.3.2 Elevating Out of Water

Water depth	45 m (LAT),48 m (Including Tide & Wind Surge)
Wind velocity (Mean)	15 m/s (Bft 7)
Significant wave height	2.5 m (Considering wave forces on hull)
Wave period	8 s
Surface current	1.2 m/s

3.3.3 Pre-Driving, Pre-Loading

Water depth	45 m (LAT),48 m (Including Tide & Wind Surge)
Wind velocity (Mean)	15 m/s (Bft 7)
Significant wave height	3.5 m (No wave forces on hull)
Wave period	8 s
Surface current	1.2 m/s
Assumed Penetration	3 m (Refer to Section 3.1.3 for details)

3.3.4 Jacking Down and Re-floating

Wind velocity (Mean)	15 m/s (Bft 7)
Significant wave height	2.5 m (Considering wave forces on hull)
Wave period	8 s
Surface current	1.2 m/s

3.4 Limitations for Elevated Conditions

3.4.1 Definition of Gap and Air Gap

"Gap" is the distance between still water level and the hull baseline, as shown in figure 3-1.

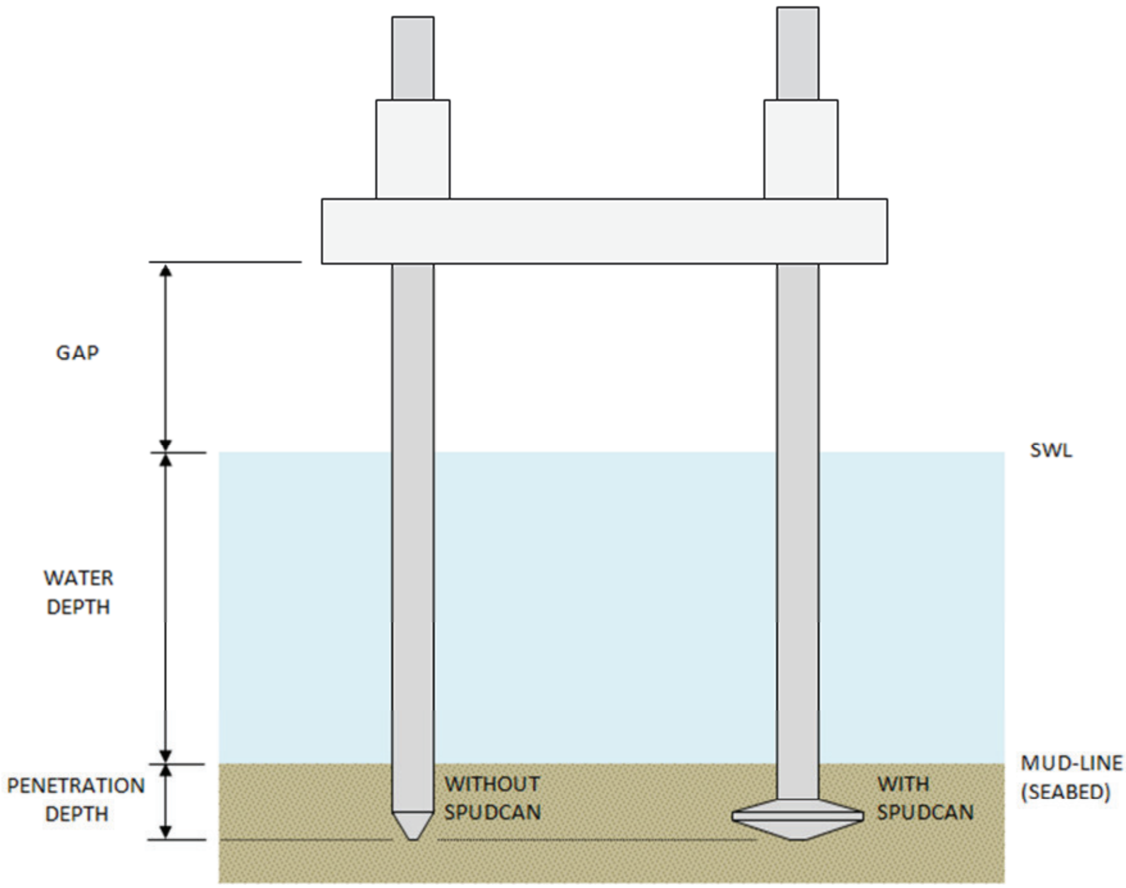

Figure 3-1 Definition of 'Gap'

"Air gap" is the vertical distance between the maximum wave crest and the baseline of the hull, as shown in figure 3-2.

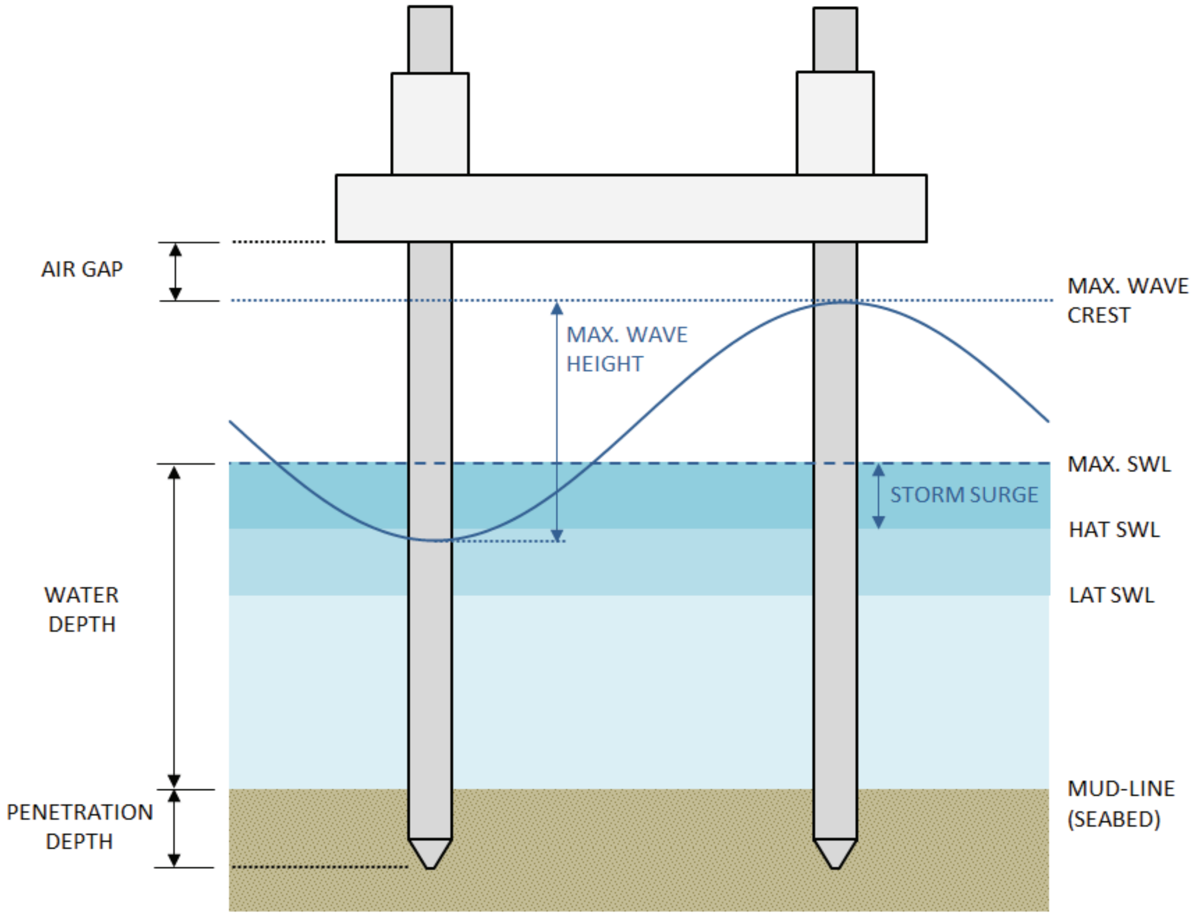

Figure 3-2 Definition of 'Air Gap'

3.4.2 Definition of Directional Conditions

Figure 3-3 shows the definition of directional wind and wave conditions considered for calculation of the elevated storm survival limits.

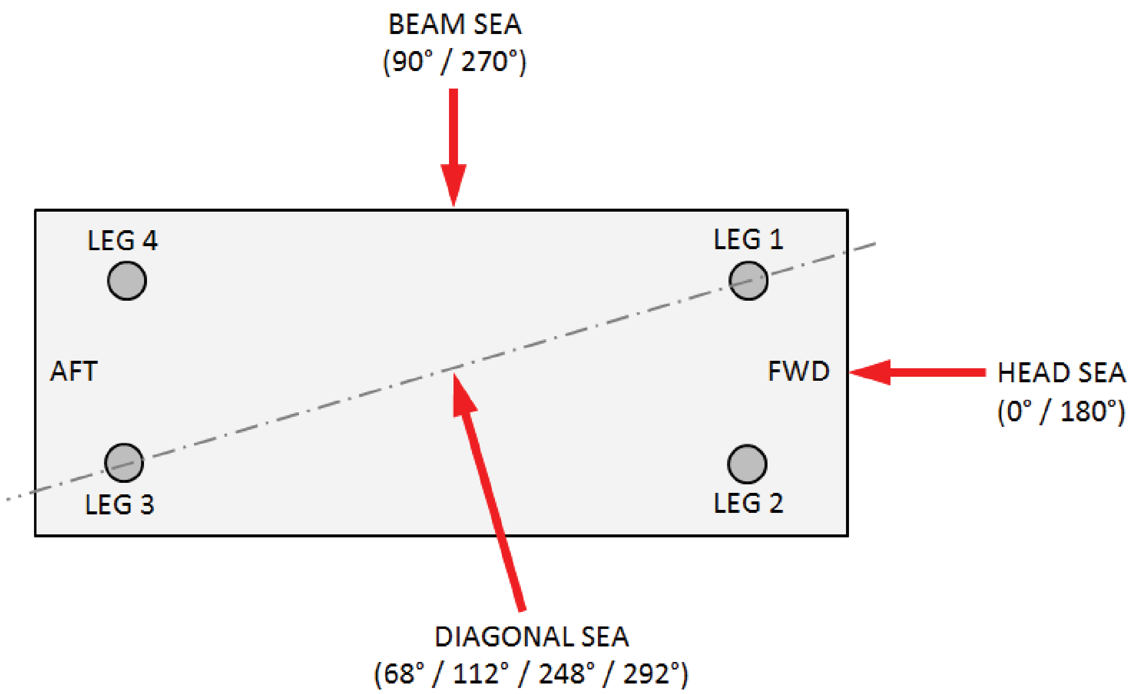

Figure 3-3 Definition of directional conditions

3.4.3 Operational Elevated Condition (Heavy Lifts)

Maximum elevated load	15,300 t
Water Depth	Up to 48 m (Still Water Level) subject to leg penetration.
Operational elevation calculation:	LAT + height of tide + max. wave crest + air gap **NOTE:** height of tide and maximum wave crest forecast during period of operational elevated condition should be considered.
Minimum air gap:	1.5 m **NOTE:** minimum air gap may be reduced subject to evaluation and approval of Owner's engineering department.
Maximum gap:	20.5 m to 24.5 m **NOTE:** this is not an environmental limitation, but is based on the following parameters: - A gap of 24.5 m may be used for all lifesaving appliances, except for the freefall lifeboat (limited to 23.9 m) - If the gap goes beyond 20.5m, special consideration should be taken for the sea water cooling and fire water supply systems
Maximum / minimum penetration	Subject to Site Assessment (also refer to Section 3.1.3 for details)
Wind speed	Up to 20 m/s (10 min mean at 10 m height)
Irregular Waves	
Significant wave height	up to 3.5 m
Average zero up-crossing period	3 – 10 s
Regular Waves	
Maximum wave height	up to 7 m
Wave period	3 – 12 s
Tidal and wind driven current	up to 1.2 m/s at surface

3.4.4 Elevated Storm Survival Condition

Maximum Elevated Load:	15,300 t
Maximum water depth:	Up to 45 m (Still Water Level), subject to leg penetration.
Storm survival elevation calculation:	whichever is the greater of the following two calculations: i) HAT + storm surge + max. wave crest* + minimum air gap *either: (a) max. forecast wave crest, or (b) 50 year return period wave crest should be considered, whichever is greater. ii) HAT + storm surge + minimum gap
Minimum air gap:	1.5 m
Minimum gap:	9 m **NOTE:** if both the minimum air gap and the minimum gap values are exceeded, then the performance of the vessel in elevated storm survival condition may reduce.
Maximum gap:	20.5 m to 24.5 m (as per section 0).
Minimum / maximum penetration:	According to site specific assessment.
Maximum wave height:	See Figure 3-4 for omnidirectional limits. See Figure 3-5, Figure 3-6 and Figure 3-7 for directional limits **NOTE:** directional limits only apply when direction of prevailing conditions can be guaranteed within ±5 degrees of vessel heading.
Maximum wind speed:	Up to 40 m/s (10 min mean at 10 m height). **NOTE:** a maximum wind speed greater than 40 m/s can be acceptable subject to verification by Owner's engineering dept. within site specific assessment.
Combined tidal and wind driven current:	Up to 1.3 m/s at surface. **NOTE:** a combined current greater than 1.3 m/s can be acceptable subject to verification by Owner's engineering dept. within site specific assessment.

NOTE: The elevated storm survival condition limits consider the structural limits of the vessel. For each jacking location the following site-specific soil dependent limits must also be verified within the site specific assessment in accordance with good industry practice:

- Soil capacity with respect to maximum leg loads (vertical and horizontal)
- Overturning stability

NOTE: Calculation of wind load for the elevated storm survival condition limits is based on projected areas of 2894 m^2 (head sea) and 4190 m^2 (beam sea). In case an alternative deck layout results in different projected areas, then the wind loads for the alternative deck layout may be calculated and a correction factor applied to the limits if necessary. Calculations and results should be documented within the site specific assessment.

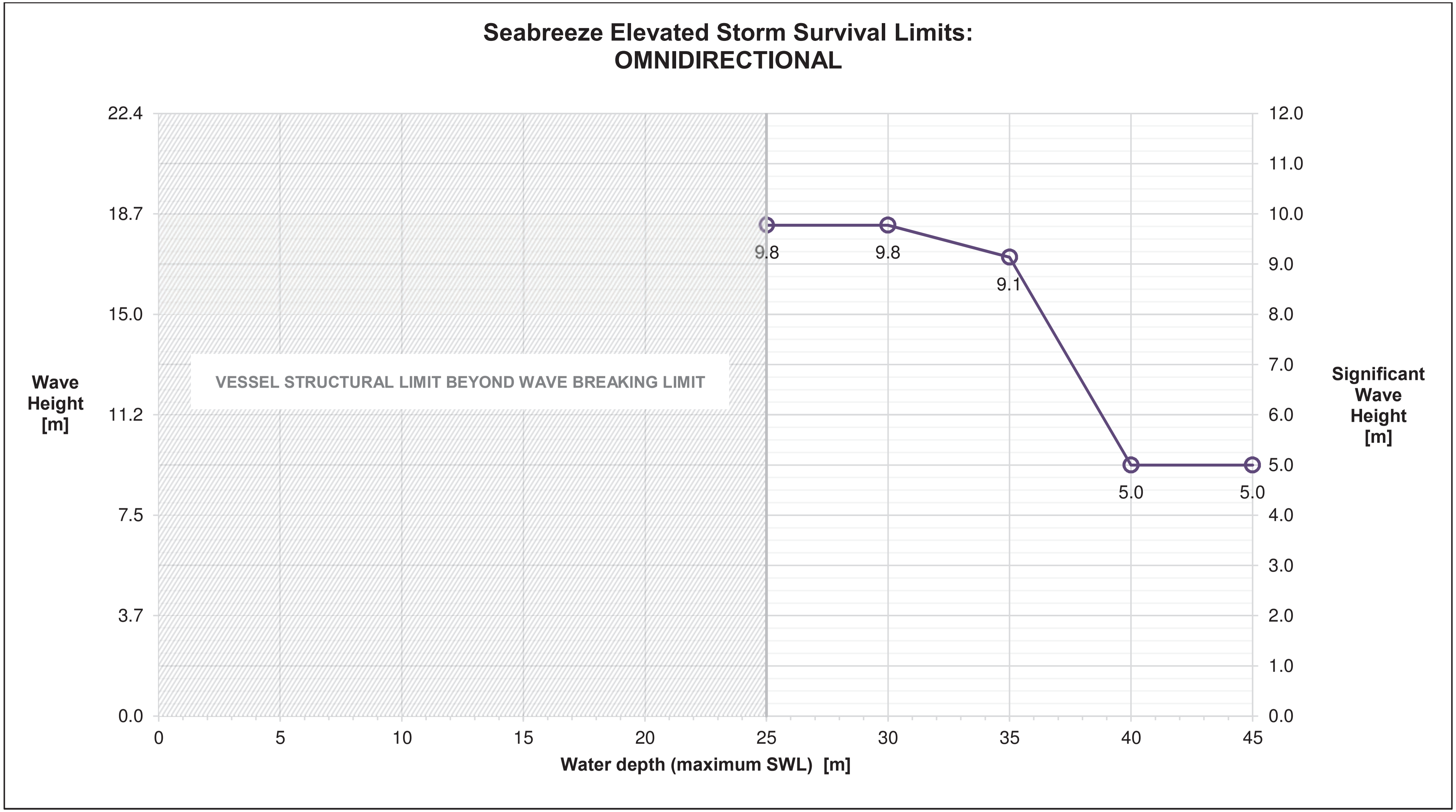

Figure 3-4 Omnidirectional elevated storm survival limits

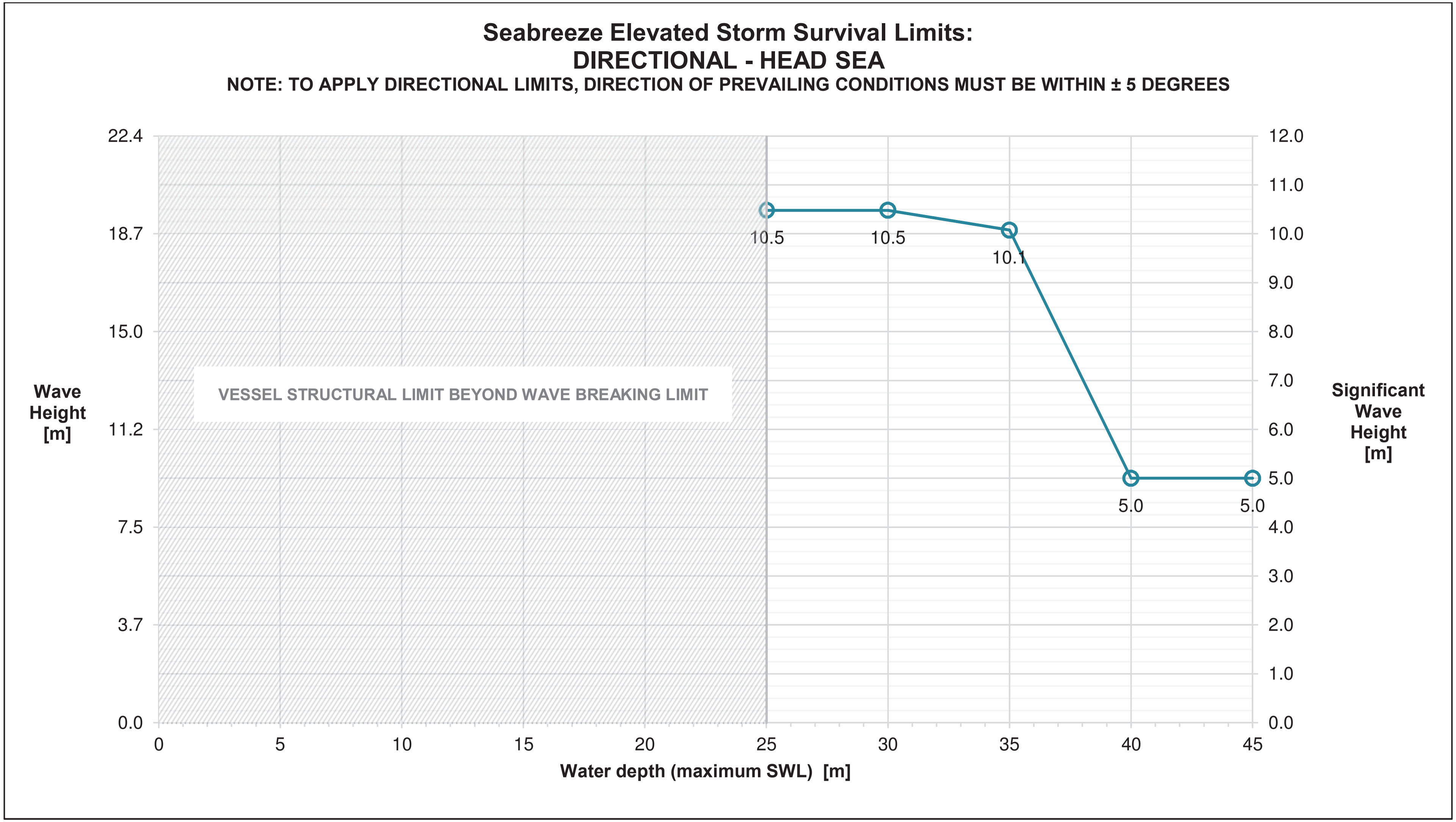

Figure 3-5 Directional elevated storm survival limits – Head sea

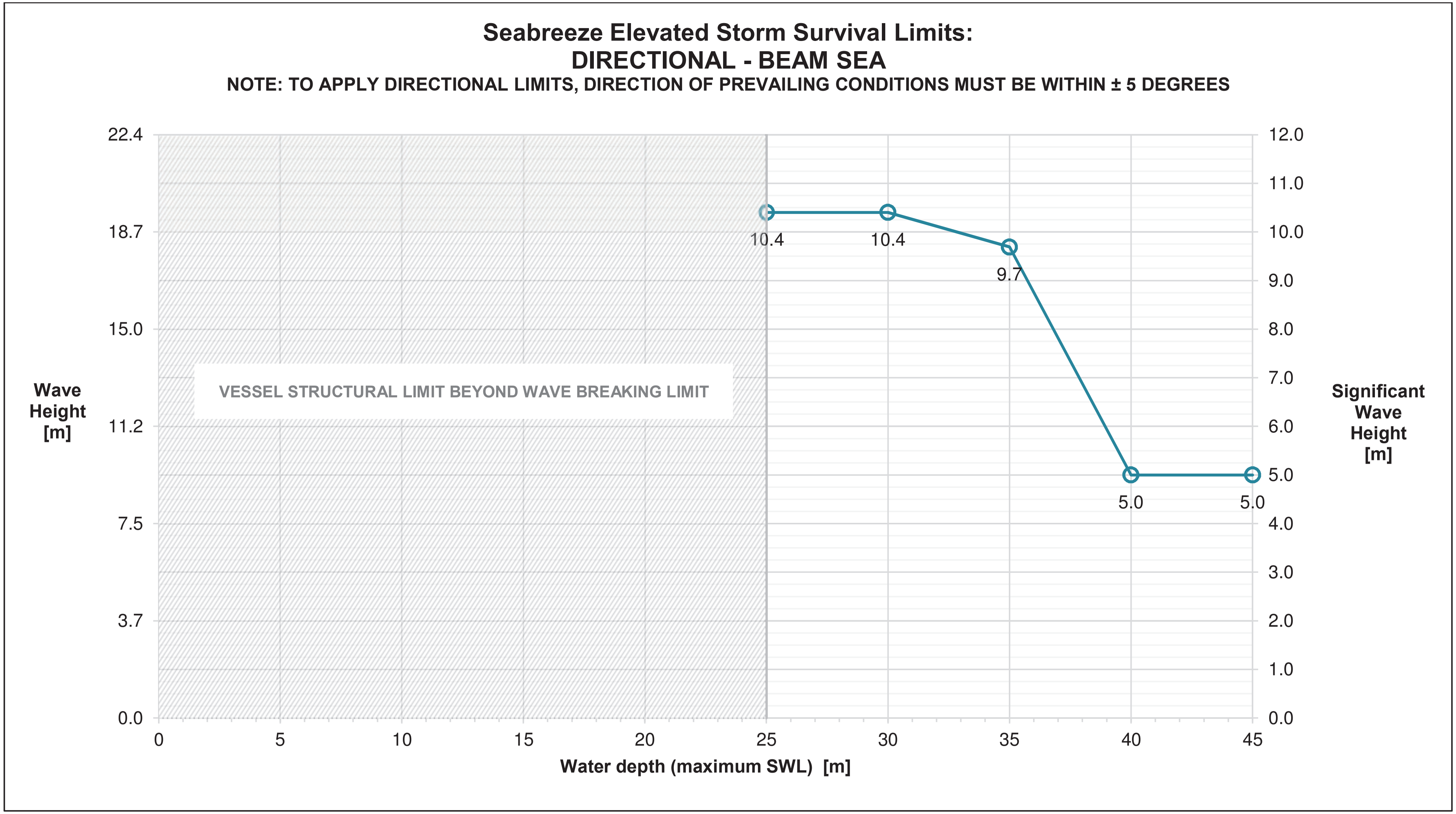

Figure 3-6 Directional elevated storm survival limits – Beam sea

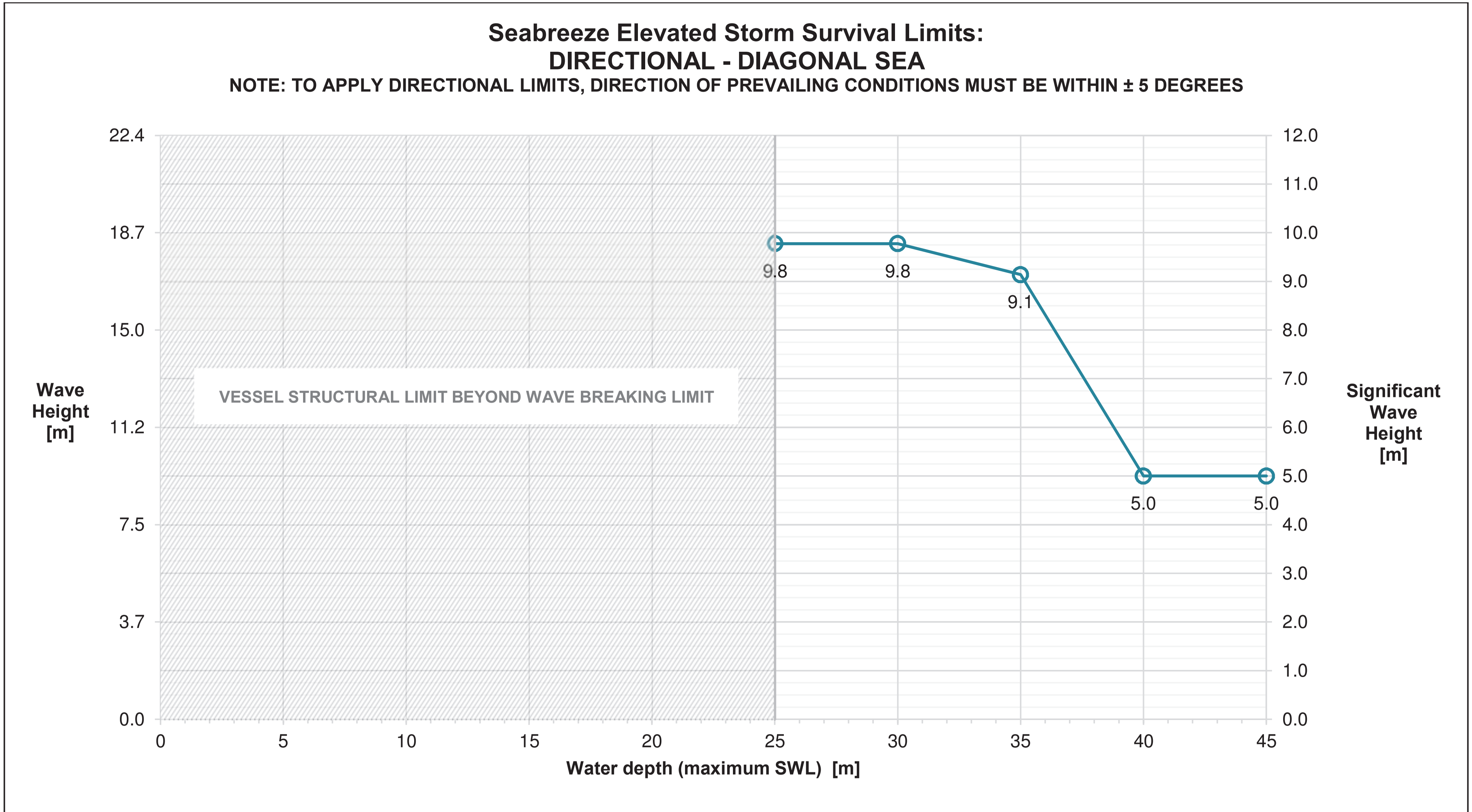

Figure 3-7 Directional elevated storm survival limits – Diagonal sea

3.4.5 Leg / Spudcan Strength Limitations

Preload at hull to leg connection	66,150.50 kN (6,743.12 t) per Leg
Spudcan design load	72,000 kN (7,339 t) per Leg
Max. average hydrostatic pressure	Approx. 60 m of water column (48m WD + 12 m penetration)

3.5 Deck Load Limitations

REF DWG: Deck Loading Plan DA300H005 Rev A

REF DOC: Project Specific Construction Manual

REF DOC: Cargo Handling & Securing Manual

The vessel is designed to carry heavy cargo for offshore wind farm installation like wind turbine components, its supports and foundations. The cargo shall be carried on the vessel's main deck within its payload limitations mentioned in section 0 and deck load limitations mentioned below:

Main Deck in way of open areas (Aft to Fr 169)	15 t/m²
Main Deck Fr 169 to forward	3 t/m²

All cargo components and items shall be carried in seaworthy frame structures or cradles specifically built for its stowage and handling. All such cargo shall be stowed and lashed as per procedures and stowage plans given in the 'Cargo Handling & Securing Manual' of the vessel. These project specific stowage plans shall be prepared after careful consideration of deck load limitations and steel member structural strength limitations.

For stowage of general cargo like stores, containers etc., which are not mentioned in the project specific stowage plans, the above mentioned maximum deck loadings should be adhered to at all times.

All cargo shall be lashed and secured as per lashing arrangement given in 'Project Specific Construction Manual. All cargo lashing / temporary welding should be carried out in such a way that the structure is not damaged and its capability is not reduced. To secure deck cargo, lashing sockets are provided within main deck area. Each single lashing point has been reinforced to withstand SWL of 76.45 t (750 kN) tension load or SWL of 101.94 t (1000 kN) compression load.

The allowable deck load for other areas is:

Compass Deck & Jackhouse Deck	0.9 t/m²
Wheelhouse Deck	1.5 t/m²

The maximum loads for the available lashing sockets are as follows:

Tension Load to the Lashing Socket	750 kN (76.45 t)
Compression Load to the Lashing Socket	1000 kN (101.94 t)

Further detailed information on allowable deck loading in all areas refers to the vessel's Deck Loading Plan DA300H005 Rev A.

3.6 Limiting Conditions for Crane Operations

REF DOC: Main Crane (Liebherr) Operating Manual, BOS 35000–1000 LITRONIC Serial No.170564, 170565

REF DOC: Main Crane (Liebherr) Technical Data Sheet 170 564 – 565 – 050 Rev 3

REF DOC: Main Crane (Liebherr) Load Charts 170 564 – 565 – 100 Rev 0

REF DOC: Operation Manual Technical Description Offshore Crane 6.5T - 15M

REF DOC: V/D of Provision Crane DV563D001 Rev 0

REF DOC: Crane Stability Booklet DA101Z034

3.6.1 General

This section describes the limiting conditions on the vessel that must not be exceeded for the crane operations.

3.6.2 Main Crane

The main crane is primarily designed to handle lifting operations in jacked up mode only. However it can also handle lifting operations in afloat condition within vessel and crane limitations.

3.6.2.1 Elevated Condition

Min. Temperature	-15 deg. C
Max. temperature	38 deg. C
Maximum static inclination trim/heel	0.5 / 0.5 degree

Other limiting conditions for crane operations in elevated conditions as same as the vessel limiting operation condition in elevated mode. Refer Section 0 for the same.

NOTE: In case crane limitations exceed vessel limitations then vessel limitations take precedence.

3.6.2.2 Afloat Condition

The main crane is also designed to handle the lifting operations in afloat mode at harbour with reduced working load within the permissible limit. Crane operation offshore in floating mode shall be applicable after verification of stability criteria and approval of class.

The vessel has to meet all relevant stability criteria as per Section 3.2 and as given in ‘Crane Stability Booklet’, during crane operation afloat.

NOTE: In case crane limitations exceed vessel limitations then vessel limitations take precedence. However, in harbour operation, crane limitation will be dominant.

3.6.3 Auxiliary Crane

The auxiliary crane is designed to handle lifting operations in both elevated and afloat condition.

3.6.3.1 Elevated & Afloat Condition

For limiting operating conditions refer Section 1.3.6.2.

The vessel has to meet all relevant stability criteria as per Section 3.2 and as given in 'Approved – Final Trim and Stability Booklet', during crane operation afloat.

NOTE: In case crane limitations exceed vessel limitations then vessel limitations take precedence.

3.7 Overview of Limiting Conditions

Operation	Water Depth	Significant Wave Height	Maximum Wave Height (= 2 x SWH)	Crest Elevation	Wind Speed (10 minute mean, 10 meter height)			Wave Period	Maximum Current	Maximum Current	Leg Lower	Minimum Gap	Maximum Gap	Minimum Air Gap	Trim/ Heel
	m	m	m	m	m/s	Bft	knots	s	m/s	knots	m	m	m	m	deg.
Normal Floating	8.86 [1] 5.96 [2] 10.6 [3]	≤ 6.5	≤ 13	≤ 9.1	≤ 28	≤ 10	≤ 54.4	3 - 12	As per thrusters capability						
Survival Floating	8.86 [1] 5.96 [2] 10.6 [3]	≤ 10	≤ 20	≤ 14	≤ 40	≤ 12	≤ 77.8	10 - 14	As per thrusters capability		≤ 15				
Engaging Bottom (with & without Spudcan)	48 [5]	≤ 2.5	≤ 5	≤ 3.5	≤ 15	7	≤ 29.2	3 - 7	1.48 [6] 0.20 [7] 1.14 [8] 0.20 [9]	2.88 [6] 0.39 [7] 2.12 [8] 0.39 [9]					
Elevating Out of Water (with & without Spudcan)	48 [5]	≤ 2.5	≤ 5	≤ 3.5	≤ 15	7	≤ 29.2	8	1.20 [15]	2.33 [15]					
Pre-Driving, Pre-Loading	48 [5]	≤ 3.5	≤ 7	≤ 4.9	≤ 15	7	≤ 29.2	8	1.20 [15]	2.33 [15]					
Jacking Down & Re-floating	8.86 [1] 5.96 [2] 10.6 [3]	≤ 2.5	≤ 5	≤ 3.5	≤ 15	7	≤ 29.2	8	1.20 [15]	2.33 [15]					
Operational Elevated Condition (Heavy Lifts)	48 [5]	≤ 3.5	≤ 7	≤ 4.9	≤ 20	8 - 9	≤ 38.9	3 - 10	1.20 [4]	2.33 [4]			20.5 - 24.5	1.5 [16]	
Elevated Storm Survival Condition	45 [5]	≤ 5 - UNLIMITED[14]	≤ 10 - UNLIMITED[14]	≤ 7 - UNLIMITED[14]	≤ 40 [19]		≤ 77.8	5 - 14	1.30 [4, 19]	2.53 [4, 19]		9 - 11 [17, 18]	20.5 - 24.5	1.5 [18]	
Anchoring					≤ 25		≤ 48.6		≤ 2.5	≤ 4.9					
Main Crane – Elevated Condition		2 [10]	4 [10]	1.4 [10]	25 [11] 63 [12]		48.6 [11] 122.5 [12]								0.5 / 0.5
Main Crane – Floating		0.50	1.00	0.70	≤ 15		≤ 29.2								0.5 / 0.5
Main Crane – Aux. Hoist Man Riding 5 t		2.00	4.00	2.80	≤ 10		≤ 19.4								

1	Minimum Water with Extended Thruster vessel fully loaded	8	Tidal Current for Water Depth up to 45 m	15	Tidal and Wind current for water depth up to 45m
2	Minimum Water with Retracted Thruster vessel fully loaded	9	Wind Current for Water Depth up to 45 m	16	May be reduced subject to evaluation by Owner's engineering dept.
3	Minimum Water for Suction Mast operation	10	Max. Wave Height for Man Riding	17	See section 3.4.4 for definition
4	Tidal & Wind Driven Current	11	Max. Operational Wind Speed	18	If both min. air gap and min. gap values are exceeded then vessel performance in elevated storm survival condition may reduce
5	Maximum still water level (SWL)	12	Survival Wind Speed (max. gust boom stowed)	19	Increased value can be acceptable subject to verification by Owner's engineering dept. within site specific assessment
6	Tidal Current for Water Depth up to 20 m	13	Not used	NOTE:	In case crane limitations exceed vessel limitations then vessel limitations take precedence
7	Wind Current for Water Depth up to 20 m	14	Refer to figures 3-4, 3-5, 3-6 and 3-7 for limits	NOTE:	For Man Riding: Max SWH = 2 m; Appropriate illumination; Max Wind Speed = 10 m/s

Table 3-1 Vessel's Limitations

4 LOAD CAPACITIES

REF DOC: Approved - Final Trim & Stability Booklet DA101Z035

4.1 Drafts and Displacements

The vessel has the following drafts and displacement capacities:

Draft (design)	4.5 m
Draft (scantling, summer load line)	5 m
Max. air draft without spudcan	79.85 m from B.L. to the top of the Leg incl. Top Light
Max. air draft with spudcan	77.55 m from B.L. to the top of the Leg incl. Top Light
Max. air draft without spudcan	78.00 m from B.L. to the top of the Leg structure only
Max. air draft with spudcan	75.70 m from B.L. to the top of the Leg structure only
Max. air draft	48.32 m from B.L.to the top of the main crane

Cargo Payload is as follows:

	Without Spudcans		With Spudcans	
	Short Boom	Long Boom	Short Boom	Long Boom
Max. Jackable Load	15,300 t			
Consumable	600 t			
Light Weight	13,006.4 t	13,042.6 t	13,578.8 t	13,615.0 t
Non-Jackable Weight	2,848.2 t		3,420.6 t	
Payload	4,541.8 t	4,505.6 t	4,541.8 t	4,505.6 t
Displacement at Maximum Jackable Load	18,148.2 t		18,720.6 t	
Draft at Maximum Jackable Load	4.737 m		4.717 m	

- Payload=Max. Jackable Load – Consumables – (Light Weight – Non Jackable Weight)

For other drafts and displacements refer to the 'Approved - Final Trim & Stability Booklet'.

4.2 Light Ship Data

Light ship weight shall include the vessel hull with all fixed and loose equipment specified and agreed to be on board at their installed locations. The light ship weight in summery is the weight of the hull including all fixed items needed by the vessel to be ready for operation. That includes all piping's, circulation tanks, pressure tanks, diesel engines, hydraulic power pack(s), hydrophore(s), heat exchangers and system fillings. All spares and tools mentioned in the specification except of additional spares exceeding the standard outfit as required by class and recommended by OEM's. All loose inventories specified and agreed.

Descriptions	Weight (t)	LCG from A.P. (m)	TCG from C.L. (m)	VCG from B.L. (m)
Elevated Lightship Weight (Short Boom & Without Spudcan)	10,158.2	51.39	-1.26	10.04
Elevated Lightship Weight (Long Boom & Without Spudcan)	10,194.4	50.89	-1.26	10.13

Non Jackable / Excluded Weights (Legs & Lower Frames & Half of Cyl. Rods)	2,848.2	50.00	-0.00	35.50

Total Spudcan Weight	572.4	50.00	0.00	-2.21

Floating Lightship Weight incl. Legs & Non-Jackable Weights (Short Boom & Without Spudcan)	13,006.4	51.09	-0.98	15.62
Floating Lightship Weight incl. Legs & Non-Jackable Weights (Long Boom & Without Spudcan)	13,042.6	50.70	-0.98	15.67

Floating Lightship Weight incl. Legs & Non-Jackable Weights (Short Boom & With Spudcan)	13,578.8	51.04	-0.94	14.44
Floating Lightship Weight incl. Legs & Non-Jackable Weights (Long Boom & With Spudcan)	13,615.0	50.67	-0.94	14.49

NOTE:

LCG from frame No.0

TCG is positive to portside

VCG is positive above baseline(molded)

4.3 Variable Loads

Variable load is the weight of items that are expendable readily removable or consumable during operations. It is the total of all the weights on the hull, which do not form part of the vessel's lightship.

The variable load can be composed of the following items:

- Fuel oil, potable water, brine, waste water, dirty oil, lubricating oil, cooling water, ballast water, seawater
- Deck cargo
- Sea fastening equipment
- Stores, crew and their effects
- Consumables
- Spare parts
- Repair equipment
- Crane load
- Temporary deck equipment
- Extra accommodation! Office module(s)
- Helicopter

4.4 Guidance for Routine Recording of Lightweight Alterations

REF REG: MODU-CODE 14.1.3.2

It is important to use the current, correct lightship numbers when calculating both afloat and elevated stability.

- Any lightship alterations executed prior to approval shall be listed as variable load in the daily calculations made for reporting of weights and centers of gravity.
- The lightweight alterations should be recorded in the Deck + Engine Logbook and */ or* in the Ballast Record Book.
- All alterations on board the vessel, resulting in lightship changes, whether ADDED or REMOVED shall be recorded.
- This description of alterations include, the date they were performed along with the weight, VCG, LCG, and TCG.
- Maintain a separate form for each category of lightship. Keep a record of these alterations on board.
- Report the lightship alterations to the vessel management immediately and update Loading Computer and Marine Operating Manual.

CAUTION!

All modifications and repairs are subject to the regulatory requirements specified for initial construction. For emergency repairs, materials and procedures used should be compatible with those employed in the original fabrication. Refer to vessel's original construction portfolio (CP). All intended changes to the original design of any mechanical, electrical, or structural systems must be reported to and approved before changes are made.

5 STABILITY AND LOAD LINE INFORMATION

REF REG: MODU 14.1.2.5

REF REG: IMO Intact Stability Code

REF DOC: Approved - Final Trim & Stability Booklet DA101Z035

5.1 General

The 'Approved - Final Trim & Stability Booklet' describes in detail the stability consideration to be applied to this vessel. The booklet presents the necessary data and instructions to arrange cargo, fuel oil, ballast water etc., in a manner so that unacceptable level of stress are not developed in hull structure and the vessel also can maintain sufficient stability while in service.

It may be noted that for loading cases not complying with the area 3040 criterion, a special stability consideration was permitted by the Flag State Administration of Germany. This exemption is based on an alternative criterion and the limitation of the significant wave height to 6.5 m. The detailed exemption is described in the 'Approved- Final Trim & Stability Booklet'.

As a complement to the 'Approved - Final Trim & Stability Booklet', the loading computer provided on board may also be used to perform the trim, stability and strength calculation for any loading conditions not included in this booklet.

5.2 Hydrostatic Data

This data is made for the guidance of Master as to the safe operation and proper loading of the vessel.

The hydrostatic data are listed in the 'Approved – Final Trim & Stability Booklet' of the vessel.

In order to reduce the possibility of bottom damages, the echo sounder and water depth alarm is to be used at all times.

This requirement is an integral part of the risk assessment based on which the competent Flag State of Germany has accepted the unusual double bottom of the vessel. (old comment from rev. 7 of OM)

5.3 Guidance for Maintenance of Stability

REF REG: MODU-CODE 14.1.3.1

The ‘Approved – Final Trim & Stability Booklet’ provides guidance to operating personnel to ensure a safe and stable afloat condition while underway. The booklet serves the purpose to give the Master and the crew guidance by the instruction given herein the crew shall be capable of assessing all situations and determining the necessary actions to maintain stability

Compliance with the stability criteria does not ensure immunity against capsizing the vessel regardless of circumstances nor absolve the Master from his responsibilities. The Master should therefore exercise prudence and good seamanship having regard to the season of the year, weather forecasts, and the navigational zone and should take appropriate action as warranted by prevailing circumstances.

Care shall be taken that the cargo allocated to the vessel is capable of being stowed and secured so that compliance with criteria can be achieved. Cargo and sizeable pieces of equipment shall be properly stowed or lashed so as to minimize the possibility of both longitudinal and lateral shifting whilst at sea, under the effect of accelerations caused by rolling and pitching (sea fastening). In general, liquids should be distributed over the length of the vessel to avoid high local stresses and possible high bending stresses. Also the tanks should as far as possible be kept full (min 95%) or empty (max 5%) to minimize Free Surface Effect (FSE).

Apart from the items mentioned in this paragraph, further items related to stability are described in the ‘Approved – Final Trim & Stability Booklet’ which the Master is advised to observe.

5.3.1 Flooding of Koker Compartments

WARNING!

When water reaches the deck edge in way of the koker compartments (Nos.1 & 9 Void Space (P&S), water will flow into the koker compartments. The Master is therefore advised to avoid static heel or rolling beyond this angle (refer to “Down flooding angle” in ‘Approved – Final Trim & Stability Booklet’) to avoid water ingress. The Master shall ensure proper working of the available system to pump out flood water from the koker compartments in any intact or damaged condition.

5.3.1.1 Koker Arrangement

The vessels jacking system is installed in koker compartments (bottom to main deck) and the jack-houses on top of the koker compartments. The main deck between koker compartments and jack-houses is penetrated by large holes for the jacking system.

While normally empty, water can fill the koker compartments through these holes as water can enter the jack.-house through the gap between the jack-house and the jack-house panels and through the gap between the leg and the koker compartment.

This flooding will occur at deck immersion angle. The Master is therefore advised to avoid static heel or rolling beyond this angle to avoid water ingress. Other measures to protect the described gaps shall be taken as appropriate.

The described arrangement of openings in way of the jacking system requires a special concept of stability consideration. This concept is described in detail in the 'Approved - Final Trim & Stability booklet' and shall be applied in detail at all times.

Apart from the items mentioned in this paragraph, further items related to stability are described in the 'Approved – Final Trim & Stability Booklet' which the Master is advised to observe.

5.3.1.2 Koker Pumping & Safety Arrangements

The Master shall ensure proper working of the available system to pump out flood water from the koker compartments in any intact or damaged condition.

The compartments are provided with limit switch to activate an alarm in case these compartments are getting flooded.

For pumping out the compartments, they are connected to the bilge system. For detailed procedure of bilge system operation refer to Section 9.9.

5.3.2 Guidance of Maintenance of Watertight Integrity

For further and detailed guidance on maintenance of watertight integrity refer to 'Approved – Final Trim & Stability Booklet' and the 'Damage Control Booklet'. In general all watertight seals and hatches must be properly maintained at all times.

5.3.3 Loading Computer

REF DOC: SEACOS MACS3 Version NET 1.1 Loading Computer System Manual

5.3.3.1 Description

Loading Computer helps Master easily and quickly ascertains operational limitations are exceeded for any loading condition

The loading computer provided on board may also be used to perform the trim, stability and strength calculation for any loading conditions.

This Loading Computer helps Master to arrange cargoes, fuel oil, ballast water etc. in such a way that the vessel can be free from creation of unacceptable stress in hull structure and also can maintain sufficient stability and loading condition in service.

The loading computer has hardware and software sides.

<u>Hardware Side:</u>

2048 MB RAM, Hard disk ca. 250 GB ,DVD Drive ,LAN interface,19" TFT monitor, Keyboard + Mouse ,HP colour laser printer ,Mariner kit fastening of computer and printer for use onboard, MS-WINDOWS XP

Voltage: 220V, 60 Hz, 1 Phase

Software Modules:

Basic Program SEACOS MACS3.NET has been provided which can work in two different modes:

- In a passive mode, requiring manual data input
- In an active mode, replacing the manual input by sensors reading (on-line module)

SEACOS MACS3.NET helps Master for:

- Calculation of stability and longitudinal strength
- Comfortable and flexible input of tanks, holds and constant items
- Calculation of displacement, deadweight, trim & draft
- Draft correction due to sea water density
- Graphical display of trim and drafts
- Intact stability including GM according to IMO A. 749 or other regulations
- Multiple GM limit curves (incl. damage criteria acc. to SOLAS)
- Results include GZ curve, weather criterion, heeling angle, multiple freeboard modes, hydrostatic summery
- Consideration of moment due to wind, period of rolling, shear force and bending moment and torsional moment (if applicable)
- Calculation, comparison of shear force and bending moment with limit (sea and port) at prescribed frames with alarm
- Maximum value of shear force and bending moment with their actual point
- Maximum percentage values of bending moment and shear force
- Graphical presentation of longitudinal strength results, shear force correction at longitudinal bulkheads (if needed)
- Graphical tank plan(s) of the vessel showing current condition
- Deflection calculation, correction of drafts due to deflection, propeller immersion, air draft
- Optimization of trim, heel, stability and stress by ballast tanks
- Display and printout of loading condition and calculation results, draft survey
- Saving and loading of loading conditions, Online help
- Warning points (e.g. trim, draft, GM) will be checked against min./max values.

Program for mixed cargo MixCargo

Program for multipurpose vessels to process any kind of cargo (container, break bulk, trailer, homogeneous load), different views of container bays as well as top view of all decks, automatic calculation of stability and strength if the loading is changed, effective pre-stowage and pre-discharge functions (bay-, tier, row-or port wise), input of a wide range of data per container, check of stack weights with warning when limits are exceeded, handling of hatch covers, file import and export facility for EDIFACT/BAPLIE, extended pier functionality (viewing different criteria, sorted by two criteria), view of various statistics, colouring in accordance to different criteria.

Tank Online

- Online interface to the tank automation system for the transfer of current tank readings (volume or level) to the loading condition. This may also include ship's draft. The system is communicating with the vessel's AMCS system.

Future Modules

The following functions are expected to be added in the future update of the loading computer:

- Crane Module
- Stowman
- Sealash Module
- Wind-force calculation
- Jacking Module
- Survival Mode

5.4 Limiting Stability Curve and Tables

The limiting curves and tables are given in the 'Approved – Final Trim & Stability Booklet' of the vessel. This must be referred to for calculation of stability for various loading conditions.

5.5 Damage Control Plan

REF REG: SOLAS Chap II-1

REF DOC: Damage Control Booklet DA101Z066 Rev 0

REF DWG: Damage Control Plan DA101Z066 Rev 0

The 'Damage Control Booklet' and 'Damage Control Plan' have been prepared in accordance with SOLAS Cap II-1 (MSC.Res.286 (44) & MSC.1/Circ.1245) as per SPS code.

They give the Master / MIC and crew guidance in the case of damage. By the instructions given in the booklet the crew shall be capable of assessing the situation and determining the necessary action to be taken in order to minimize consequences of the damage with respect to the safety of persons on board and protection of the marine environment.

Page No. 4 to 14 of the booklet shows watertight/weather tight boundaries, watertight/ weather tight closures and all the Down flooding points.

5.6 Tank and Bulk Capacity Plan

The tank/ bulk capacities and COG's of tanks are listed in the 'Approved – Final Trim & Stability Booklet'.

5.7 Tank Sounding Table

REF DOC: Page No. 9 – 101 of Calibration Table (Water Ballast Tank) DA101Z061 Rev 1

REF DOC: Page No. 9 – 100 of Calibration Table (MGO, LO & Misc Tanks) DA101Z022 Rev 0

Refer to the above mentioned documents for Tank Sounding Tables.

5.8 Load Line Certificates

REF DOC: Load Line Certificate

Refer to the above mentioned document for Load Line Certificate.

5.9 Hazardous Areas

There is no hazardous area in the vessel

VOLUME II – NORMAL OPERATING PROCEDURES

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Figures

6 NORMAL OPERATING PROCEDURES

6.1 Jacking System & Operations

REF DOC: Operation Manual for Jack up System DA101D030 Rev 0

6.1.1 System Description

The hydraulic jacking system is designed to lift the vessel out of the water by means of four jacking legs, standing on the seafloor.

The hydraulic power pack unit (HPU) hydraulically drives the jacking system. The hydraulic power pack unit is composed of

- Hydraulic fluid tanks
- Electrically driven hydraulic pumps
- Hydraulic fluid cooling unit
- Three central manifolds
- Four leg Jacking manifolds

Each jacking Leg equipped with the following:

- **Jacking Frame** – two hydraulic jacking frames (Lower and Upper) assembly, and each ring is fixed to the vessel through six hydraulic jacking cylinders. Hydraulically powered from the main central hydraulic manifolds.
- **Hydraulic Jacking Cylinders** – The set of six main hydraulic jacking cylinders is connected to the upper and lower jacking frame respectively to perform the retracting and extracting operation of hull
- **Locking Pins** – Three hydraulic locking pins are mounted on the jacking frame, locking pins cylinders are moving horizontally to engage the locking pins into the leg holes.
- **Horizontal Jacking Cylinders** – At the time of leg lowering operation the three hydraulic cylinders of horizontal positioning system together will position the centre axis of the leg perpendicular to hull before touchdown to sea bottom. Horizontal positioning system can also be used to lash the leg while vessel is in floating/transit condition.

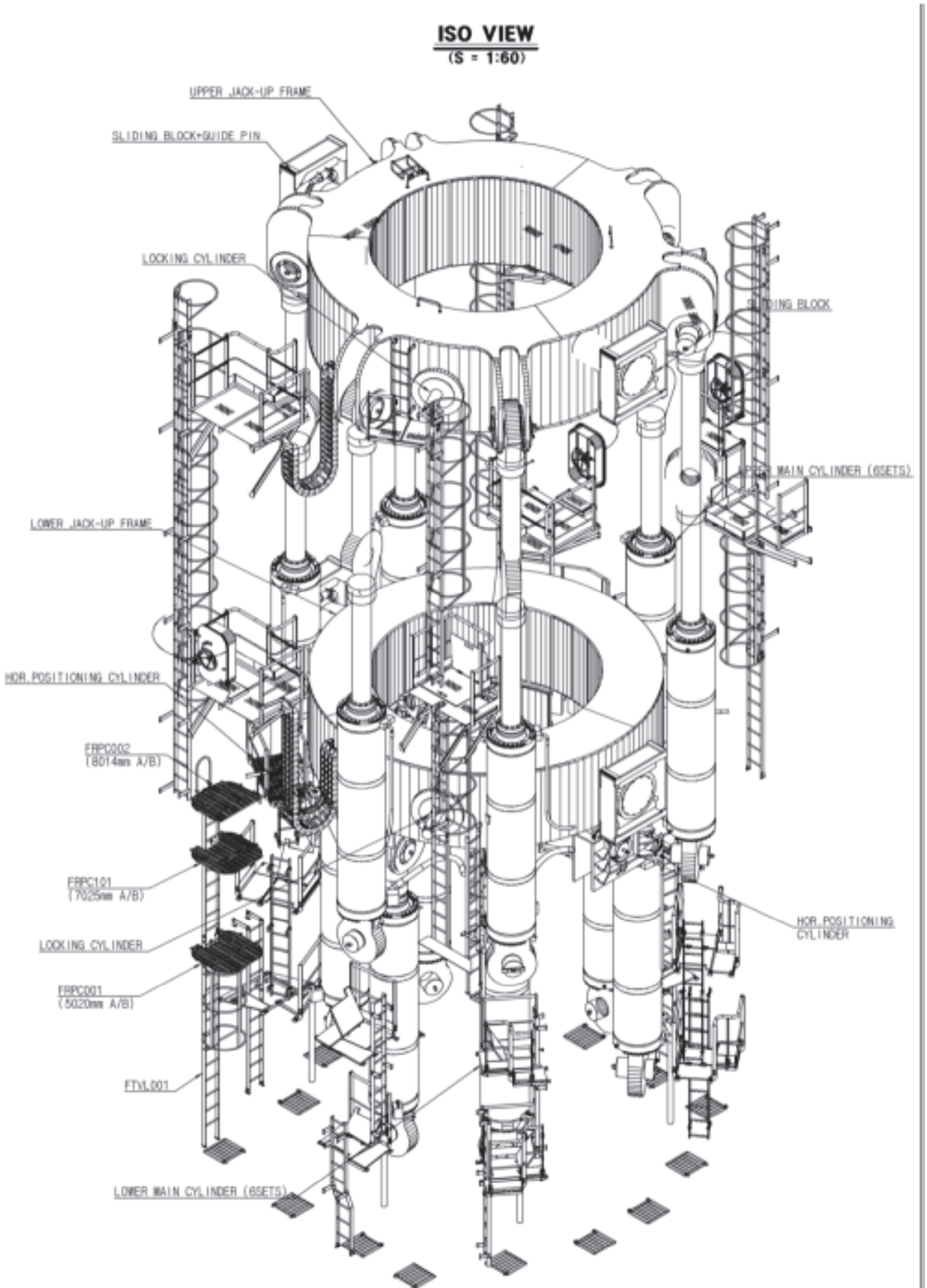


Figure 6-1 Jacking System Cylinders and Frames Layout

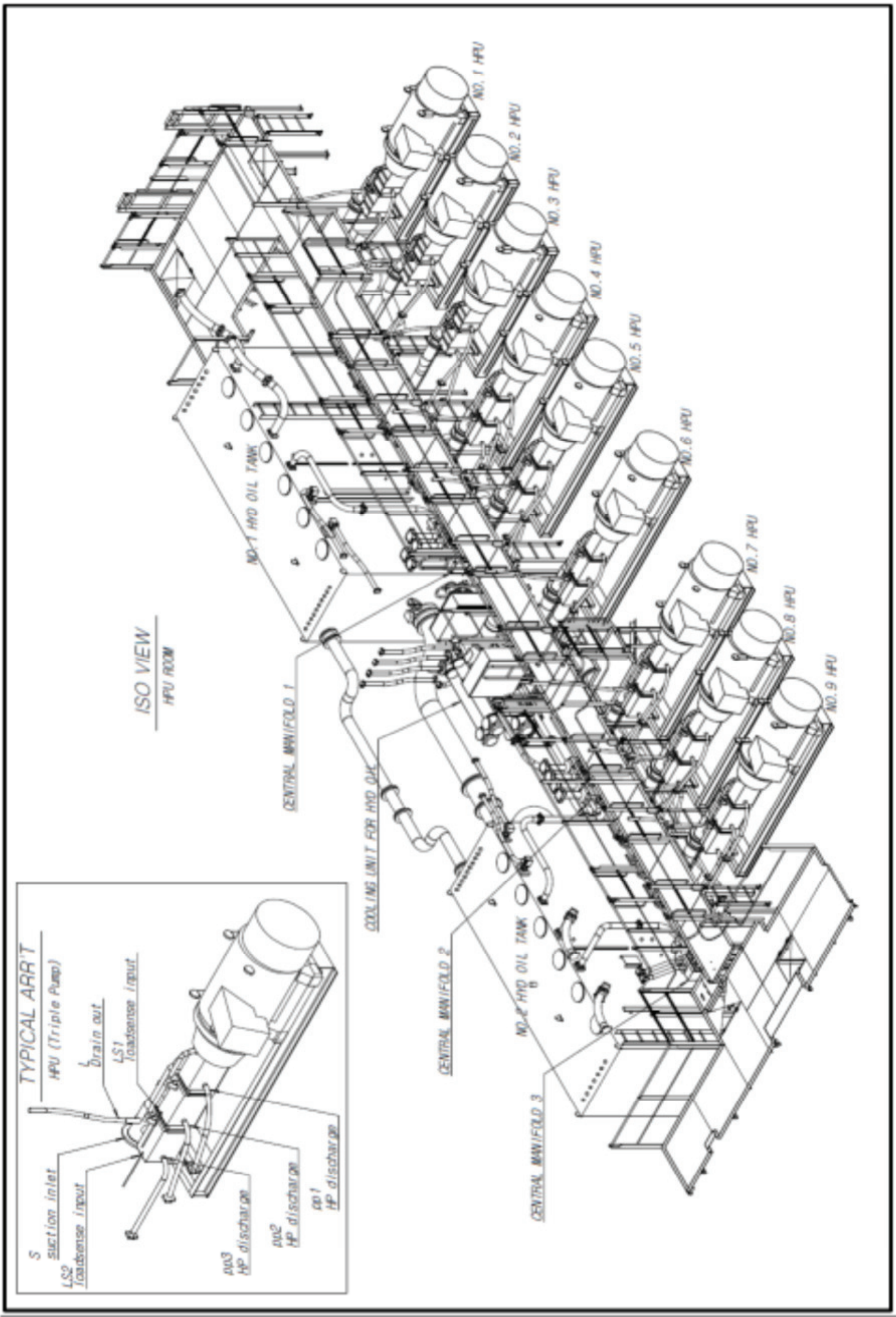


Figure 6-2 Hydraulic Power pack Unit

6.1.2 Technical Details of the Jacking System

Description	Technical Details
Type of Leg	Round Legs
No. of Legs	4 Nos.
Number of Active Jacking rings each Leg	2 x 1
Number of Lifting Cylinders each Leg	2 x 6
Number of locking Units each jacking Rings	3 x1
Dimension Lifting Cylinders	630 /280 mm Max. Stroke 3,000 mm
Number of Locking units each Locking rings	3 Each with a diameter of 640 mm
Required Power Electric- Hydraulic Units	
Three stage High pressure Pumps	6 x 460kW 690V
Two stage High pressure pump	3 x 410 kW 690 V
Cooling Pump Units	4 x 12.5 kW 690 V

6.1.3 Jacking Equipment Limitations

For details on limitation of jacking system equipment refer to Section 1.3.3.

6.1.4 Jacking Bridge Control Panel

6.1.4.1 Description

The jacking control panel is located in the bridge to control all the jacking leg operation and Horizontal Positioning System (HPS). Computerized jacking control panel has a series of push buttons, switches, indication lamps, gauges and meters. Refer to 'Operation Manual for Jack up System' for detailed description of jacking panel.

6.1.4.2 Mode of Operations

Automatic and manual operation of the jacking system will be decided by the operator.

The choice between manual and automatic operation is made by means of the buttons "Use upper" and "use lower" from jacking bridge control panel. If both buttons are depressed (yellow colour), then the operation of the leg is automatic mode. Locking pins also will operate automatically in this mode of operation.

In manual mode individual button need to switch on or switch off for the leg operation and in this mode only one jacking ring will be used by the system. Locking and unlocking of the pins must also be operated manually by the operator.

For further details on use of jacking system from jacking pane refer to MUNS Jacking System operation manual.

Local Operation – Each jacking leg is locally controlled by the local controlled box equipped with PLC. These local PLC are interconnected with bridge control panel.

Local control box PLC control the following

- Entire local hydraulic leg system
- Local horizontal positioning system
- Local operator interface

Main Connection Box (MB1) and Local Control Box are located inside of each jack house of main deck level. Local Control Box is positioned on the entrance inside of each jack house from main deck level. For detail of local PLC controller and control location, refer to below.

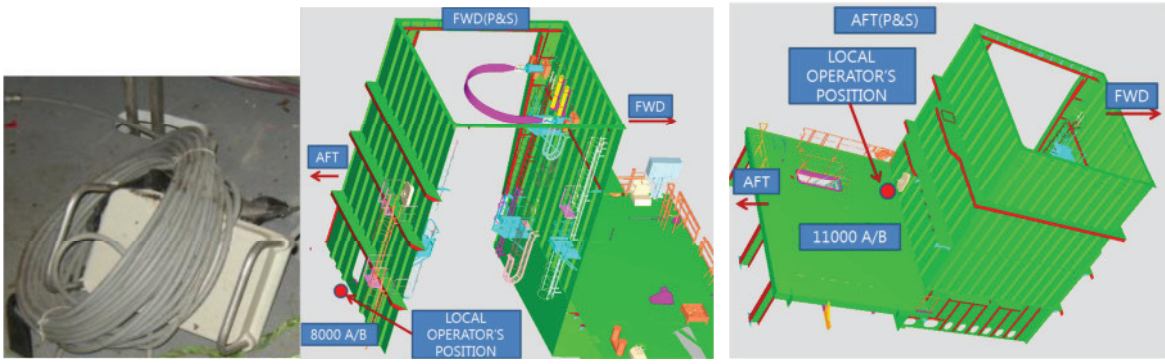


Figure 6-3 Local Control Box & Position

6.1.5 Check List for Jacking Operation Preparation

The Master should verify according to Company IMS manual and checklists that all the preparations have been completed prior to beginning the operation. The following general guideline of items that should be accomplished prior to jacking operation.

- Check the power distribution load before planning jacking operation, When vessel is approaching the jacking destination vessel will be on the DP mode and leg lowering operation will also be simultaneously performed.
- Level of the hydraulic oil in hydraulic oil tanks need to be checked prior to the jacking operation.
- Verify that the Jacking System has been prepared and inspected.
- Check all Jacking System warning devices. Correct any deficiencies or malfunction(s) before starting the Jacking operation

NOTE: Detailed checklists for bridge and engine department according to Company IMS manual to be completed before operation is commenced.

6.1.5.1 Jacking Operations

For details on use of jacking system, refer to Section 6.1 and the 'Operation Manual for Jack up System'.

- All jacking operations must be performed in a safe manner within vessel operating limits. For the environmental limitations of engaging bottom operations refer to Section 3.3.1

- All necessary care and thorough checks must be taken according to Company IMS manual to ensure that the jacking operation is carried out smoothly without incurring adverse loads to the system.
- Jacking houses are restricted area during jacking operations. In case authorized personnel must enter jacking houses during jacking operations, care should be taken by keeping hands and clothing clear of the jacking mechanism.
- In case authorized jacking personal must enter jacking houses to check the system the jacking operation has to be interrupted. If necessary for failure analyses system has to be operated with utmost care by direct VHF communication to the bridge.

6.1.6 Emergency Jacking Operation without Standard Cooling Water Supply

The Air cooled containerized Genset DG6 may be used to operate jacking system during emergency conditions where both the sea water suction mast and the flexible hose submersible pump fails and the vessel is in elevated condition.

The jacking system may work with DG6 only with the following restriction.

- Minimum jacking speed of approx. 0.1 m/min with a maximum of three hydraulic pumps running.
- Sea Water cooling for hydraulic oil can be achieved through one of the methods mentioned below
  A. Cooling by ballast Water provided that ballast water tank is full and that the temperature of the tank is carefully monitored.
  B. Cooling water supply by external pumps if NPSH of the external pump can handle the air gap.
- During this condition sea water supply for other systems like HVAC may be halted to provide enough capacity to jacking system.

6.2 Overview of Vessel Operations

REF DOC: Approved - Final Trim and Stability Booklet (DWG No.DA101Z035)

REF DOC: Company IMS Manual for SIMOPS

REF CKL: Company IMS Manual & Checklist for Jacking (Transient) Operations

REF CKL: Company IMS Manual & Checklist for Preloading Operations

REF CKL: Company IMS Manual & Checklist for Elevated Operations

REF DOC: MUNS Operation Manual for Jack up System DA101D030 Rev A

6.2.1 Overview of Vessel Operations

- Vessel afloat- jacking system ready for use
- Positioning (Section 6.3.1)
- Leg lowering (Section 6.3.2)
- Engaging bottom (Touch down / Stand on) (Section 6.3.2)
- Cooling system on suction mast (Section 6.9)
- Elevating out of water (Section 6.3.3)
- Preloading (Section 6.3.4)
- Elevating up to required Air Gap (Section 6.3.5)
- Working task in elevated mode (Section 6.3.5)
- Jacking down & Refloating (Section 6.3.6)
- Cooling system on sea chest (Section 9.10)
- Leg pulling/Stand off (Section 0)
- Vessel afloat (Section 6.5)
- Leg lifting (Section 6.3.6)
- Sea fastening of legs (Section 6.7)
- Vessel ready for transit (Section 6.5)

6.2.2 Preparations for Vessel Elevating Operations

Prior to commencing vessel field operations at an offshore location it must be ensured that the followings assessments for the specific location and vessel conditions have been carried out and confirmed as approved:

- Location information and assessments as defined in section 6.2.3 below.
- Site specific leg/spudcan penetration & extraction analysis to be carried out to check if the following shall be satisfied:

  NOTE: The required preload values are varying based on the site condition, upcoming task and safety margin, there for it is not necessary to achieve maximum preload reaction (66,150 kN (6,743.12 t)) in every preloading operation.

- Required air gap fulfillment based on water depth and expected sea conditions at location.
- Leg extraction force shall be available with the aid of jetting system (if required).

- Attaching spudcan shall be considered in case excessive leg penetrations are expected where one of the above will not be satisfied.
- Vessel's environmental limitations assessment for positioning based on DP capability plots.
- Vessel's environmental limitations assessment for transient and elevated conditions based on site specific water depths & expected penetrations.
- Vessel loading condition assessment as defined in section 6.2.4 below to ensure maximum jackable load of 15,300 t is not exceeded.
- Location and job specific pre-driving method & load requirement assessment based on expected weather conditions and planned heavy lift operations.
- Calculation of preloading draft based on expected vessel loading condition at the time of preloading if same is planned to be carried out with hull in the water. The method for same is defined in section 6.2.5 below.
- Preparation of expected vessel loading condition at the time of jacking down and ensuring that maximum jackable load of 15,300 t will not be exceeded.
- Calculation of vessel overdraft that will be required to provide the leg pulling force as estimated in the leg/spudcan penetration & extraction analysis. The method for same is defined in section 6.2.6 below.
- General preparation checks as stated in section 0 below.

6.2.3 Location Information

6.2.3.1 General

The following location information should be available to determine if the location for vessel elevated operations is fit for purpose. This information is extremely important to ensure safety of the vessel.

- Geo-hazard surveys to determine sub-surface hazards on the ocean floor. These surveys shall be conducted if there is a concern of occurrence of hazardous objects in site.
- Weather forecast and sea conditions including tidal information for the duration of operation.
- Soil characteristics for the location for carrying out site specific assessments.
- Water depth information should be provided.
- Information on sea bed pipelines, cables, obstructions, restricted areas etc. within the area.

6.2.3.2 Soil Characteristics

Soil strength and underlying soil stratigraphy of the location must be determined. Leg or spud can penetration must be estimated prior to going on location. This estimate can be based on site surveys, other geographic data, and the performance of other jackups in the vicinity.

For the normal (harder) sea bottom conditions, the vessel is designed to operate in pillar (without spud can) mode. However, during soft sea bed conditions removable spudcan should be attached to the leg bottom to avoid excessive leg penetration.

6.2.3.3 Seabed Conditions

A seabed survey must be performed to ensure that certain sea floor hazards that affect the placement of the leg on site are identified to avoid unit damage or delay. These hazards include obstructions, scouring, previous footprints, seabed slope and rock outcrops and punch through or rapid penetration.

- **Hard Sea bottom:** If very hard sea bottoms are expected, such as rock, a special assessment of the legs integrity is required. If rock is present, there is no problem with scour.

- **Obstructions:** May be wrecks, pipelines, rocks, or other obstacles that would prevent the vessel from pinning its legs. A target area can be prepared prior to the vessel's arrival.

- **Scouring:** When locating the vessel in areas of high current, after a storm and on hard sands/silt bottoms, where penetration is limited, the possibility of scour around the leg's bottom exists. Scour causes uneven loads on the leg and should be monitored and measures effected to stop it when it becomes excessive.

- **Footprints:** When operating with spudcans, previous spud can holes in the sea floor can be hazardous to a new unit arriving on location. If the vessel's legs/spudcans are to be located close to the holes / footprints of previous units, there is a risk of the vessel's legs sliding into these holes and causing structural damage. The vessel should carry the latest footprint record of the operational area at all times. If footprint plots of former jacking operations are not available an assessment has to be made of such risks and special expertise sought to prepare solutions and procedures at such problematic locations before the vessel is installed there. The minimum distance between existing leg holes/footprints has to be assessed in the site specific assessment. In case exact values are not available 10 m distance from edge of old footprint to new footprint can be evaluated as a rule of thumb for minimum distance in accordance with the soil conditions.

- **Punch through (or Rapid Penetration):** Punch through or rapid penetration occurs during initial elevation of the vessel at a new location, either before or during preloading. It is normally caused by the presence of a weak soil layer underneath a thin but stronger layer (see stratified soil condition in figure below). A punch through can cause serious damage to vessel legs and leg holding structure. A detailed soil analysis for the location should be carried out before the vessel is installed to ensure that no punch through occurs during preloading or operations.

- **Other Conditions:** When operating with spudcan some seabed conditions like inclined bottom and rough bottom can cause leg inclination and eccentric loading see figure below.

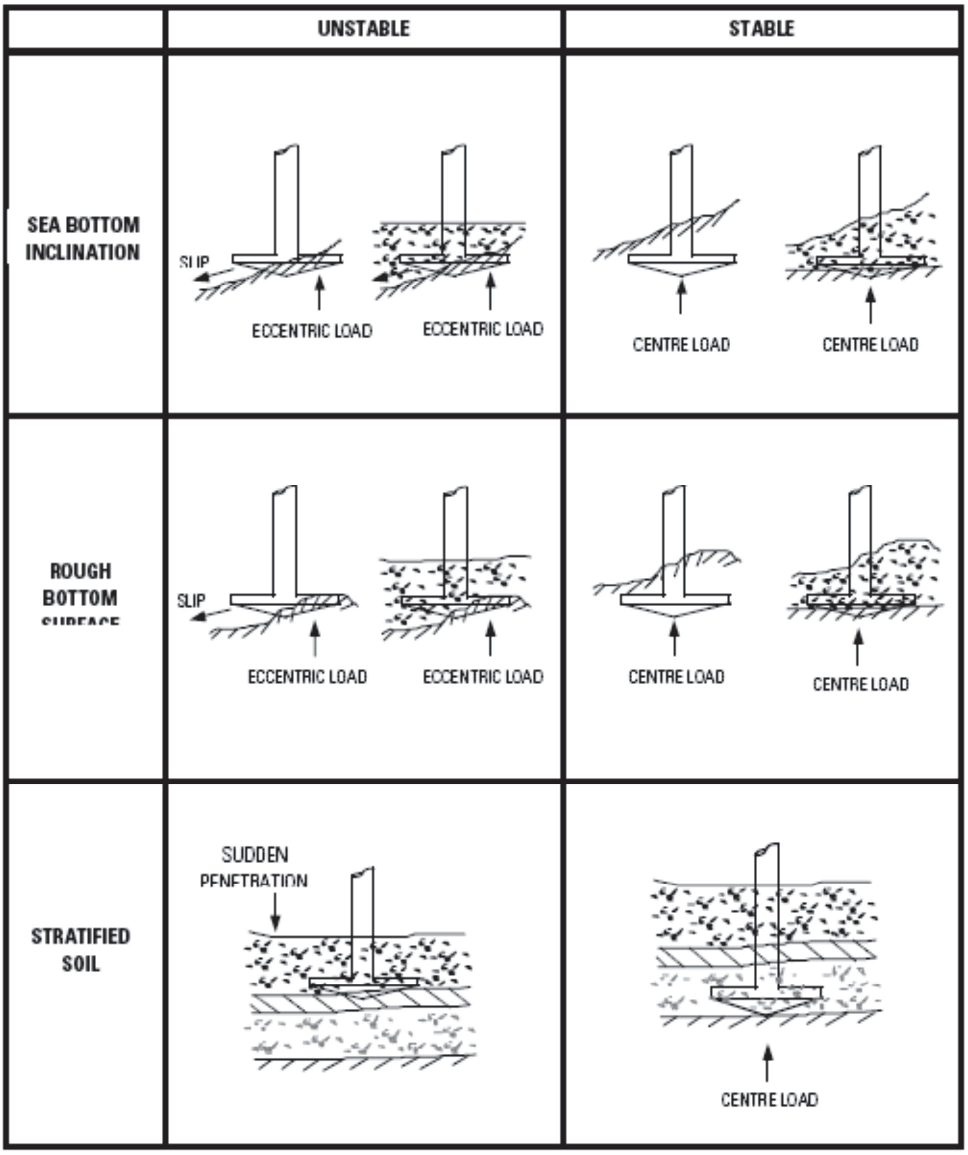


Figure 6-4 Seabed Conditions

6.2.4 Assessment of Transient Loading Condition

The loading condition of the vessel before commencing transient operations like leg lowering & engaging bottom, elevating out of water, preloading, elevating up to required air gap and jacking down should be planned well in advance.

The objective of this assessment is to ensure that the total elevating weight of the hull and its variable load (like consumables, payload, ballast etc.) is less than the maximum jackable load of 15,300 t. The maximum displacements and its corresponding drafts in floating condition equivalent to the maximum jackable load are as follows:

Table 6-1 vessel's Draft at max jackable load with and without Spudcans

	Without Spudcans	With Spudcans
Max. Jackable Load	15,300 t	
Displacement at Maximum Jackable Load	18,148.2 t	18,720.6 t
Draught at Maximum Jackable Load	4.737 m	4.717 m

It must be ensured that the above drafts based on the equivalent draft(*) on the onboard loading computer are not exceeded.

NOTE (*): The draft read by the draft gauges can be different from the equivalent draft due to the vessel's defection caused by the global bending. Refer to draft correction table in part B, section 2.7 of the 'Approved – Final Trim and Stability Booklet'.

When the loading conditions are simulated, the following should be included in the calculation:

- The vessel intended condition should be planned by using the onboard loading computer system.
- When planning the loading condition, the cargo loading status such as weight and location on main deck should be exactly inputted into the loading computer.
- The cooling sea water of approx. 200 t in No.6 WBT (P) should be taken into consideration of all the loading conditions.
- Minimum fresh water required for operation of low pressure water mist system (approx 2 m^3) as stated in section 8.2.3 must be always considered.
- The actual filling status of the ballast water, consumable such as fuel oil, fresh water, etc can be verified on the onboard loading computer system online connected with AMCS in ECR.
- Weight for crew effects and waste water of approx. 140 t should be considered (for detail, refer to the Part B, section 2.1 of the 'Approved - Final Trim and Stability Booklet') unless it is not further determined.

- If the certain amount of the ballast water is necessary to be de ballasted during the transient operation, the un-pumpable water in the ballast tank with the tank level of approx. 0.045 m from the tank bottom should be taken into account.
- In this case, the vessel condition after de ballasting should be maintained to be within reasonable trim and heel condition
- The condition should be saved in order to reproduce the jacking down condition.

6.2.5 Calculation of Preloading Draft

In case preloading is being planned to be carried out with hull in the water and on two legs at a time, the preloading draft of the vessel can be calculated using the steps/example stated below.

The below example considers vessel without Spudcans at a floating draft of 4.737 m looking to achieve preload of 6743.12 t (maximum preload reaction).

Table 6-2 Vessel's Overdraft example without spudcan

	Instruction	Example
(1) Equivalent draft	Read form the loading computer or AMCS	4.737 m
(2) Displ. based on floating condition	From the loading computer or the loading manual corresponding to the equivalent draft (1)	18,147.8 t
(3) Excluded Weight	- w/o spud cans : 2,856.9 - w/ spud cans : 3,429.3	2,856.9 t
(4) Platform Weight	(2) – (3)	15,290.9
(5) Allo. Ver. load on each leg	6,750	6743.12 t
(6) All the Leg Buoyancy	11.30 x [(1) – 2.42] x 4 ea	11.3 x (4.737 – 2.42) x 4 = 105.6
Equivalent Displ.	(4) – [(5) x 2] + (6)	15290.9 - (6,743.12 x2) + 105.6 = 1,910.1 t
Preloading Draft	Read from the loading computer system or the hydro table in the loading manual corres. to (6) Ref to sec. 3.2 in part B of the loading manual	0.539 m

6.2.6 Calculation of Vessel Overdraft

The draft to which the vessel will need to be over-drafted to provide the required leg pulling force in the form of additional vessel buoyancy can be calculated using the steps/example stated below.

The below example considers a required pulling force of 6,000 t.

Table 6-3 Vessel's Overdraft Example With Spud-can

	Instruction	Example
(1) Expected draft for Re-floating cond.	Calculate it from the loading computer	4.042 m
(2) Displ. based on Re-floating condition	From the loading computer or the loading manual corresponding to the equivalent draft (1)	15,327.3 t
(3) Excluded Weight	- w/o spud cans : 2,856.9 - w/ spud cans : 3,429.3	2856.9 t
(4) Platform Weight	(2) – (3)	12,470.4 t
(5) Leg Pulling Force	Calculate the total Leg Pulling Force	6,000 t
(6) All the Leg Buoyancy	11.30 x [(1) – 2.42] x 4 ea	11.3 x (4.042 – 2.42) x 4 = 73.3
Equivalent Displ.	(4) + (5) + (6)	12,470.4 + 6,000 + 73.3 = 18,543.7 t
Final Overdraft	Read from the loading computer system or the hydro table in the loading manual corres. to (6) Ref to sec. 3.2 in part B of the loading manual	4.834 m

NOTE: Overdraft up to draft 6 m can be allowed for a limited time and under limited weather conditions. The master of the vessel and the jacking operator has to observe the maximum wave height for carrying out jacking operations. Special attention has to be paid to the maximum wave height limitation during leg extraction operation, as the draft may temporarily increase during this operation.

6.2.7 General Preparations

The following general guidelines shall be followed before commencing and during transient operations like leg lowering & engaging bottom, elevating out of water, preloading, elevating up to required air gap and jacking down:

- Good weather forecasts (normally at least two) should be taken before commencing operations. This should allow for sufficient time for lowering the legs, preloading and jacking up to final air gap to be completed before inclement weather arrives.

- Environmental limitation criteria for each operation as mentioned in section 3 should be followed at all times.
- It must be ensured that all cranes are in stowed position.
- Other critical operations like crane operations or the landing of helicopters are not allowed while transient operations are being carried out. For further details on simultaneous operations refer to Section 6.26 and the Company IMS Manual for simultaneous operations.
- It must be ensured that lighting is adequate in all observation areas.
- The legs, jacks etc. should be visually inspected for any physical damage, debris, or obstruction.
- All jacking units including horizontal positioning units should be completely serviced and all their components should be in good working condition.
- All control and remote sensing equipment including draft gauges, load indicators, inclinometers, hydraulic pressure indicators etc. should be checked for being in good working condition and adjusted as required.
- One leg observer should stationed on the main deck, standby for jacking operations.
- Communication between the bridge, jacking control console, engine room and observation areas should be established, tested and maintained throughout the operations. They must be instructed to report any abnormalities at first instance.
- All personnel should be instructed not to enter jack houses during operations. Jacking houses are restricted area during jacking operation due to safety regulations.
- The hull must be maintained watertight, all watertight doors to be closed and all materials and equipment maintained secured.
- All the bilge water in the void spaces, especially in Nos.1 & 9 void spaces (koker compartments), should be removed prior to commencement of operations.
- Leg Lashings/Sea fastening to be unlashed and lashings must be removed before commencing and during the operation.

6.3 Changing Mode (Transient) of Operations

REF REG: MODU-CODE 14.1.3.3, 14.1.3.7, 14.1.3.9

REF DOC: Approved - Final Trim and Stability Booklet DA101Z035

REF DOC: Company IMS Manual for SIMOPS

REF CKL: Company IMS Manual & Checklist for Jacking (Transient) Operations

REF DOC: MUNS Operation Manual for Jack up System DA101D030 Rev A

REF DOC: L-3 DP Operation Manual DV943E00 Rev 1

REF DOC: DP Capability Plots Rev A

Changing mode (Transient) operations consists of the following basic steps to complete jacking operations from floating mode back to floating mode.

- Positioning
- Leg lowering & engaging bottom
- Elevating out of water
- Preloading including elevating up to required Air Gap
- Jacking down & refloating
- The below subchapters describe procedure to be followed to accomplish each of the modes.

6.3.1 Positioning

6.3.1.1 General Guidelines

The following general guidelines are to be followed before positioning the vessel at an open location or near a fixed structure:

- Adequate information should be available to the Master before positioning the vessel to avoid damage to the vessel and to third party facilities.
- Observers should be stationed for keeping a continuous watch at the shipside near to the fixed structure being approached.
- It is advisable to use the vessels DP system for positioning. However, manual approach can be considered in accordance with the Company IMS Manual.
- Any attempt to position the vessel using the DP system must be carried out after ensuring that the environment conditions are within the safe working zone as per DP capability plots.

6.3.1.2 Positioning Procedure

For further details on positioning procedures refer to DP operational procedures in section 6.12

6.3.2 Leg Lowering & Engaging Bottom

6.3.2.1 General Guidelines

The following general guidelines are to be followed to lower the legs and engage bottom:

- The limiting environment conditions for engaging bottom operation are stated in Section 3.3. These conditions must not be exceeded as large motions due to heavy seas during the engaging phase may result in the legs hitting the bottom with enough force to cause damage.
- Assessment of bottom soil conditions should have been carried out and requirement of attaching spudcan must be confirmed before engaging bottom in soft soil conditions.
- The vessel floating condition prior to start of lowering the legs should be adjusted to no trim, no heel condition as far as practicable. This signifies that the total load of the vessel is evenly distributed.
- The vessel loading condition should be checked as defined in section 6.2.4 to ensure that the total elevating weight of the hull and its variable load is less that the maximum jackable load of 15,300 t. This corresponds to a draft of 4.737 m in floating condition without spudcans or 4.717 m in floating condition with spudcans.
- The vessel's draft, trim and heel should be verified from the onboard loading computer system, the AMCS in ECR and by manual measurements.

6.3.2.2 Leg Lowering & Engaging Bottom Procedure

The following procedure is to be followed to lower the legs and engage bottom:

- Use jacking system to lower all four legs simultaneously till the bottom of the leg tip/spudcan a few meters above the sea bed. Master must make his assessment on the value depending on seabed and sea state conditions.
- The horizontal positioning system should be activated to ensure that the engagement of legs to the seabed is vertical. Then lower each leg individually with low speed till the sea bottom to avoid damage to leg tip/ spudcan.
- Information like water depth, tide and hull draft should be used to estimate the amount of leg to be deployed and when the leg is likely to contact the seabed.
- As the tip/spudcan touch-down, keep a close eye on the leg depth mark, inclinometer, hydraulic pressure and hull draft.
- In the event that the ocean floor is not level, or one leg penetrates more than other, it will be noticed on the inclinometer that the hull is out of level. In such a case continue to jack one leg at a time until the platform is level. At all times keep the vessel as level as possible.
- Thrusters should be stopped when all four legs are resting securely on the seabed and the vessel shows no signs of shifting under environmental loads. The vessel's cooling system can now be changed over from sea chest supply to suction mast if required.

6.3.3 Elevating Out of Water

6.3.3.1 General Guidelines

The following general guidelines are to be followed to elevate the vessel out of water:

- The limiting environment conditions for elevating out of water are stated in Section 3.3 and should not be exceeded.
- The vessel loading condition should be checked as defined in section 6.2.4 to ensure that the total elevating weight of the hull and its variable load is less that the maximum jackable load of 15,300 t. This variable load should be evenly distributed such that the loads on all legs are equalized as much as possible.
- When the vessel is lightly loaded, the vessel can be jacked up with uneven loads on the legs provided the load on any single leg does not exceed its individual jacking capacity as stated in section 1.3.3.
- The sea water suction mast and sea water submersible pump should be kept ready for use as per procedure given in Section 6.9.

6.3.3.2 Elevating Out of Water Procedure

The following procedure is to be followed to elevate the vessel out of water:

- Once sufficient leg load is achieved and support of thruster is not required, the vessel cooling system should be changed to suction mast. The minimum vessel draft before which the change over should be carried out is approx. 2.5 m.
- After stand on, the Master shall check that the load is balanced between the legs. Ballast can be transferred to obtain equal loading on the legs.
- The maximum allowable load should not be exceeded on any leg during elevating operations (see maximum load limit in Section 1.3.3).
- Evenly elevate the hull out of water to the required preloading air gap (see next Section 6.3.4). The hull should elevated in steps to allow sufficient time for leg penetration.

6.3.4 Preloading

REF CKL: Company IMS Manual & Checklist for Preloading Operations

6.3.4.1 Purpose of Preloading

Preloading is a method used to drive the legs and spud cans into the sea bed until a sufficiently firm foundations is reached to withstand the vertical footing reaction that would be imposed during the design storm conditions or most unfavourable operational cases, e.g. load-out of heavy components. Preloading manly linked to upcoming crane operations or similar primary safety test of the vessel's seabed soil foundation. During the stages of preloading, the vessel's soil foundation is load tested for the first time and as with any load testing, precautions against failure of the soil foundation to hold the required loading must be taken. Preload figures are site specific related to the soil conditions, weather forecast and upcoming task. The maximum preload reaction on each leg for this vessel is 66,150 kN (6,743.12 t). The corresponding pressure on the hydraulic cylinders of the jacking system for this preload reaction is mentioned in Section 6.2.

6.3.4.2 General Guidelines

The following general guidelines should be followed for preload operations:

- Preloading should not be carried out in strong or gusting wind conditions or in strong currents condition. The limiting environment conditions for the preloading operation are stated in Section 3.3 and should not be exceeded.
- During preload operations the hull must be maintained watertight and all materials and equipment maintained secured.
- Other critical operations like Crane operations or the landing of helicopters are not allowed during preloading operation. For further details on simultaneous operations refer to Section 6.26 and the Company IMS manual for simultaneous operations.
- Before preloading commences, the jacking system should be in good working condition and operational guidelines as mentioned in the 'MUNS Operation Manual for Jack up System' should be followed.
- A continuous watch at each jack-house/Leg and at draft measuring station forward and aft should be maintained during the duration of the preloading procedure. Jacking houses are restricted area during Jacking operation due to safety regulations.
- The amount of preload weight must be determined from the corrected variable load aboard prior to the start of preload. All lightship corrections are also to be included. Add reference to calc.
- No jacking-operations should be carried out without soil analysis including penetration prediction and preload data.
- The hull must be maintained as level as possible while preloading. Prior to preloading, the level indicators are to be checked and adjusted as required.
- The Master and jacking operator must continuously monitor the leg reactions at all times. The maximum allowable leg reaction should not be exceeded the required preload reaction on each leg.

- During, preloading operations the maximum air gap above the wave crest should not exceed 1.5 m. Preloading with an air gap of greater than 1.5 m may lead to injury to personnel or damage to vessel if a punch through occurs.

6.3.4.3 Preloading Procedure

The preloading for this vessel is carried out by a two stage method with hull out of the water. This method involves reliving a pair of diagonal legs and thus applying more loads on the remaining two diagonal legs. During this process the upper as well as the lower jack frames of the jacking system are activated at each leg i.e. 2 x 3 locking pins are engaged.

WARNING!

To attain maximum preloading forces the vessel may need to be preloaded above water , the air gap during preloading shouldn't exceed 1.5m

The following procedure describes the overall preloading sequence for the vessel. For specific procedure including use of jacking controls refer to 'MUNS Operation Manual for Jack up System'.

- As described in Section 6.3.4 evenly elevate the vessel to an air gap of about 1.5 m. A lower air gap may be used for preloading in area where punch through is expected.
- Lift two diagonally opposed legs until the force on the other two legs reach the required preload reaction.
- Wait for the force on the loaded legs is stabilized. This period will depend on the seabed soil characteristics. For hard bottoms the loads will stabilize quickly, however for soft bottoms this may take longer. The unloaded legs may be lifted further to maintain stable preload force.
- If the legs being preloaded penetrate during this process (called settling), then the procedure must be stopped before the hull touches the wave crest and load should be evenly distributed between the legs. The vessel should then again be jacked up to preload air gap and the procedure should be restarted.
- Maintain preload force on the loaded legs for about 30 minutes after settling has stopped unless mentioned otherwise in the site specific assessment report.
- The other two legs can now be preloaded lowering the two initially lifted legs until load on all leg are approximately equal. The process is similar where the previously loaded legs are lifted to preload the other two diagonal legs.
- Once preloading has been completed for the other two legs, the hull load can be brought back to equally distributed on the four legs and inclination be adjusted to minimum in both directions
- In soft bottom conditions, this preload procedure may also be required to be carried out in steps where the four legs are preloaded to lower load first before preloading to the final specified preload.

6.3.5 Elevating to Operational Air Gap

After the preload procedure is completed and conditions have stabilized, the hull can be raised to the operational air gap. The following procedures and guidelines must be followed:

- The hull must be maintained as level as possible while elevating the hull.
- The jacking system should be secured in storm holding mode as per procedure given in 'Jacking System Instruction Manual'.
- Bridge is permanently attended by OOW monitoring the leg loads frequently .The out-of-level alarm should be activated.
- Vessel's cooling system to be supplied by Suction Mast when leg loads are sufficient that thrusters support for safe position keeping is not necessary anymore. Latest when vessel's draft is less than approx 2.5 m sea chests are not usable anymore due to loss of suction

6.3.6 Jacking Down and Re-Floating

6.3.6.1 General Guidelines

The following general guidelines should be followed for preload operations:

- Jacking down should not be carried out in strong or gusting wind conditions or in strong currents condition. The limiting environment conditions for the operation are stated in Section 3.3.
- One observer in save position on main deck in standby to Master's/Jacking operator's order before starting to lower the hull. The leg observer shall be instructed to watch the legs for damage or being stuck.
- The jack down condition should be planned from the jack up condition by removing the cargoes on main deck with using the loading computer system in advance to immense the jack down operation.
- The vessel condition for jack down and re-floating condition should be based on no trim and no heel as far as practicable.
- In order to balance the vessel center of gravity to meet the vessel's condition mentioned above, the ballast water should be re-distributed or introduced additionally by using the sea suction mast pump. The suction mast pump shall fill the heeling tank and ballast water can be further transferred to other tanks from this tank.
- Once balancing the vessel condition is completed, the vessel's center of gravity as intended should be check by the actual load of the legs from the jacking system console.
- The estimated overdraft that will provide the calculated leg pulling force should be calculated prior to starting jacking down operations.

6.3.6.2 Jacking Down Procedure

- Jack down the hull about 2 m to check the functioning of the equipment. Verify this by contacting the leg observers.
- The sea water suction mast can be raised partially while monitoring the position of the pump in relation to the air gap and water depth. Do not retract the mast completely at this time, since the water may still be needed. Vessel's cooling system cannot be operated by sea chest before vessel's draft is approx. 2.5 m.
- Begin lowering the hull and while jacking, keep the hull level to prevent bending of the legs.
- Lower the hull into the water until it is about 1 m from its estimated floating condition. Check for leaks in ballast tanks, bottom tanks, voids and spaces in the machinery deck. If there is leaking, raise the vessel from the water and fix the problem.
- As soon as sea chest are sufficiently flooded (Approx. draft > 2.5 m) and the leg load is sufficiently reduced for safe position keeping, test thruster and DP system.
- Continue jacking down the legs to over draft the vessel by the calculated draft with the displacement of the jack down condition according to Section 6.3.2. The overdraft buoyancy will force the legs to be pulled out of the sea bed. The maximum overdraft for the vessel should not exceed 6 m or the maximum capacity of the jacking system as mentioned in Section 6.2 should not be exceeded.
- When notified by the leg observers that a leg is stuck or upon observance of a noticeable change in the level indicator, jacking operations should be stopped and jetting out procedures should be applied as given in Section 6.8.

WARNING!

Avoid placing excessive stress on stuck legs and the elevating system.

- Raise the legs to their correct floating position and secure them.
- In case the penetrations have been excessive (refer section 3.1.3) which may have caused mud ingress, the legs should be cleaned of the mud using spray jets or manual thruster wash cleaning. In case these methods are not successful manual cleaning by personnel may be required.

WARNING!

When using spudcans, excessive mud build-up on top of the spud can may cause damage to the hull and legs as the spud can is pulled up to the hull. Exercise caution while retracting the spud cans.

- Verify that the draft, heel, and trim are the same as the prior calculations. If there is a discrepancy, correct the problem or account for the difference.

- During the leg extraction operation, the longitudinal stress on the hull could exceed the values for the normal seagoing condition. Overdraft up to draft 6 m can be allowed for a limited time and under limited weather conditions.

6.4 Elevated Operations

REF REG: MODU-CODE 14.1.3.3, 14.1.3.8

REF DOC: Company IMS Manual for SIMOPS

REF CKL: Company IMS Manual & Checklist for Elevated Operations

REF DOC: MUNS Operation Manual for Jack up System DA101D030 Rev A

6.4.1 Operating in Elevated Condition

The following guidelines should be followed for operating in elevated condition.

- Elevated operations shall not begin until preloading has been completed and the unit has been elevated to the working air gap.
- Receipt and review of weather forecasts shall be continued throughout the period elevated on location.
- The progress of elevated operations shall be closely monitored to ensure that weather conditions do not exceed the prescribed limits (see Section 3.4) and to ensure that there is adequate time remaining to implement contingency plans for removal of the jack-up or for placing the unit in the elevated survival mode before the onset of adverse weather, as applicable.
- The elevated load condition shall be calculated and any changes in weight attributable to material loaded, discharged or consumed shall be recorded in such a manner that the individual leg loads for all stages of the elevated operation are known.
- Hull inclination shall be monitored on a frequent and regular basis, maintain hull elevation within the limit.
- The leg loads shall be monitored on a frequent and regular basis. In the event that any inclination or loss of jack pressure is observed the elevated operations should be suspended until the cause of the inclination or loss of pressure has been investigated and the condition has been rectified.
- Consideration shall be given to the potential impact of seabed scour on the integrity of the jack-up foundation over time especially at locations with strong currents
- Particular consideration shall be given to the potential for movement of seabed soils caused by currents or waves. Where risk of such conditions is deemed to exist
- The integrity of the foundation is to be tested by repeating the preload operation following a storm or other event that may have adversely affected the strength of the soil supporting the jack-up.
- At locations where potential for seabed scour exists, an increase in leg penetration, inclination and/or loss of hydraulic jack pressure (for units elevated by means of hydraulic jacks) may occur. Scour effect may create a requirement for frequent operation of the jacking system as adjustments to leg heights become necessary to maintain elevated stability. In such cases a suitable ‘bedding-in’ period must be allowed for and elevated operations should not be attempted until the leg penetration has reached a depth at which the rate of additional penetration caused by scour has reduced to a manageable level.

- If any unexpected increase in leg penetration or inclination occurs during elevated operations then all operations should be suspended immediately and expert geotechnical advice should be obtained. Jacking of the unit should only be undertaken after consultation with experts. Subject to the provision of expert advice the hull may be lowered to the lowest practical air gap until the cause of the settlement has been investigated and rectified. After the jack-up has been stabilized the preload operation must be repeated.
- Sea fastenings for turbine towers should not be removed until lift rigging is connected and lifting operations are ready to proceed.

6.5 Floating (Transit) Operations

REF REG: 14.1.2.17, 14.1.3.17

REF DOC: Approved - Final Trim and Stability Booklet DA101Z035 Rev 1

REF DOC: Company IMS Manual for Afloat Condition.

REF CKL: Company IMS Checklist for Afloat Condition.

This Section provided guidance to the Master on procedures to be followed for floating/ transit operations.

6.5.1 Floating Preparation Procedure for Transit

- Ensure main crane is in stowed position.
- Ensure legs are sea fastened for their sailing position (Normal sailing position of leg is fully retracted, however the legs may be lowered considering water depth and sea state, during floating storm condition, as mentioned in Section 3.2.2). The fully retracted position of the legs can be manually confirmed if the drain holes are at a position of 1.6 m above the shoe plate of horizontal positioning system.
- All doors on and above the main deck should be kept closed and secured weather tight unless in use.
- Secure all WT door and hatch openings. The bulkhead openings and watertight integrity of the underwater portion of the vessel (below water line) shall be checked prior to floating the vessel.
- Any and all loose equipment and loose cargo shall be lashed down in the proper stowed positions prior to floating the vessel.
- All shell penetrations not needed for normal operation should be closed and secured watertight.
- Ensure that sea water suction mast is in stowed position and secured, if the hull draft is approximately equal to 2.5 m i.e. sufficient for sea chest operation.
- Prior to floating the vessel test of all ballast & SW pumps, tanks and piping should be performed to ensure proper working condition.
- Determine beforehand what tanks and expected amounts of ballast will be used when the vessel is floated.
- Follow instructions in Section 6.3.6 for jacking down the vessel.

6.5.2 Use of Vessel’s Propulsion

The vessel is equipped with a propulsion system consisting of as six thrusters (Refer to Section 9.5 for further details of system and forbidden Zone).

The propulsion system has DP capability and should be started when the hull is jacked down into the water and the legs are about to break free from the seabed. The operations of retraction of the legs from the seabed and engaging the propulsion system are to be carried out concurrently. Vessel’s sea water cooling has to be switched over from suction mast to sea chest. The Master should ensure that during these operations the following precautions are taken:

- Sufficient power is available to the thrusters such that the vessel moves away from any fixed installations nearby when the legs break free.
- The thruster force applied is not too excessive such as to cause damage to the spudcans or legs while breaking free.
- The thrusters directed outside forbidden zones, refer to section 9.5 for forbidden zones.

Aft two thrusters are required to be engaged for steering. The vessel is capable of achieving the below mentioned speeds using its thrusters in calm weather condition (no wind, no wave) at 100% loading.

Table 6-4 Vessel Speed in different thrusters configurations

No. of Thrusters	Speed in knots (Calm Weather Condition)	
	Without Spud Can	With Spud Can
Six	9.15	Tbc after SAT
Four (Two Aft + any two parallel)	8.20	Tbc after SAT
Two (Aft)	5.60	Tbc after SAT

The Master should control the speed and heading of the vessel, in all weather conditions, such as to minimize vessel motions. Pitch and roll motions in a vessel need to be minimized as they induce bending loads in the legs.

The OOW should control the vessel while under transit using good marine, sea keeping practice and according to Company IMS manual.

6.5.3 General Afloat Procedures

REF DOC: Approved Final - Trim and Booklet DA101Z035

REF DOC: Company IMS Manual for Afloat Condition.

REF CKL: Company IMS Checklist for Afloat Condition.

Current weather reports must be obtained and assessed. Master should ensure that the expected weather is well within the limiting floating environment of the vessel (defined in Section 0). Weather forecasts should be used by the Master to decide to continue to the intended destination.

During the move, transfer of weights and fluids must be restricted and monitored. The Master must follow the guidelines for maintaining stability as given in Section 5.3 and 'Approved – Final Trim & Booklet'. The Master should ensure that a reasonable even keel, trim and heel is maintained.

The following general afloat procedure should be followed:

- The OOW is responsible for navigation/security messages.
- Ballasting other than consumables to be done only at the express order of the Master.

- During rounds VHF/ UHF radios are to be carried and personnel to be in continuous communication with a watch stander.
- Major jobs to be executed while afloat are to be planned prior to the move. The Master must be aware of ongoing jobs at any particular moment and to be notified when started/completed. When a job is completed the equipment used shall be stowed away and the area to be secured immediately.
- Before commencement of the voyage, the Master shall be provided with a sailing plan and any other pertinent information pertaining to developing situation onboard the vessel.
- Before commencement of the move (field move/transit) all relevant authorities according to IMS must be notified
- Personnel performing the rounds and inspections will report to the watch stander according to IMS.
- To minimize free surface effect, keep as many tanks as possible either full or completely empty.
- The Master / OOW should pay attention to the possibility of accumulating the sea water ingress into the koker compartments (Nos.1 & 9 Void Space (P&S)). Those spaces should be kept as empty from sea water ingress due to the harmful effect on the cargo pay load and the vessel's stability as described in Section 5.3.1

6.5.4 Loading Conditions for Floating (Transit) Operations

REF REG: MODU-CODE 14.1.3.3

Sample floating loading conditions for the vessel are listed in the 'Approved - Final Trim and Stability Booklet'.

6.6 Bridge Operations

6.6.1 Description of Bridge Items

REF DWG: Arrangement of Wheel House & Bridge Wings DA410E010 Rev 2

REF DWG: Console Layout MRC-H3303 WHC Rev 4

REF DOC: Operator chair document number 271.035 099.TDE

Following are the consoles installed in the bridge

Table 6-5 Bridge Equipments

Console	Equipment Installed in the Console	
W/H Transit Navigation Console	Wheel House Console (Port)	• Radio Beacon Control Unit • VHF AM Transceiver • Helideck Status Light control Panel • Navigation Light Control Panel • Outside Light Control Panel • Bridge Wing Search Light Remote Controller (Port and Starboard) • UV Search Light Remote Controller • Anti-Heeling Mimic Panel • DGPS Display • DGPS Selector Switch • Window Wiper Controller • Handset For No.2 VHF • No.2 VHF Controller • BNWAS Push Button
W/H Transit Navigation Console	Wheelhouse Cons ole (Centre)	• RADAR Multipilot (X/S-Band) including Track Pilot • ATOW Display • Joystick for IBJS/ ATOW • Overriding tiller • Trackball for IBJS/ ATOW • TCP-Transfer Control Panel • TCL-Manual Thruster Control Levers for MTOW • Horn Controller

Console	Equipment Installed in the Console	
		• Gyro Operation Unit • Gyro + Standards Repeater • Engine Order Telegraph • Thruster Gauge Panel • IBJS/MTOW/DP Mode Selector Switch
	Wheelhouse Console (Starboard)	• Handset and controller for the No. 1 VHF • GMDSS Alarm Unit • Whistle Push Button • BNWAS Push button • ECDIS Display Unit • Trackball • Ethernet Switch • Auto Telephone • Battery less Telephone • Gen. Emcy Alarm • PA Panel • W.T Door Indicator • Talk Back Alarm Panel • Duct Heater Control Panel • Master Clock
Overhead Gauge Panel		• Digital Speed Indicator • Digital Depth Indicator • Digital Gyro repeater • Wind Speed Indicator
W/H Group Panel (Chart Room Panel)		• Speed Log Operator Unit • Echo Sounder Selector Switch • Echo Sounder • NAVTEX Receiver • Whether Fax receiver • Thermostat • Chart Light Lamp

Console		Equipment Installed in the Console
		• ECDIS-Planning Station
GMDSS Console		• MF/HF control unit • MF/HF Handset • INMARSAT FB IP phone • MF/HF Telex Data Terminal
Back Up Transit Navigation Console	Back Up Transit Navigation Console	• RADAR Multipilot X-Band 3 and ECDIS • Compass GPS • BNWAS alarm Panel • PA Panel • Digital Depth Indicator • Window Wiper Controller • Heated Glass controller • CCTV keyboard
	Jack Up Console	• 2 x Touch screen Panel • UPdown Lever for Leg PSF • Pump motor start stop Push button • Selector Switch and Indicator for cylinder and Indicators for Pins • Emergency Stop Button • Spirit level indicator
	DPOW	• DP OW Monitors • DPOW Joystick Units • DPOW Trackball Units
	CYSCAN Console	• Cyscan Monitor
	AMCS, DGPS Console	• DGPS Display • DGPS combined trackball & Keyboards

Console	Equipment Installed in the Console
	• DGPS VARIPOS INTEGRATED RECEIVER • AMCS Display
EMP Console	• EMP Monitor • Keyboard and Track ball for EMP • Speed Log (Current sensor located in suction mast)
WS Safety and Ship System	• AMCS Monitor • Monitors • Bridge Watch Alarm Panel • AMCS keyboard and Mouse • Sound Powered Telephone • Fire alarm Operation Panel • Data Logger L3 System • Loading computer

6.6.2 Bridge Operations in different Modes

REF DOC: Bridge operation procedures IMS manual

REF DOC: Dynamic Positioning System Operations & Maintenance Manual - 27006000TM-387 NMS6000 OW & CP DPS Manual

REF DOC: MUNS System Description of Hydraulic and Electronic System 09-06-10 Rev 3

REF DOC: L3 NMS 6000 Thruster Control System Document Number 27005000PS-387T-S

REF DOC: NACOS PLATINUM Operating Instructions

Company 'Bridge operations Procedures' manual should be followed for general bridge operations.

6.6.2.1 Modes of Operations

The main modes for the operations of the thruster control are DP, Manual (MTOW), Independent Backup Joystick (IBJS) and Remote IBJS (Portable Joystick).

In DP mode, thrusters are fully controlled by the DP system.

In Manual mode thrusters are controlled manually via the MTOW which gives individual and / or grouping thruster control to the operator through the Thruster Control Levers (TCL).

The Automatic Thruster Operator Workstation ATOW / IBJS perform coordinated control of the vessel thrusters using three axis joystick. In addition to the joystick the ATOW includes automatic heading control, remote centre of rotation and automatic wind compensation.

The Portable Joystick (Remote IBJS) is a self-contained unit that can be carried around by the operator. It has a long cable “tether” that plugs in to a connection box (cables are available in 11’ & 30’ lengths). There are connection boxes installed at bridge wings Stb and PS. The three buttons (Accept Control, Hold Heading & Wind Comp) and an alarm indicator light on the Portable Joystick, shown in below figure 6 - 4.

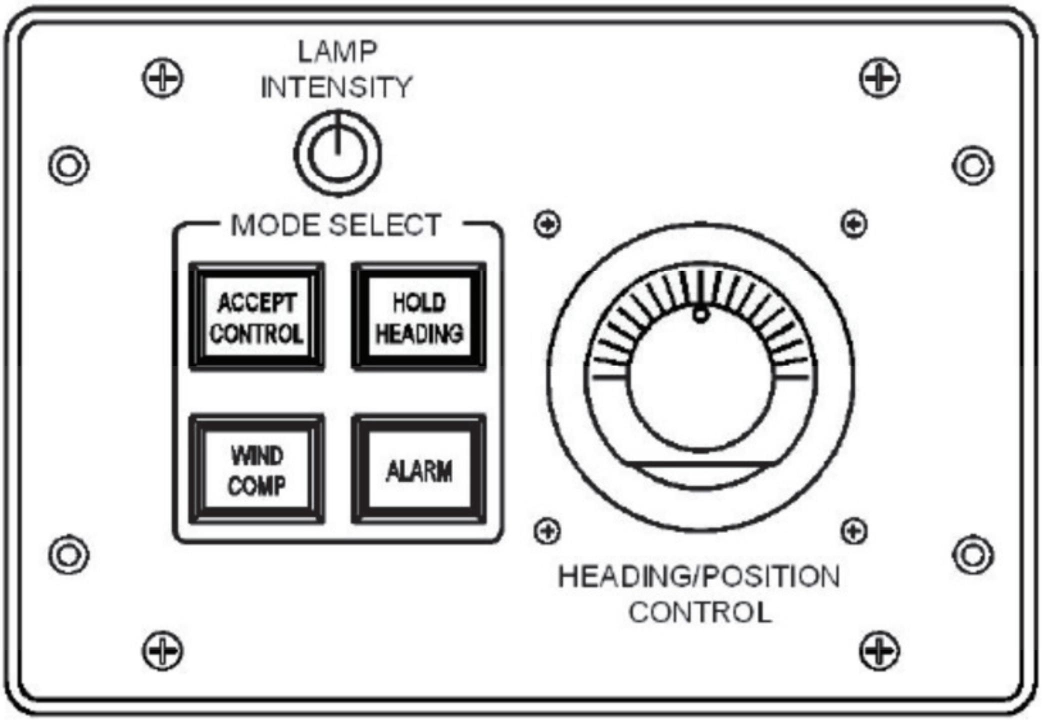


Figure 6-5 Remote IBJS

6.6.2.2 Switching Between Modes

The Central Bridge Consol features a Mode Select Switch which allows the operator to select the DP – MTOW - IBJS. When the switch is moved from one position to the next, all thruster commands will go to zero (Azimuth and RPM). After the switch position has been changed, the operator will be required to manually accept control. If the operator does not manually accept control, the thruster commands will remain at zero. When transferring from an automated station (e.g. DP OW or ATOW) the MTOW lever must be at the zero position to assume control of that thruster. If the lever is not at zero, the "Take" button on the TCL will flash indicating action is needed in order for the MTOW to take control of this thruster. The basic switching modes are presented in the following table.

Figure 6-6 Selector Switch

Table 6-6 Thrusters Mode Switching

Switch From	Switch To	DP OW	MTOW	ATOW (IBJS)
DP	MAN	Was previously in control. No longer in control.	Operator accepts control by pressing the Take button on the TCL.(only if lever position is non-zero)	
MAN	JS		Was previously in control. No longer in control.	Operator accepts control by pressing Take Control/Yes button on the ATOW pop-up display window.
JS	MAN		Operator accepts control by pressing the Take button on the TCL. (only if lever position is non-zero)	Was previously in control. No longer in control.
MAN	DP	Operator accepts control by pressing the Take Control/Yes button on the DP OW pop-up display window.	Was previously in control. No longer in control.	
DP	JS	Was previously in control. No longer in control.		Operator accepts control by pressing Take Control/Yes button on the ATOW pop-up display window.
JS	DP	Operator accepts control by pressing the Take Control/Yes button on the DP OW pop-up display window.		Was previously in control. No longer in control.

<table>
<tr><th>Remote IBJS to Other Modes</th><th colspan="2">Actions</th></tr>
<tr><td>Taking Control of Master & Backup Stations</td><td colspan="2">1. Verify the Operator Workstation to become the Master is functional.
2. Select YES on the Confirm Take Control dialog box,</td></tr>
<tr><td>Taking/Transferring Control of Remote & Portable Joysticks</td><td colspan="2">Control can be transferred to or taken from the Operator Workstation and any one of the Portable Joysticks.</td></tr>
<tr><td rowspan="4">Transfer from Operator Workstation to Portable Joystick</td><td colspan="2">Select the MODE FUNCTION drop-down menu on the DP System Navigation Bar,</td></tr>
<tr><td rowspan="2">Select the PORTABLE JOYSTICK button from the MODE FUNCTION drop-down menu.</td><td>That button begins to flash green.</td></tr>
<tr><td>The ACCEPT CONTROL buttons start flashing on all of the Portable Joysticks.</td></tr>
<tr><td colspan="2">Press the ACCEPT CONTROL button on the Portable Joystick to be in control. This action causes all ACCEPT CONTROL lights to extinguish except on the unit now in control, where it remains steadily illuminated. Or press the PORTABLE JOYSTICK button again to cancel the transfer.</td></tr>
<tr><td rowspan="4">Transfer from Portable Joystick to Operator Workstation</td><td rowspan="2">Press the ACCEPT CONTROL button on the Portable Joystick that is in control.</td><td>The ACCEPT CONTROL buttons start flashing on all of the Portable Joysticks.</td></tr>
<tr><td>The PORTABLE JOYSTICK button on the MODE FUNCTION menu begins to flash green.</td></tr>
<tr><td colspan="2">Select the MODE FUNCTION drop-down menu on the DPS Navigation Bar</td></tr>
<tr><td colspan="2">Select the PORTABLE JOYSTICK button from the menu.</td></tr>
<tr><td rowspan="4">Take Control Away from a Portable Joystick</td><td colspan="2">Select the MODE FUNCTION drop-down menu on the DP System Navigation Bar,</td></tr>
<tr><td rowspan="2">Select the PORTABLE JOYSTICK button from the MODE FUNCTION drop-down menu.</td><td>That button begins to flash green.</td></tr>
<tr><td>The ACCEPT CONTROL buttons start flashing on all of the Portable Joysticks.</td></tr>
<tr><td colspan="2">Select the PORTABLE JOYSTICK button again.</td></tr>
</table>

6.6.3 Operator Chair

An Operator Chair is installed at the wheel house that allows the user to operate the following systems:

- DP System
- Jack Up System
- ECDIS

The necessary equipment for the above mentioned systems are mounted into the armrests of the chair. For further details refer to the chair operational manual

6.6.4 Other Bridge Items

6.6.4.1 Radars

There are S and X band Radars mounted on the mast, another AFT X band radar is mounted on the main crane boom rest. For simultaneously display radar and ECDIS on the MULTIPLOT, radar has to be activated first. The blind areas chart of the radars on board as below

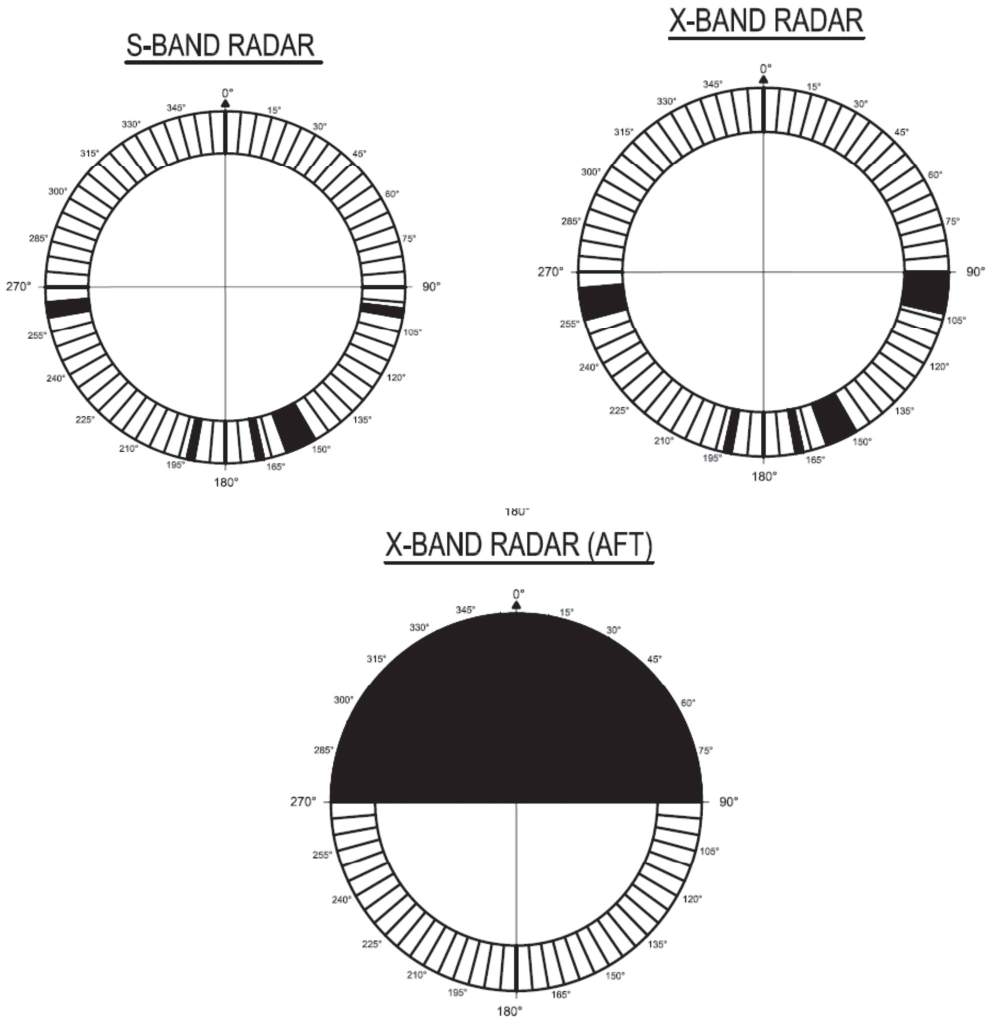


Figure 6-7 Radars Blind Areas Charts

6.6.4.2 CCTV System

A closed circuit television system (CCTV system) is installed on the vessel. The CCTV system with all necessary ancillaries is used for observation of important components.

Cameras are at the following locations:

Mooring winches	1 camera each, in total four
Jacking System at all 4 Legs	6 cameras each, in total twenty four
Top of jack houses	2 cameras each, in total eight
Engine Rooms	1 camera each, in total two

Three LCD display screens are installed at wheelhouse. The list below lists CCTV camera locations and its focal point

Mooring Winch FWD CAM.1- FWD STBD Winch
Mooring Winch FWD CAM.2- FWD PORT Winch
Mooring Winch FWD CAM.3- AFT STBD Winch
Mooring Winch FWD CAM.4- AFT PORT Winch

JACK HOUSE #1 CAM.5- Upper Cylinder head & Locking Pin
JACK HOUSE #1 CAM.6- Upper Cylinder head & Locking Pin
JACK HOUSE #1 CAM.7- Upper Cylinder head & Locking Pin
JACK HOUSE #1 CAM.8- Upper Cylinder head & Locking Pin
JACK HOUSE #1 CAM.9- Low Cylinder head & Locking Pin
JACK HOUSE #1 CAM.10- Low Cylinder head & Locking Pin

JACK HOUSE #2 CAM.11- Upper Cylinder head & Locking Pin
JACK HOUSE #2 CAM.12- Upper Cylinder head & Locking Pin
JACK HOUSE #2 CAM.13- Upper Cylinder head & Locking Pin
JACK HOUSE #2 CAM.14- Upper Cylinder head & Locking Pin
JACK HOUSE #2 CAM.15- Low Cylinder head & Locking Pin
JACK HOUSE #2 CAM.16- Low Cylinder head & Locking Pin

JACK HOUSE #3 CAM.17- Upper Cylinder head & Locking Pin
JACK HOUSE #3 CAM.18- Upper Cylinder head & Locking Pin
JACK HOUSE #3 CAM.19- Upper Cylinder head & Locking Pin
JACK HOUSE #3 CAM.20- Upper Cylinder head & Locking Pin

JACK HOUSE #3 CAM.21- Low Cylinder head & Locking Pin

JACK HOUSE #3 CAM.22- Low Cylinder head & Locking Pin

JACK HOUSE #4 CAM.23- Upper Cylinder head & Locking Pin

JACK HOUSE #4 CAM.24- Upper Cylinder head & Locking Pin

JACK HOUSE #4 CAM.25- Upper Cylinder head & Locking Pin

JACK HOUSE #4 CAM.26- Upper Cylinder head & Locking Pin

JACK HOUSE #4 CAM.27- Low Cylinder head & Locking Pin

JACK HOUSE #4 CAM.28- Low Cylinder head & Locking Pin

Fwd STBD Jack-up house top CAM.29- Main deck & ship's side

Fwd STBD Jack-up house top CAM.30- Main deck

Fwd PORT Jack-up house top CAM.31- Main deck

Fwd PORT Jack-up house top CAM.32- Main deck & ship's side

Aft STBD Jack-up house top CAM.33- Main deck & ship's side

Aft STBD Jack-up house top CAM.34- Main deck

Aft PORT Jack-up house top CAM.35- Main deck

Aft PORT Jack-up house top CAM.36- Main deck & ship's side

No.1 D/G SPACE com.37 – No.1 D/G

No.2 D/G SPACE com.38 – No.1 D/G

6.6.4.3 GPS

The vessel is provided with two GPS sensors. A selector switch has been provided to change the GPS selection which has the following three positions:

- GPS 1
- GPS 2
- Both

It is recommended that the selector switch should be kept on the 'Both' position as its standard working position.

6.6.4.4 Duty Alarm System

A Master duty alarm panel is included at the bridge and ECR for details of operation of the alarm panel refer to NACOS Platinum operating instructions manual. For other panels locations refer to section 8.1.3

6.7 Leg & Cargo Lashing

6.7.1 Positioning and Securing of the Legs

REF DOC: Operation Manual for Jack Up System DA101D030 Rev 0

The vessels legs should be positioned lashed and secured while the vessel is in floating/transit condition to avoid damage to the legs and in its pin holes. The securing of legs can be carried out using one or a combination of the below mentioned methods:

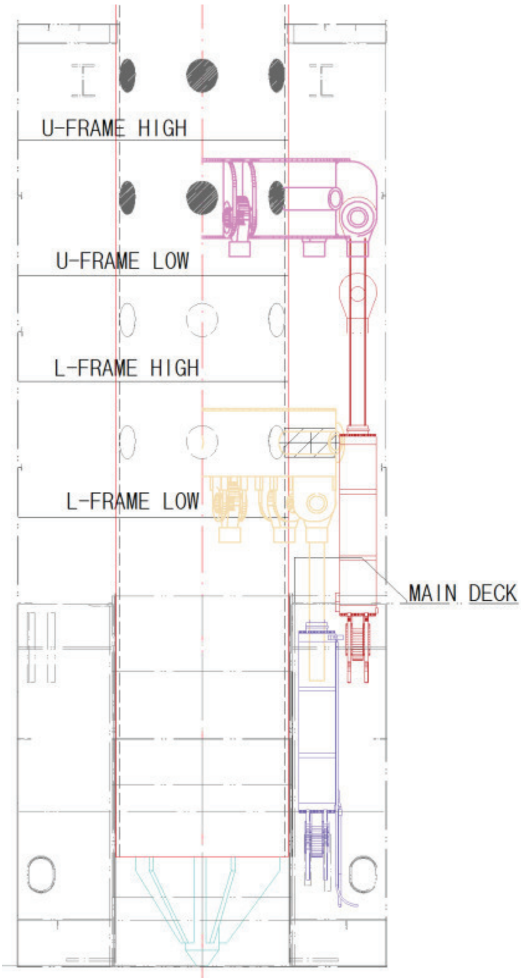
- Locking the upper/lower jacking frame in the opposite direction to prevent vertical play.
- Use of sling and hydraulic tensioning.
- Use of horizontal positioning System (HPS).

Note: Leg lashing procedure to be updated by Owner acc. operational experience.

6.7.1.1 Locking the Upper/Lower Jacking Frame in the Opposite Direction

In this method both upper and lower jacking frame’s pins are engaged to leg. The jacking cylinders of the lower frame pulls the lower frame towards hull, whereas jacking cylinders of upper frame pushes the upper frame away from the hull. The operational procedure and system limitations are mentioned section 6.1 and 1.3.3.

The max/recommended force to be applied on the jacking frame with this method is 1000 t.



U-FRAME HIGH
U-FRAME LOW
L-FRAME HIGH
L-FRAME LOW
MAIN DECK

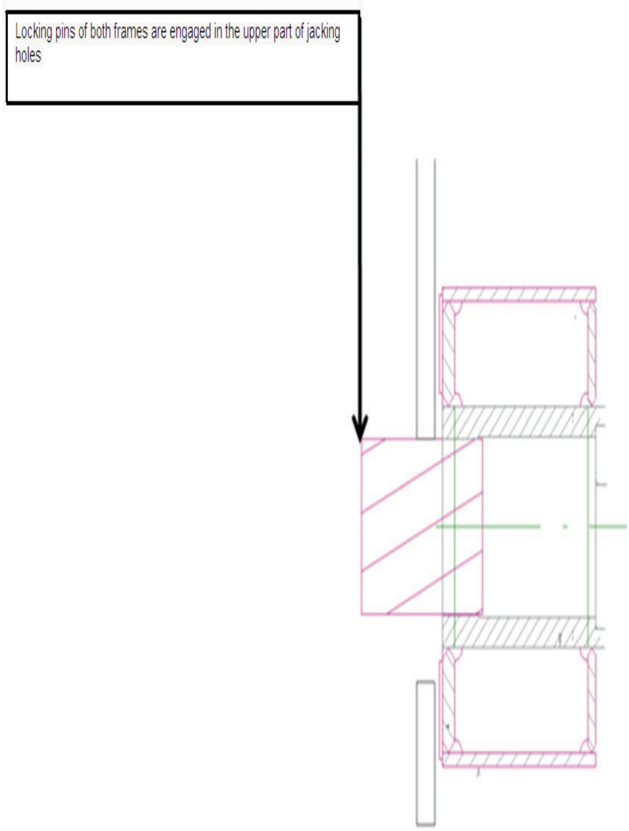
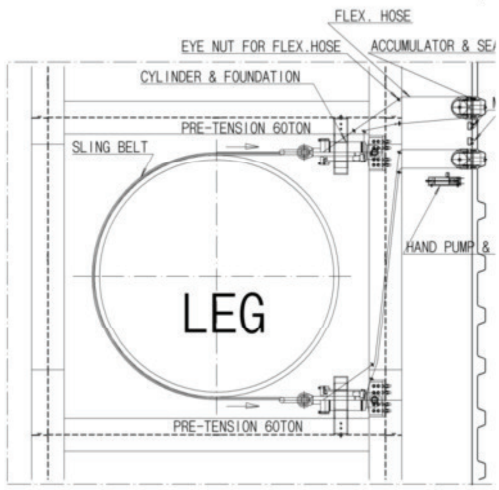


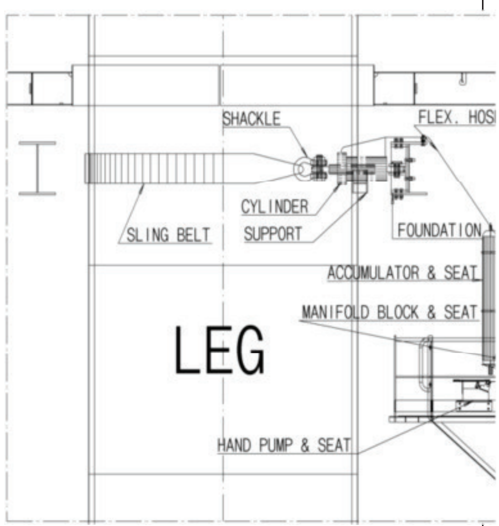
Figure 6-8 Leg Lashing

6.7.1.2 Use of Sling and Hydraulic Tensioning

A sling belt and hydraulic tensioning system has been provided below each jack house to secure the leg and restrict / dampen its movement. The sling belt will be pre tensioned with a 60 t force using hydraulic tensioning system.

The hydraulic system consists of a hand pump, two manifolds, two accumulator and two hydraulic cylinders. The accumulators provide the dampening of leg movement. The operational details of the system are as follows.





- Ensure that the lashing belt level is not in level of the leg pin. If adjustment of leg pin holes by leg movement is not feasible, the belt must be protected from damages due to sharp edges of the pin hole.
- Lash sling belt around the leg and tighten it to the shackle of each hydraulic cylinder.
- Connect flexible hoses between hydraulic cylinder and hand pump (pressure 140 bar).
- Start hand pump operation, so that it supplies hydraulic fluids into hydraulic cylinder.
- Disconnect hydraulic cylinder and hand pump flexible hose connection when enough tension is on sling belt. The flexible hose for the hand pump only connected when in use.
- Accumulators keep the belt in position on legs by maintaining enough pressure on hydraulic cylinder through manifolds.
- The connection between different hydraulic equipment is done by using a flexible hose.

Warning!

The lashing belt mechanism must be released before leg lifting/lowering.

6.7.1.3 Use of horizontal positioning System (HPS)

Three horizontal positioning hydraulic cylinders with shock pads are arranged for each leg on the main deck as the part of jacking system to control the movement of legs. The main function of the HPS is to assure leg verticality during soft pining of the leg into the sea bed formation. The HPS can also be used for leg lashing purposes as follows

- Start Hydraulic Pump 1 or 2 or 3
- Force Slider to 1000 K.N (100 tones)
- SB red dot on force circle from centre at approx 150 degrees
- PS red dot on force circle from centre at approx 210 degrees

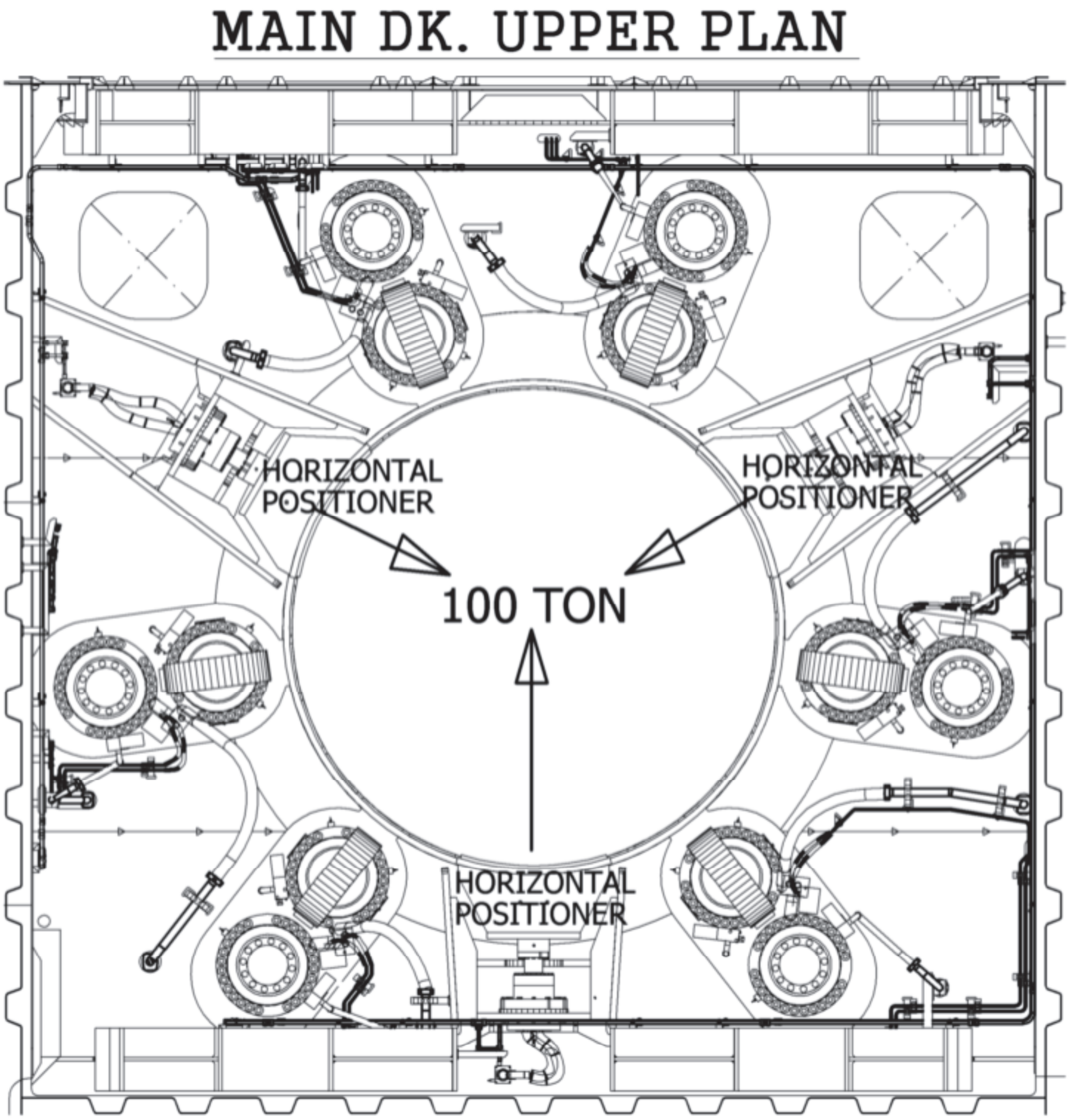


Figure 6-9 HPS System

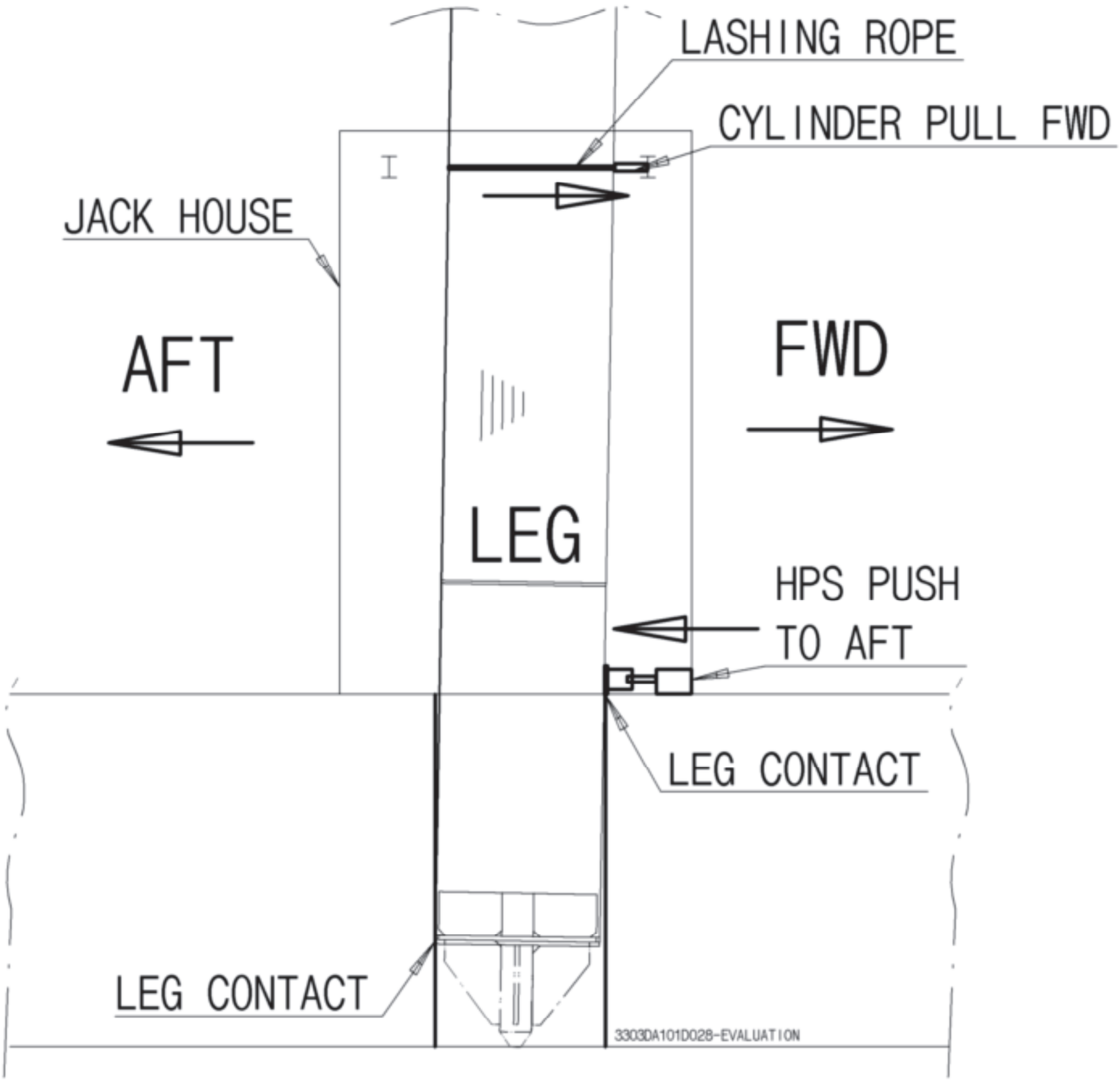


Figure 6-10 Leg Lashing Diagram

6.7.2 Securing Heavy Cargo

REF DOC: Cargo Handling & Securing Manual

REF DOC: Company IMS Project Specific Construction Manual

As per storm procedures all heavy cargo should be stowed and secured. For detailed guidelines for securing of heavy cargo refer to 'Cargo Handling & Securing Manual' and method statements according to 'Project Specific Construction Manual'.

Also, refer to the HO(A)-37, Arr't of Deck Lashing Socket in the final drawing.

6.8 Leg Jetting Procedure

REF DWG: Ballast Anti Heeling Jetting and Suction Mast DA800D101 Rev 5

REF DWG: Leg Jetting System Piping Arrangement Drawing

REF DWG: Leg Jetting Nozzle Block and Pipe Protector OCD011-DWG-PIP014

REF DWG: SAMKUN Century Hose Reel Operating Manual & Drawing.

REF DOC: Jetting Hose Reel for Jetting Nozzle Cleaning Pump Unit.

REF DOC: Jetting Hose Connection Procedure 3303DA800D000 Rev 0.

6.8.1 General

After the unit has ceased operations at a particular location the hull is jacked down into the water and the legs are extracted from the seabed typically using the upward buoyancy force from the hull.

This is achieved by jacking the hull down into the water such that additional extraction forces can be gained from the upward buoyancy from the hull is transferred into an upward leg extraction force on each of the engaged legs. This force will be distributed to all four legs or a combination of diagonal leg or even a single leg based on extraction force requirement.

In soft soils, the deep leg penetrations increase the force required to extract the legs as a greater shaft area is in contact with the seabed soils. The overall force that is necessary to extract the leg is thus related to the shear strength and density of the overlying soil, as well as the buoyant self-weight of the leg.

Leg jetting system should be considered during leg pulling in clayey soil. Since clayey soil (endorse) adhesive force (suction) on the leg bottom. However as a general rule leg jetting system should be used during leg pulling operation, when the leg extraction forces applied and monitored by the jacking system are near the limits of maximum forces that jacking system can handle.

Note: Chapter to be reviewed and updated to final as-built system version.

6.8.2 Objective

The leg jetting system serves to ease the extraction force required to pull the jacking leg out of the formation.

The leg jetting system shall provide enough sea water flow at the leg bottom to fill-in the void generated due to leg extraction. Filling this void shall prevent the suction forces opposing the pulling forces generated by the jacking system.

NOTE: A hose clamp in each four vertical level to be provided to tie up the jetting hose to the leg. For detail procedure, refer to 3303DA800D000 Rev 0 Jetting Hose Connection Procedure.

6.8.3 System Components

Hose Reel	2 No. Quantiy Winding Length 61 m Winding Speed 1.01 m/min Manual Braking System
Induction Motor	440 VAC, 3 ph, 60 Hz, 1.5 kW (IP 56)
Main Jetting pumps (Centrifugal pumps)	Capacity : 360 m^3/hr Head : 9 bar Quantity: 2 x 100% capacity
Nozzle Cleaning Pump	Capacity : 30 m^3/hr Head : 70 bar Quantity: 1 x 100% capacity
Pump Locations	Both pumps in Aft Machinery Space
Pump Operating Location	Locally & AMCS
Leg Piping	5"OD SCH80
Flexible Hose	61 m, 235 mm OD, 203 mm ID, 20 bar max Black NBR Rubber with Reinforcement
	For Inside of 8" Hose, 61 m, 54 mm OD, 38 mm ID, 135 bar max Black Seamless Synthetic Rubber with Reinforcement
	For Jumper to Connection 1 m, 54 mm OD, 38 mm ID, 80 bar max
Leg pipe connection to vessel sea water supply	2 connection points for each leg @ 78 m (top of the leg) and @ 58.8 m
Total no. of nozzle block	8
Type of nozzle block	4" BSP removable nozzles

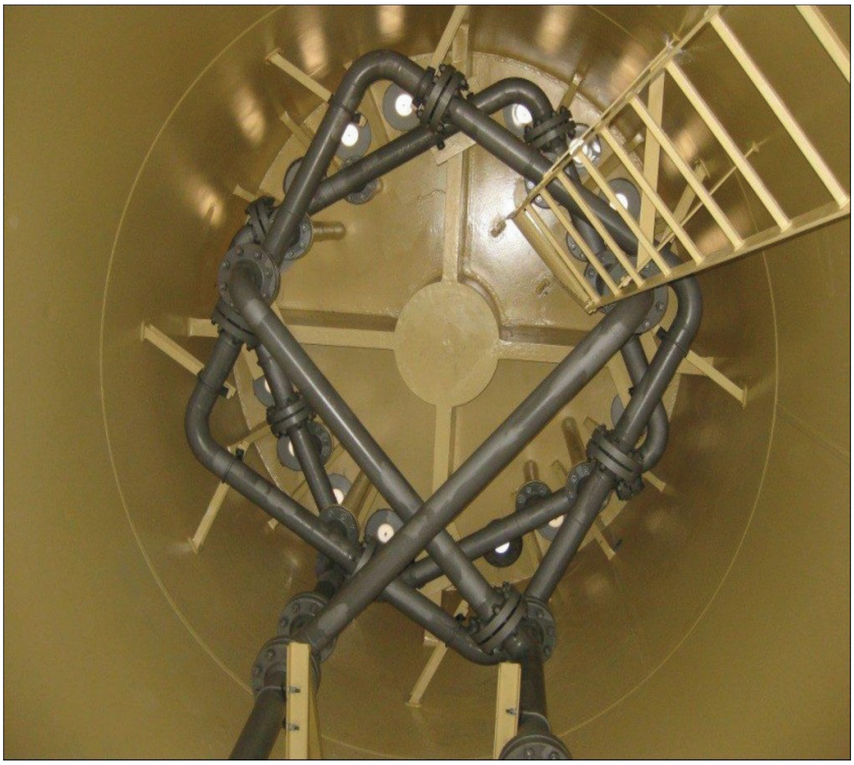


Figure 6-11 Jetting Piping Inside Leg

Figure 6-12 Jetting Nozzle Block

Figure 6-13 Jetting Operation from Nozzle Block (Without Spudcan)

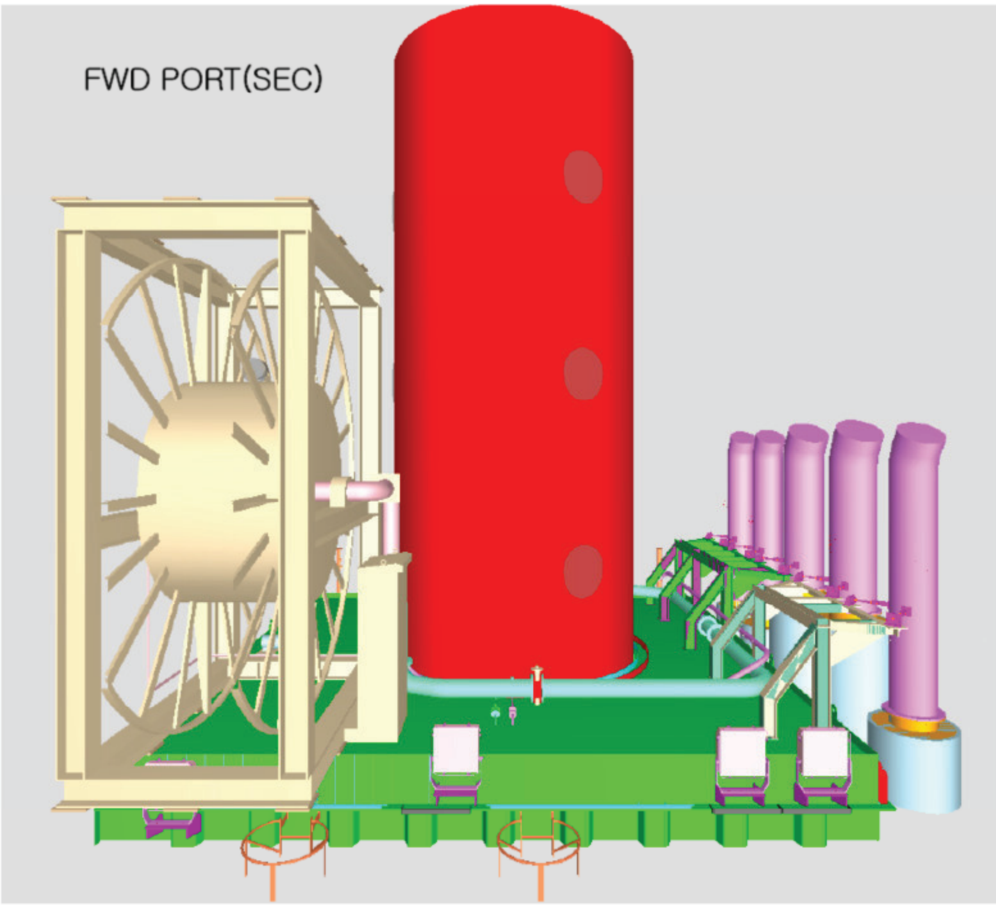


Figure 6-14 Hose Reel Arrangement

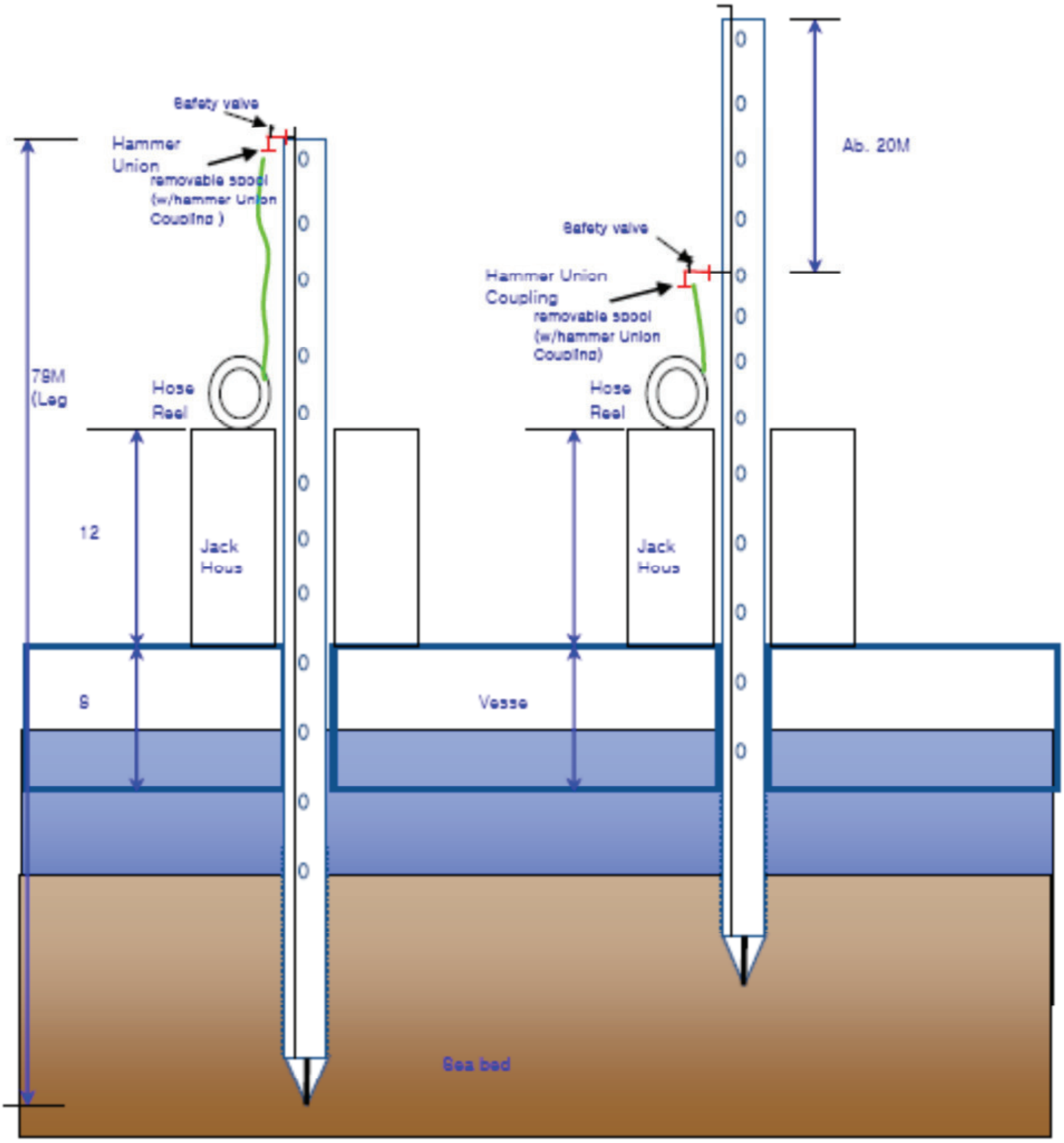


Figure 6-15 Configuration of Jetting System

6.8.4 Hose Connection Procedure

6.8.4.1 Installation of Removal Pipe and Support

- Set the leg at proper location on the jack house top.
- Check the power of Jetting Hose Reel and the condition of operation.
- (This procedure must be needed for giving tension after hose connecting piece is assembled with removal pipe)
- Prepare the lifting tools and ready to operate a davit on the top of the leg
- Prepare the tools and materials for assembly
- When people arrive at the place, top or middle part installation shall be carried out.

For further detail, refer to Jetting Hose Connection Procedure 3303DA800D000 Rev 0.

6.8.4.2 Installation of flexible hose

To help install the flexible hose a small davit (SWL 0.7t) is mounted on the top of the leg, the steps below summarize the procedure for connecting the flexible hose.

- 1) Install the removable spool piece to the jetting line flange, which is at the top of the leg, connected to the line from inside the Leg (A davit on the top of the leg can be utilized).
- Using chain blocks bend the jetting hose toward the removable spool piece connection.(Davit on the top of the leg can be utilized for auxiliary support).
- Adjust the jetting hose exactly to the centre of the removable spool piece using the chain blocks.
- Note) Hose holders can be used for the centering of the jetting hose, if needed.
- When the centering is set between the removable spool connection and the jetting hose connection, put the union joint nut closely for assembly.
- Rotate (clockwise) the union nut by hands until the union nut is not rotated by hands any more.
- Fix the union nut firmly using a Hammer.
- Be careful that the equipment is not damaged during installation. Make sure that the hammer union does not loose.
- For safety, wire ropes are installed to prevent any accident during installation.

- For further detail and for the connection procedure at the middle part of the leg, refer to refer to Jetting Hose Connection Procedure 3303DA800D000 Rev 0.

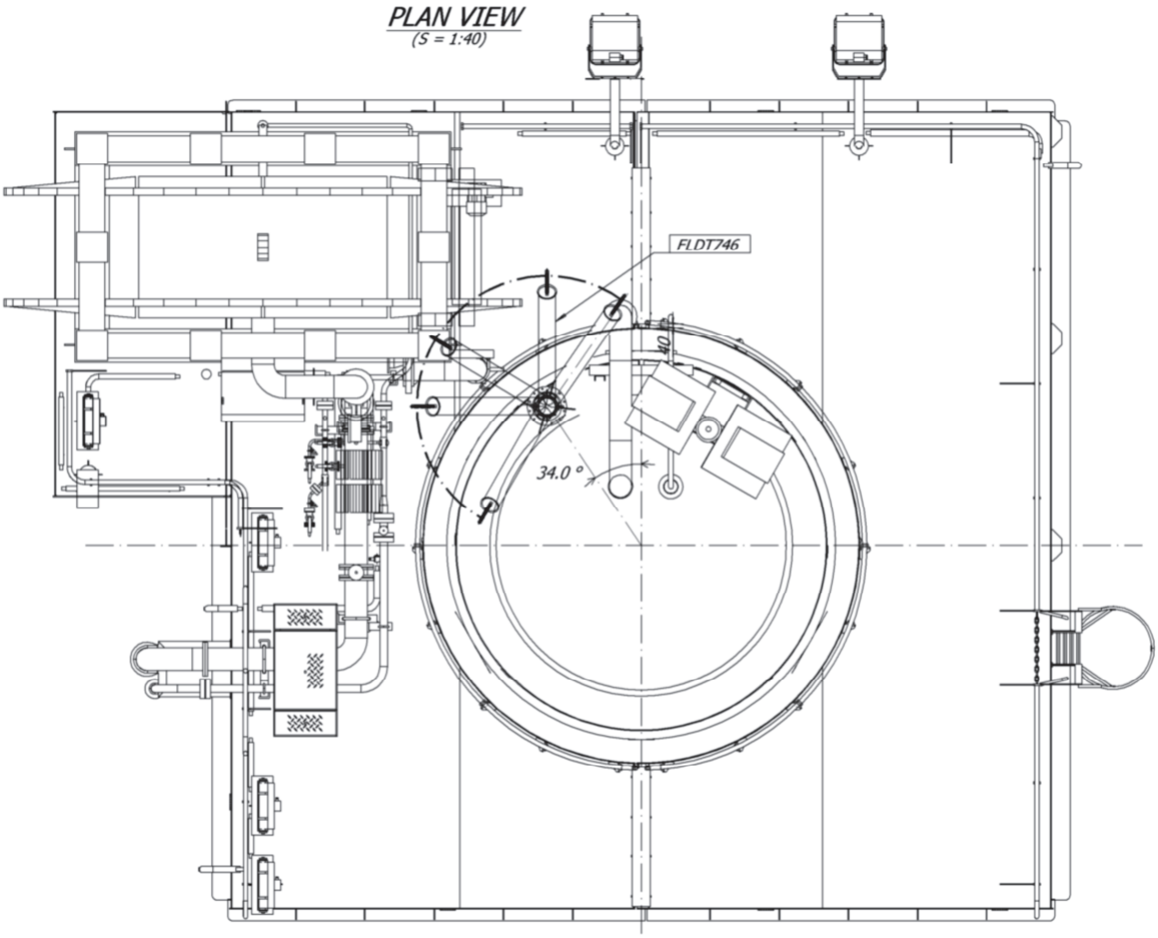


Figure 6-16 Davit on Top of Legs Top View

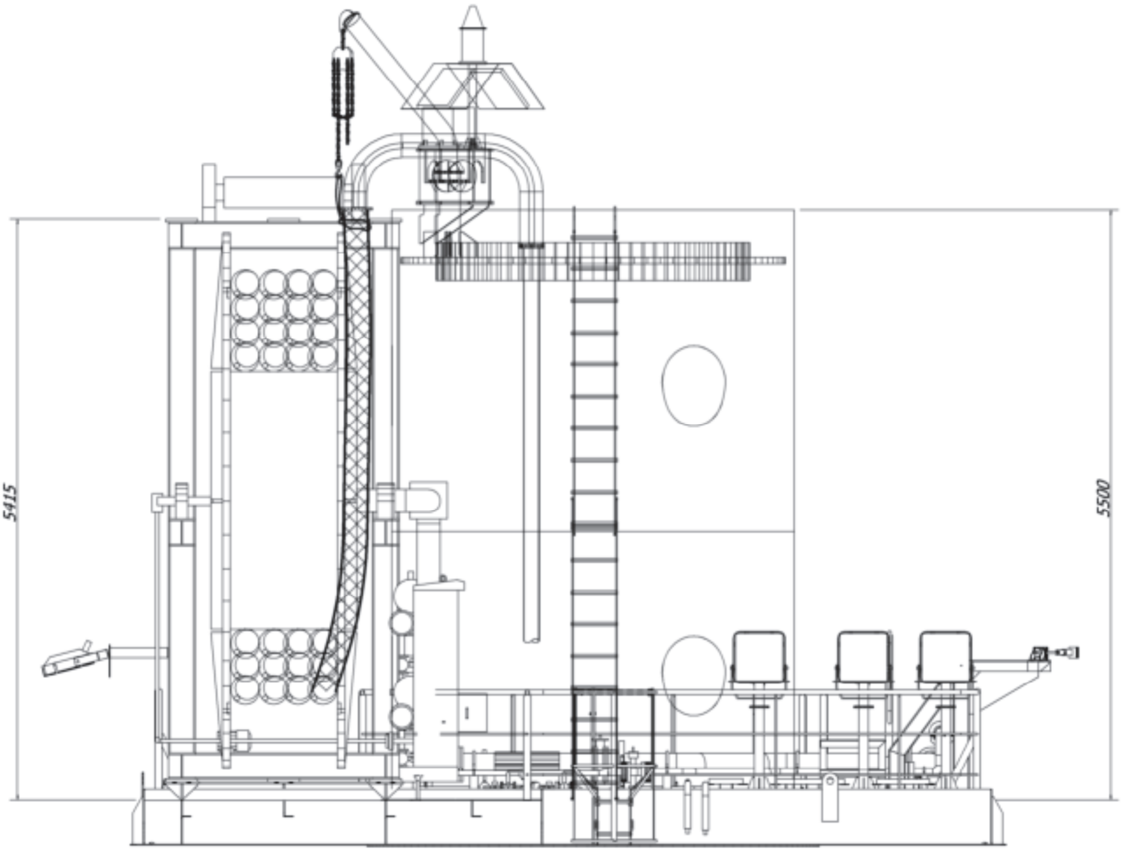


Figure 6-17 Davit on Top of Legs Front View

6.8.5 System Main Function

6.8.5.1 Water Jetting

- The main function of the system is to provide sea water flow @ flow rate of 180m^3/hr for every jacking leg during leg pulling of formation such that it allows leg extraction speed of 0.3 m/min without development of suction forces. The following to be noted carefully during the system design process.
- Two Legs can be extracted simultaneously at maximum jacking system pulling force as mentioned Section 1.3.3. The legs to be extracted are diagonally located. If one set of diagonally allocated legs is under extraction the other two legs will be held in place without applying any extraction forces.
- It is possible to extract four legs simultaneously; however the extraction speed will be almost halved.
- The jetting system will have two booster pumps for redundancy; each pump is capable of supplying two legs with 180 m^3/hr at head of 55 m. The total capacity of each booster pump is 360 m^3/hr at 9 bar head.
- The system will be designed such that one booster pump can run at a time.
- The two 5" standpipes built and supported inside the leg will be connected to the water source at the vessel.
- There shall be 2 connection points along the leg for the leg jetting pipes to the vessel for sea water supply. The first connection will be at 780 m elevation (top of the leg) and the other one will be 20 m below the top of the leg.
- Each connection point along the leg shall have 2 pipes. The 8 inch (200A) pipe connected to the main leg jetting pump while 2 inch (40A) is connected to nozzle cleaning pump.
- Connection to the legs shall be possible by using flexible hose wrapped on a hose drum. Connection type will be hammer union coupling.
- Intermediate hose connection to leg piping will be beneficial in easing the hose connection/disconnection when the leg is not deeply penetrated.
- The hose drum will have a retriever mechanism to keep the hose under tension so that any extra length can be retrieved at the drum.
- Automatic shutoff valve and orifice with flow transmitters are installed on the main jetting pump line and the nozzle cleaning pump line.

NOTE: Nozzle cleaning pump only used for pillar mode operation.

6.8.5.2 Modes of Operation

There will be two modes of operation:

Pillar mode: In this mode the spudcan is detached from leg.Nozzle cleaning pump will be operated prior pulling the legs from sea bed to clear the nozzle from packed soil. See below for definition of pillar and spudcan mode.

Spudcan mode: This is mode is for jetting the spudcan bottom with sea water. This utilizes the main jetting pumps.

6.8.5.3 Nozzles Clearing from Soil ingression (Pillar Mode Only)

Although this can be thought of as maintenance function, this function is considered as a main function due to its importance. It is expected that the nozzles at the bottom of the jacking leg will be blocked by soil ingression during the leg penetration phase. The soil will be packed inside the nozzle with estimated 60 bar bearing pressure.

To be able to clear the Nozzles from the packed soil, pressurised water at 70 bar will be applied prior the jetting process to clear the nozzles. The following to be noted carefully the system operation.

- Nozzle Cleaning to be undertaken prior jetting or pulling the legs.
- Once flow occurs at rate of 10 m^3/hr occurs the pump pressure will drop to few bars at the nozzles. Hence it gives an indication that the nozzle is cleared.
- Nozzle Cleaning is temporary action for short period.

6.8.5.4 Safety Functions

The system shall be designed with necessary safety functions to avoid piping bursting due to over pressure. The over pressure protection preferably implemented using mechanical relief valves set at 25% above working pressure.

In case of connecting high pressure and low pressure systems, at the connection point of the two systems an isolation valve (Non Return Valve for example) is to be used to isolate the two systems. A relief valve is to be used after the isolation valve which is set to 25% above working pressure of low pressure system to protect the low pressure system in case of failure of the isolation valve.

6.8.5.5 Flexible Hose

Functions:

- Allowing Sea water flow to the leg jetting system during leg pulling while keeping the hose connected during leg jacking operation.

Description:

- Automatic retrieval and tensioning of the hose using retrievable hose drum. The system will provide constant tension is about 1.5 t over the hose/s so that excess length of the hose/s is retrieved in the hose drum.
- Draining of the hose after jetting operation is recommended to reduce the strain on the hose and the retrievable hose drum during hose retrieving. Manually controlled drain valve is recommended at the jacking house before the hose reel.
- The hose is reinforced with suitable pressure connection to allow for fast connection/ disconnection.
- The hose is ended with a gooseneck connection to connect to the leg piping system without sever bending hence preventing the hose from rupturing at the connection points.
- Periodic inspection and maintenance on the hose is mandatory.
- During transient conditions the hose shall be drained and strapped to the leg (for details Refer Jetting Hose Connection Procedure 3303DA800D000 Rev 0). To drain, make sure the pump is closed. Then isolate hose by closing valves before the drain line. Open the drain line to remove the water from the hose.

- Intermediate hose connection to leg piping will be beneficial in easing the hose connection/disconnection when the leg is not deeply penetrated.
- High pressure and low pressure hoses may be used and segregated such that the high pressure hose is smaller in diameter. The two hoses and be coupled together using split couplings thus one hose retrieving and tensioning system can be used.

6.8.6 Operation

- Prior to installation of the vessel at a location, the jetting system should be tested and the jetting nozzles unblocked prior to penetration of the legs into the seabed.
- Make sure that the jetting hoses are connected and secured to the legs.
- If the leg is anticipated to be lowered below the jack house, the jetting hose shall be disconnected from mid point and the spool will be disconnected from leg top, then after the hull is elevated and stabilized the hose can be connected to the leg top connection points.

6.8.6.1 Prior Lowering the Legs

- Activate the jetting system pump and operate one leg at a time
- Monitor the pressure and flow-rate for each leg
- If spudcan is not attached and at the moment where the flow halts / reduced activate the Nozzle cleaning pump for 1 minute or till maximum flow-rate is attained from the nozzle cleaning pump.
- If spudcan is attached allow the jetting pump to run for 5 min on every leg.
- This application of jetting pressures prior to leg pulling will assist by applying positive water pressures at the base of the legs to prevent suctions from developing.

6.8.6.2 During Leg Extraction

- At the moment of starting the leg extraction activate the jetting system pump and operate on extracted legs.
- Monitor the pressure and flow-rate of the jetting system for the leg under extraction.
- Should the jetting nozzles be found to be blocked (flow transmitter detects no water flowing), the pillar mode should be activated. A jetting pressure of up to 70 bar will be applied until flow occurs through the jetting system whereupon the pressure should be reduced such that it does not exceed that at which hydraulic fracture occurs for the location and penetration depth. Allow the nozzle cleaning pump to run for 1 min or till maximum flow-rate is attained from the nozzle cleaning pump
- If spudcan is attached allow the jetting pump to run during extraction operation of the leg.
- Once the extraction forces on the leg are noted to be reduced significantly then the jetting system pump can be stopped.

NOTE: The jetting flow required will vary dynamically due to vertical movement of the hull caused by heave, pitch and roll of the hull. This will depend on the motions response of the hull and the sea state chosen for pulling the legs.

This dynamic movement of the hull is likely to cause the jetting water pressure trapped under the leg to vary with time as the pressure bulb is compressed cyclically. This will result in dynamic pressures being applied to the jetting line and pump and these items must be capable of supporting such varying loads.

6.8.6.3 After Leg Extraction

Once each leg is free from the seabed the jetting system should be thoroughly flushed to clear the jetting system of any soil ingress.

- Activate the jetting system pump and operate one leg at a time
- Monitor the pressure and flow-rate for each leg
- If spudcan is not attached and at the moment where the flow halts / reduced activate the Nozzle cleaning pump for 1 min or till maximum flow-rate is attained from the nozzle cleaning pump.
- If spudcan is attached allow the jetting pump to run for 5 min on every leg

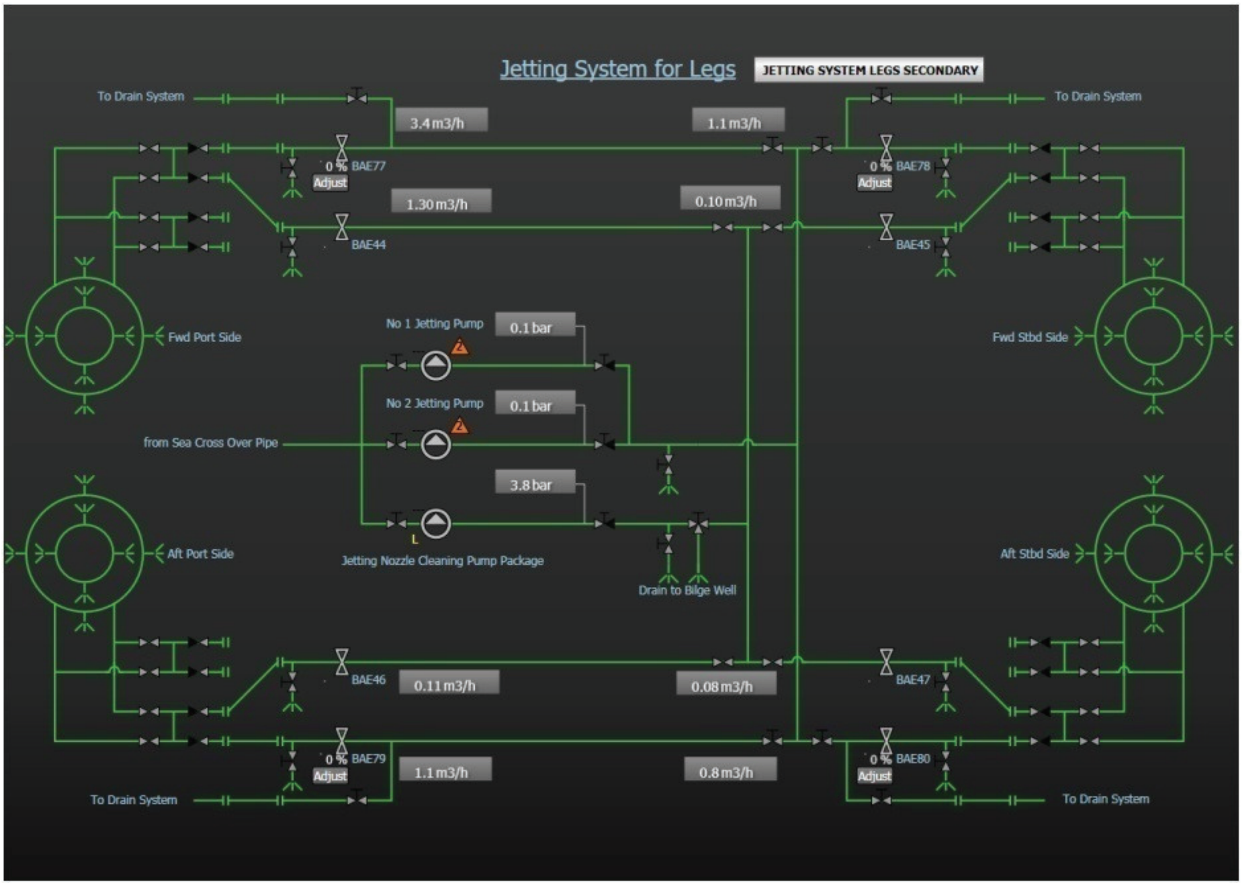


Figure 6-18 Jetting System Control Panel

6.9 Sea Water Suction Mast Operating Procedure

REG DWG: P/D of Ballast Anti Heeling Jetting and Suction Mast DA800D101 Rev 5

REF DWG: Suction Mast Unit – General Assembly P10010-DWG-M-001

REF DWG: Suction Mast Drive Unit – General Assembly No. P10010-DWG-M-201

REF DOC: V/D of Suction Mast 3303DV840D101

6.9.1 General

The vessel has been fitted with a sea water suction mast to supply sea water to the platform in elevated condition for equipment cooling and fire fighting purposes.

6.9.2 Equipment Description

The sea water suction mast located at forward of the aft-port side jackhouse is a long pipe with a dual rack assembly mounted on its sides. A rack and pinion arrangement used to drive / brake the mast using hydraulic power. Rack and pinion device is mounted on left and right side of SM, operating device is located in front of the mast. The mast includes internal piping, fittings, rack assembly and submersible pump.

A submersible pump is fitted at the bottom of the suction mast, the bottom of which should be submersed approx. 6.4 m in the water for efficient operations. The mast is provided with six connection points (valves) which are spaced approx. 5.5 from each other. Based on the expected air gap the mast can be lowered and the flexible hose can be connected to the nearest connection valve. The flexible hose has its fixed end connected to the heeling tank.

The sea water suction mast is guided by four sets of guiding rollers mounted at the jack house of the aft port leg. The lower most guide is approximately 3 m above main deck. It must be ensured that at least one guide level is always supporting the suction mast.

> **Warning !**
>
> Before pumping the submersible pump, it shall be make sure that the pump is immersed 6.4 m below the water surface and that the mast is engaged in one guide ruler as minimum.

Equipment details for sea water suction mast assembly are as follows:

Suction Mast Pi	Dual rack assembly
Mast Length	38.2 m
Pipe Diameter	900 mm
Mast weight	Approx. 36.4 t
Pipe material	GL-A 36
Connection Valves	Butterfly valve (6 sets) Spaced approx. 5.5 m (0m, 5.5m,11m,16.5m, 22 m & 27.5 m)

Warning !

0.0m valve connection not usable – seawater pump will be damaged.

Connecting Flexible Hose	Diameter: 150 mm
Submersible Pump	S&N Pump 260 m^3/hr x 45 MTH
Suction mast lifting speed	3 m/min
Suction Mast Pipe Driver	Wonil T&I Hydraulic driver operated rack teeth type 38m(H)x900mm(Dia)x25 mm(Thick)

Figure 6-19 Suction Mast Location

6.9.3 System Description

In general all cooling water and water supply for the fire fighting system is taken from the seawater crossover pipe between the sea chests. In floating condition the sea chests are always filled with seawater. For efficient operations with sea chests the vessels draft must be maintained at least approx. 2.5 m.

During transient and elevated condition when the sea chests will be out of water or when the vessel draft is lower than approx. 2.6 m, the suction mast is to be used. The suction mast fills up the heeling tanks using its submersible pump. Water from heeling tank in turn is used for cooling or other sea water usage purposes. In case this is not enough for the connected cooling water pumps, heeling tanks receive additional water from the return lines of the cooling system.

Change over from sea chests to heeling tanks must be carried out after safe stand on and once the thrusters support for position keeping is not required any more. The sea chests can then be disconnected from the crossover pipe by non-return valves. The Heeling System is switched off and the interconnection with the heeling pump closed. The Heeling tanks are then directly connected with the crossover pipe in front of Main S.W strainer, so that the entire volume of the Heeling tanks can be used as cooling water and the water (mainly) needed for cooling the generators is taken from the heeling tanks.

In this respect the heeling tanks serve two purposes: 1. act as regular Heeling tank in floating condition and 2. act as cooling water buffer and fire extinguishing reservoir during jacking and in elevated position. For the latter the tank is equipped with heating coils from the thermal oil system, so the firewater does not freeze during cold weather periods in jacked up position.

For further details of sea water cooling system description refer to section 9.11.

6.9.4 Limitations of Operation

The suction mast is designed to be used in environmental conditions not exceeding the following:

Wind speed (Mean)	up to 25 m/s (Bft 9 - 10)
Irregular Waves	
Significant wave height	up to 5 m
Average zero up-crossing period	7 – 10 s
Regular Waves	
Maximum wave height	up to 10 m
Wave period	8 – 13 s
Tidal and wind driven current:	1.3 m/s at surface

In case these conditions are expected to be exceeded the suction mast should be secured and stowed (refer to procedures given in section 8.8).

6.9.5 Mast Deployment Procedure

The sea water suction mast should be deployed while the vessel still in floating condition and sea chests are in use. Drive unit is used to deploy the suction mast at the required depth. The driving unit is also provided with a dead man function type of operating lever with a braking system as during deployment the mast can be lowered down by gravity of its own weight.

The final deployment depth for the mast is based on the final operating air gap and the minimum submergence length of the pump (6.4 m). This will need to be further adjusted to the nearest upper connection point where the flexible hose can be connected. The normal level of connecting the flexible hose to the connection point is approx 2.3 m above main deck. Over-deployment of the mast to suite nearest connection point or as per higher air gap is acceptable as long as there is sufficient water depth to do so. Thus the suction mast has to be deployed in step. These steps for lowering the suction mast are marked on the mast and are shown on the figure below:

NOTE: The suction mast cannot be operated at position 0 m extension.

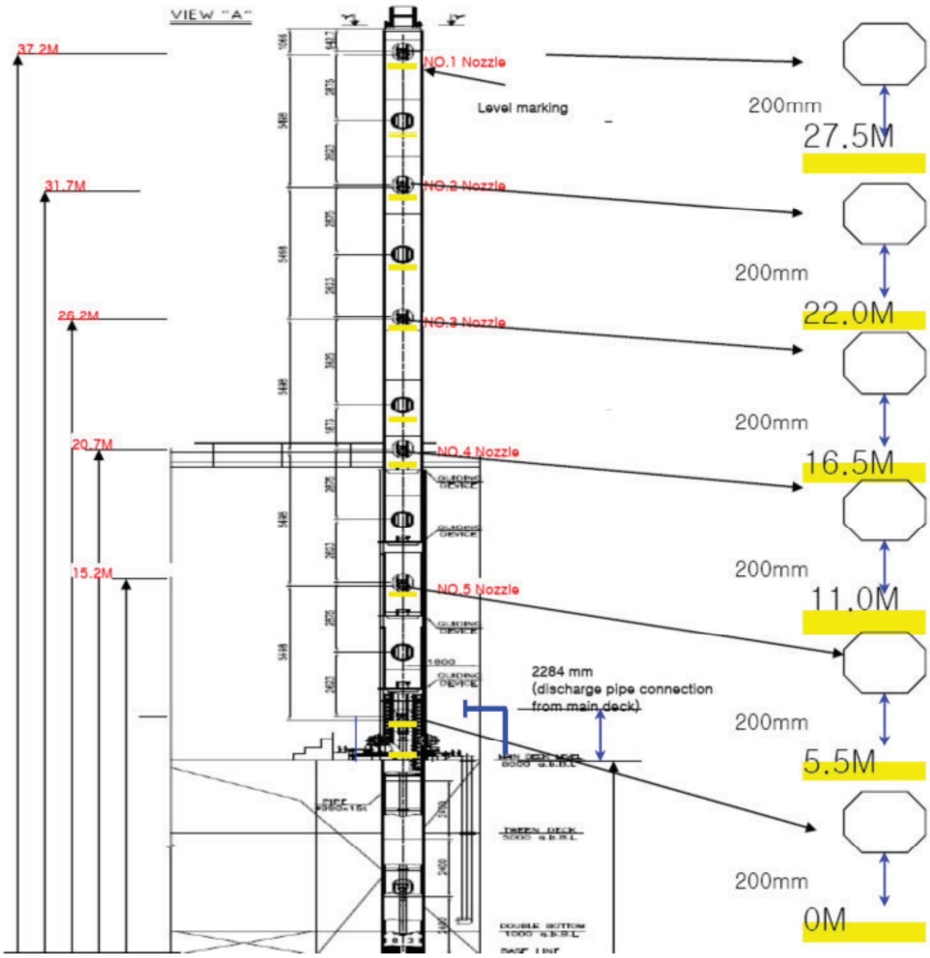


Figure 6-20 Steps for Suction Mast Deployment

While deploying the mast in floating condition it must be ensured that there is sufficient water depth available to deploy the mast for use at final air gap. It is advisable to have a clearance of at least 2.5 m between the sea bed and mast bottom to avoid suction of debris and sand with the sea water. In case the water depth is insufficient, the mast can be in two or multiple stages i.e. the mast to be deployed to a lower water depth while in floating condition and then further in elevated condition.

6.9.6 Operating Procedure

Once the mast is deployed to the required depth, the flexible hose connecting the heeling tank filling line can be connected to the connection valve. It must be ensured that the connection is sealed. The required line valves can then be opened to test the pump filling to the heeling tank.

It must be ensured that the heeling tanks are filled up using the suction mast or main sea chest while the vessel is in floating condition. Once the vessel is safely standing on it legs, and the use of thrusters is not required for position keeping, the cooling system can be changed over to heeling tanks as per change over procedure given in section 9.11. It must be ensured that this change over is carried out before the vessel draft reduces to 2.5 m.

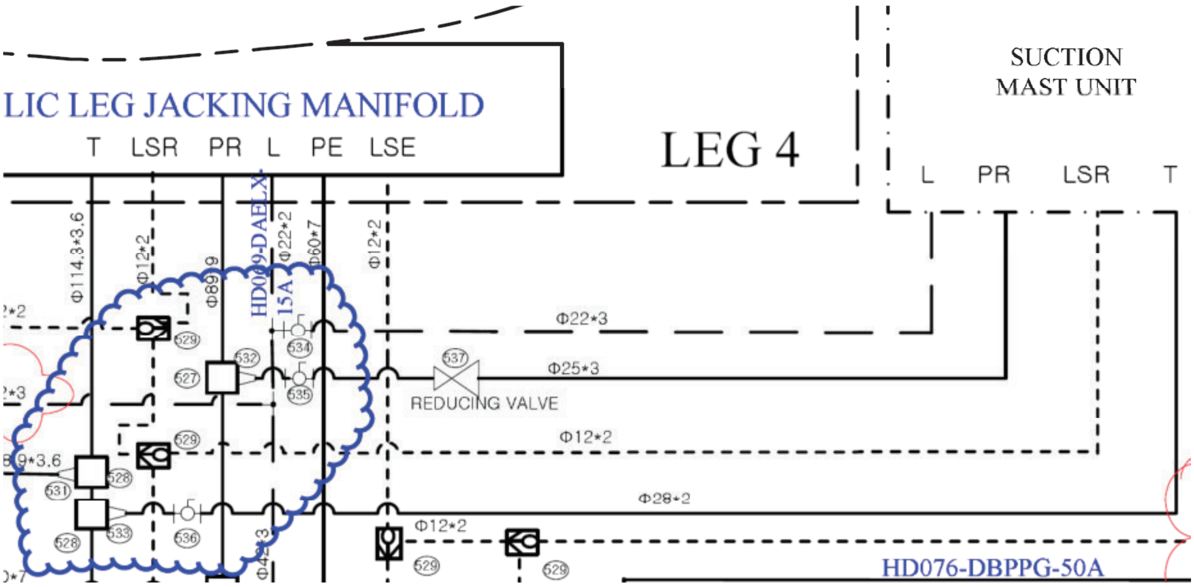


Figure 6-21 Hydraulic Power Unit Connection to Suction Mast

1) Hydraulic pump in hydraulic power unit for jacking system shall supply necessary volume of oil for nominal speed.

2) Isolation valves from hydraulic jacking system to the suction mast shall be opened before one pump of the nine hydraulic pumps start

3) Stopper pins Ps and Stb side must be fully disengaged before suction mast operation

4) Cable reel of suction mast should be activated and locking pins for pump and signal should be disengaged.

5) Suction mast is lowered/upward by a control lever operation on drive unit at the required

position.

6) When the suction mast is positioned at the location, the discharge nozzle is connected by a flexible hose to the cooling water supply line

7) For further related document, (Refer to PID(3303DA800D101, Page 9-1), V/D of Suction Mast 3303DV840D101.

6.9.7 Disconnection & Securing

Once the vessel is jacked down and the vessel draft is greater than approx. 2.5 m the cooling system can be changed over back to sea chests from heeling tanks. It must be ensured that this change over is carried out before the start of using thrusters for position keeping.

The line up valves can then be closed and the flexible hose be disconnected. The mast can then be lifted out of water using the hydraulic driving unit. Once the mast is out of the water and completely back into the hull, the manual brakes can be engaged and mast can be secured.

6.9.8 Emergency Operation

In case of emergency when sea water suction mast driving gear or its pump is not functioning, other sea water cooling methods/opportunities to be considered. Abortion of operation after evaluation/ risk assessment of alternative cooling abilities to be considered. For intermediate use the vessel is provided with a sea water cooling supply suction (hose reel).

- Lower down the supply pump hose reel.
- Open the valve connecting the hose reel to the heeling tanks.
- Start the submersible pump as soon as the sea water mast bottom is about 6.4 meters from the sea surface.
- Minimum required clearance for suction mast operation is 2.5 m from sea-bed. The minimum clearance may be increased or decreased subject to risk assessment of the actual condition by the vessel master.
- In case of emergency, preferred alternative methods are cooling on ballast water or other external cooling pump.

6.10 Spudcan Mounting and De-mounting

REF DOC: Spudcan Mounting and De-Mounting Procedure DA101D031 Rev 2

REF DOC: Spudcan Install / Dismantle Plan DE740TL12 Rev 0

REF DWG: Leg Structure Drawing 10-B4040_41-001 Rev 4

REF DWG: Spudcan Structural Drawing DA330H001 Rev 3

REF DWG: P&ID Leg Jetting System OCD011-DWG-PIP-001 Rev C

REF DWG: Leg Jetting Nozzle Block & Pipe Protector OCD011-DWG-PIP-014

REF DWG: Leg to Spudcan Connection Details OCD011-SK-STR-403 Rev 3

REF DWG: Tightening Bolt Details for the Leg to Spudcan OCD011-DSH-STR-001 Rev B

REF DWG: Plug Bolt Details for the Leg to Spudcan OCD011-DSH-STR-002 Rev B

6.10.1 General

Depending up on the sea bed condition the vessel is operated with and without spudcan mode. In cases where deep leg penetration is expected spudcan may be required. The spudcan provided for this vessel is detachable type that can be connected to the vessel legs via tension bolts. Each leg is connected to the spudcan via 16 bolts, however during pillar mode where the spudcan is not attached the bolts holes are plugged by plug bolts to prevent water sipping into the buoyant section of the leg.

For easing spudcan extraction, jetting system may be required. The spudcan is provided with jetting nozzles at the bottom side of the spudcan, these nozzles are protected from soil ingress by 3/4” SCH XS nozzle protecting cover. The jetting water is supplied from the Nozzle blocks at the leg bottom via flexible hoses to the spudcan. The hoses are connected to dedicated connection points on the nozzle blocks to flanged connections on the spudcan. 8 flexible hoses are required per spudcan.

Before connecting the spudcan to the vessel legs the following have to be provided

- 4 sets of tension bolts. The set contains the following items
- 16 tension bolts Ø120 x 860 mm (each bolt weights 148 Kg)
- 16 120 mm Nut
- 16 rubber gasket Ø 7.5 mm
- 16 Washer

- 4 sets of eight 4” flexible hoses are connected between jetting nozzle blocks at the bottom of the legs and the flanges provided inside the spudcan for jetting water supply. Each flange supplies 2 nozzles at the bottom of the spudcan.

Before disconnecting the spudcan the following items have to be provided:

- 4 sets of 16 plug bolts Ø120 x 500 mm to avoid water ingress into the leg chamber.
- 16 tension bolts Ø120 x 500 mm (each bolt weights 76 Kg)
- 16 120mm Nut
- 16 rubber gasket Ø 7.5 mm
- 16 Washer

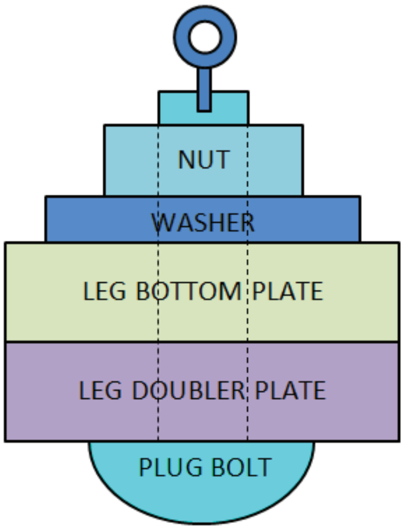


Figure 6-22 Assembly of Plug Bolt

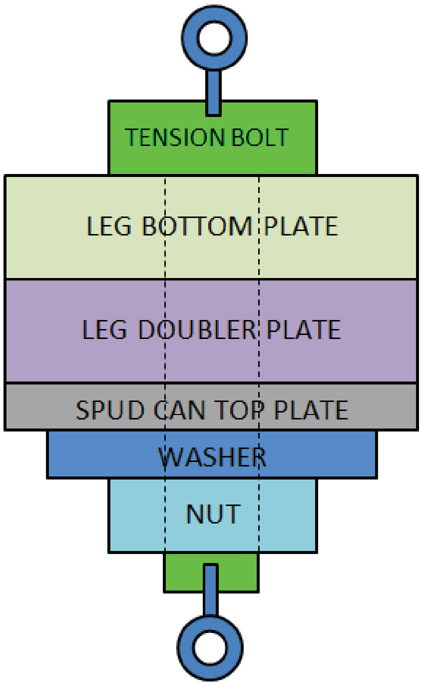


Figure 6-23 Assembly of Tension Bolt

Figure 6-24 Spudcan Connection

There are two methods available for the spudcan mounting and demounting operation:

- Operation with Launching Barge
- Jacking Up on Three Legs

NOTE: The following procedure is a guide-line for assembly / disassembly of the spudcan, to the vessel. A detailed Safe Job Analysis is to be performed by the installation team prior spudcan assembly and disassembly.

6.10.2 Operation with Launching Barge

Spudcan mounting and demounting operation can be carried out with a heavy launching barge. The operation must be planned well in advance as arranging barge and docking facility may have long lead times. The detailed procedure is described below:

6.10.2.1 Spudcan Mounting Procedure

Step – 1 Barge Operations

- Keep vessel's hull is in minimum draft condition at E3 quay area of the yard.
- Fix spudcan without bottom drain plug in correct position on jig by temporary weld and grillage structure on L/B deck.
- Ballast the Launching Barge (L/B) as maximum as possible so that it submerges below the bottom line of the hull.
- Once L/B comes below the bottom line of hull, de-ballast the L/B so that bottom line of the hull seats on the grillage of L/B.
- Transport hull and L/B to assembly area.
- Once the L/B seats above the keel blocks (assembly area), start the re-docking procedure.

NOTE: All the ballasting, de-ballasting and transporting procedure should be done at safe environment. Keep fenders in correct position of the L/B to avoid hitting of vessel on the side walls of L/B.

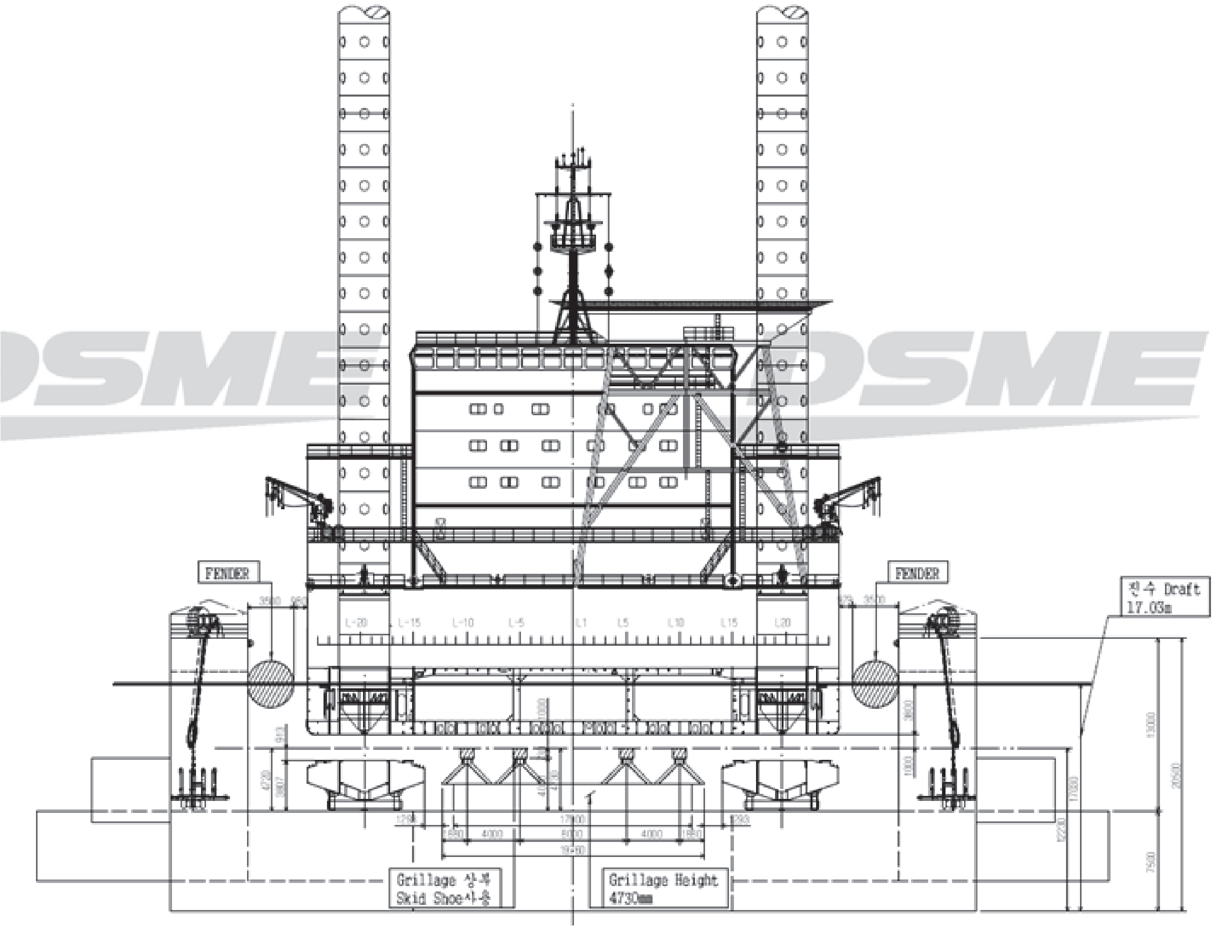


Figure 6-25 Vessel on Launching Barge Grillage Structure

Step – 2 Preparing the Buoyant Section of the Legs

- After complete safe re-docking, open the leg manhole, conduct drainage and safety check of leg inside. Prepare leg inside for utilities, lighting, fan, tensioners etc for safe and proper environment of work.

Step – 3 Disassembly of Plug Bolts

- Lowe the leg till plug bolt head comes below the bottom line of the hull
- Inside the leg, connect the tensioner to the plug bolt and apply pulling load of 200 t. When the plug bolt can be turned easily, release the plug bolt and slowly lower the disconnected plug bolt from outside the leg.
- Grind off all protruding leg bottom screws to make fine contact between leg bottom and spudcan

Step – 4 Assemble Nozzle Blocks in Spudcan Mode Configuration

- Remove the two blind plug caps at the bottom of the nozzle block by unscrewing the 4 M12 Hex bolts.
- Remove the two 4” blind plugs
- Remove the 4 jetting nozzles from nozzle block and plug it with blind plugs (2 Extra blind Plugs should be available)
- Connect flexible hose to bottom of nozzle block

Step – 5 Alignment of Spudcan

- Set a pendulum or laser on the tip of the leg for the centre line adjustments of leg and spudcan. If any un alignment, make fine adjustments on spudcan with the jack cylinder provided on the launching barge.
- Check for bolt and hole alignment. Use a guide pin for correct alignment if necessary.

Step – 6 Tension Bolts Installation

- Pre assembles four bolts symmetrically after dimension check.
- Lower the tension bolt from the leg and stab into the spudcan. Connect washers/nuts from bottom of the spudcan's top plate.
- Tension the tension bolts with 3,000 kN (305.81 t), fix all tension bolts symmetrically and apply 70% tension initially and then 100 %.
- Insert shim plates to prevent shear and rotational movement between the leg and the spudcan.
- Sealing to be applied to protect ingress of foreign material (mud) into the spudcan.

Step – 7 Jetting System Connection

- Connect the 8 flexible hoses from the nozzle blocks to the spudcan flanged connections

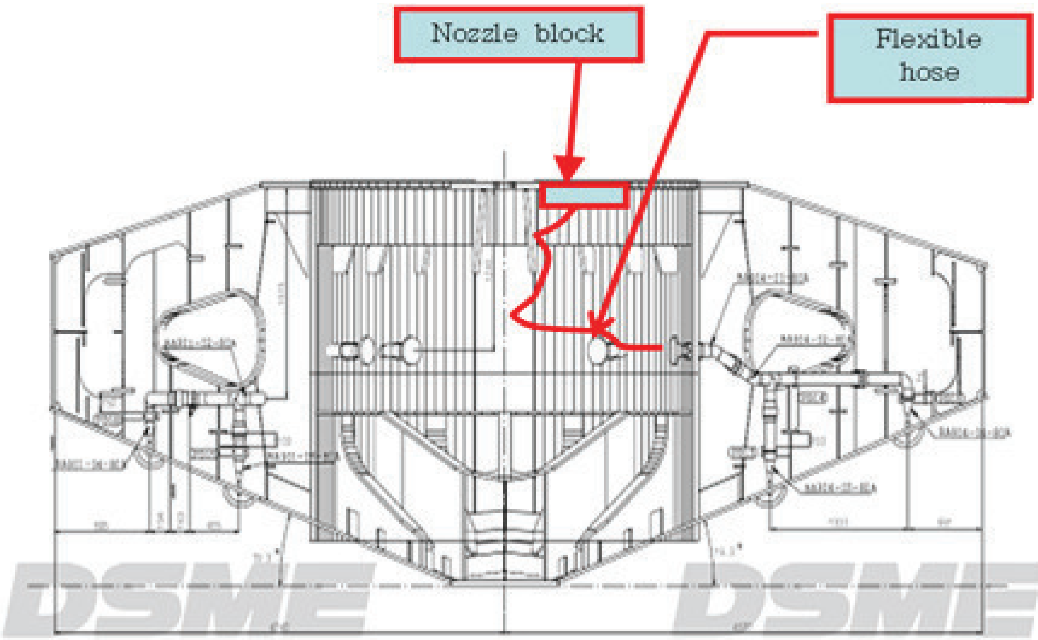


Figure 6-26 Flexible Hose Connection Inside the Spudcan

Step – 8 Finalizing Connection

- Cut off fixed bracket of the spud can
- Jacking up the leg to certain height to insert spudcan bottom drain plug.
- Move workers and all equipment to deck of barge and close the manhole of the leg. Follow the step 2 to 8 procedure for next diagonal leg and complete spudcan installation procedure for all four legs.

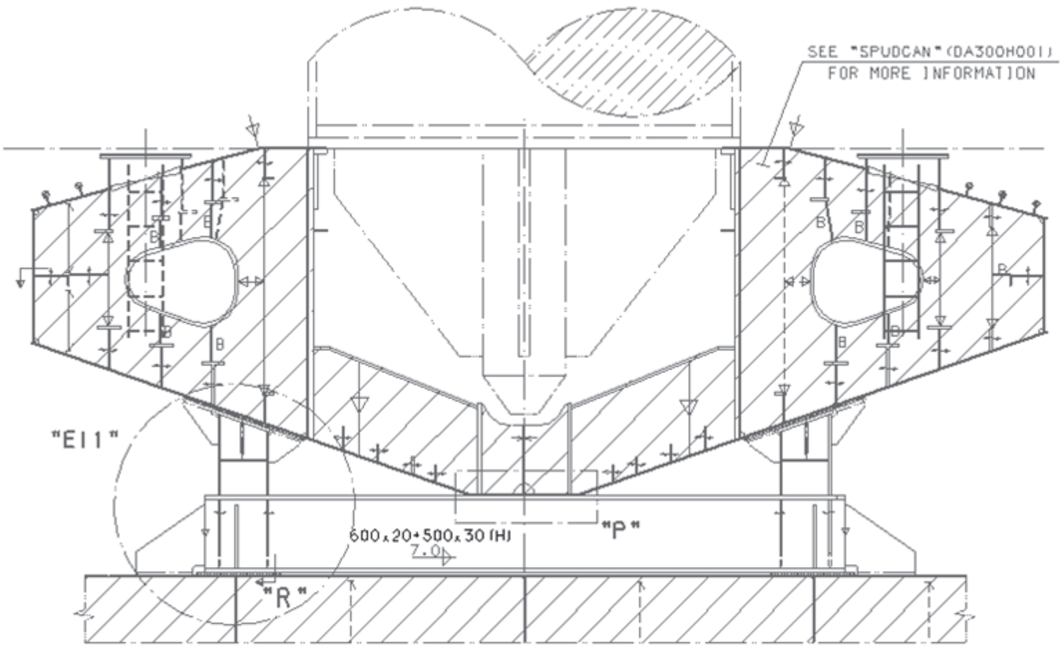


Figure 6-27 Spudcan & Jig Arrangement

6.10.2.2 Spudcan De-mounting Procedure

Step – 1 Barge Operations

- Keep vessel's hull is in minimum draft condition at E3 quay area of the yard.
- Fix jig and grillage structure on barge, ballast the Launching Barge (L/B) maximum as possible, so that launching barge can submerge below the bottom line of the spudcan.
- Once L/B comes below the bottom line of spudcan, de-ballast the L/B so that bottom line of the hull seats on the grillage.
- Follow the guidelines for the safe floating and transport hull and L/B to assembly area
- Once the L/B seats above the keel blocks (assembly area), start the re-docking procedure.

NOTE: All the ballasting, de ballasting and transporting procedure should be done at safe environment. Keep fenders in correct position of the L/B to avoid hitting of vessel on the side walls of L/B.

Step – 2 Spudcan Alignment

- After complete safe re-docking, remove spudcan bottom drain plug and open the leg manhole
- Set a pendulum or laser on the centre of the spudcan for the centre line adjustments of leg and Jig. If any un alignment make fine adjustments with the jack cylinder provided at the lower part of Jig.
- Lower the leg till spudcan seats on the jig safely.

Step – 3 Preparing the Buoyant Section of the Leg

- Open the leg Man hole
- Conduct safety check of leg inside. Prepare leg inside for utilities, lighting, fan, tensioners etc for safe and proper environment of work.

Step – 4 Tension Bolts Disassembly

- Apply more than 300 t to release tension from tension bolt and remove washers/nuts from inside of the spudcan.
- Remove tension bolts from leg inside and lift the leg about 1 m.
- Store disconnected washers/nuts inside of the spudcan.

Step – 5 Jetting Hoses Disassembly

- Make sure that the jetting system is isolated
- Disconnect the Flexible hoses between the leg nozzles blocks and the spudcan

Step – 6 Assemble the Nozzles Block to Pillar Mode Configuration

- Make sure all O-Ring Seals are in place and installed on the nozzles / the blind plugs
- Install blind plugs and blind plug caps into the bottom of the nozzle blocks
- Remove blind plugs and Install the 4 Nozzles on each nozzle block

Step – 7 Installing Plug Bolts

- Connect plug bolts at bottom of leg and tighten with nut from leg inside using tensioner set at 200 t tension force.
- Move workers and all equipment to deck of barge and close the manhole of the leg. Follow the step 2 to 7 procedure for next diagonal leg and complete spudcan dismantling procedure for all four legs.

6.10.3 Jacking Up on Three Legs

REF DOC: Spudcans Installation Feasibility Study OCD011-DOC-NAV-402 Rev 1

For the spudcan mounting and demounting operation, first the vessel is jacked up on four legs, then every leg is lifted up one by one out of the water and spud cans installed using a barge. Variable load is redistributed each time to move the COG of the platform to achieve stability. Crane boom is also used as variable load by rotating it within three legs triangle.

The basic procedural steps are described in the Spudcans installation feasibility study OCD011-DOC-NAV-402 Rev 1.

NOTE: Jacking up on three legs is an alternative method for the spudcan mounting and demounting, in case suitable dock or heavy launching barge is not available. The procedure itself is time consuming due to the multiple number of operations involved. Prior to use of this method a detailed stability analysis and safe job analysis should be carried out for the safe operation.

6.11 Operational Planning and Manoeuvring Method

REF REG: MODU-CODE 14.1.2.16, 14.1.3.13

REF DOC: IMCA M 103, M 117, M 182

REF DOC: L-3 DP-Operation manual

REF DOC: Company IMS manual for operational planning and manoeuvring methods.

REF DOC: DP- Operator’s Handbook (TNI), ch.5

For detailed procedures on operational planning and manoeuvring methods refer to above mentioned reference documents.

6.12 DP operations

REF REG: MODU-CODE 14.1.2.16, 14.1.3.13

REF DOC: IMCA M 103, M 117, M 182

REF DOC: L-3 DP-Operation manual

REF DOC: DP- Operator's Handbook (TNI)

6.12.1 Principals of DP- Operation

This provides a general description of the Dynamic Positioning System operation. The DP System automatically maintains the vessel's position and/or heading without anchors or mooring equipment. The DP System is a closed loop control system that adjusts the thrusters' magnitude and direction in order to respond to changes in the environment. The input to the DP System is the Operator Commanded Position/heading. This command, which is manually entered by the operator, tells the DP System what the desired vessel position and/or heading set points are. The outputs of the DP control system are the Propulsion Commands, which are the thrust magnitude and direction commands. The Reference Position/heading Sensors, such as DGPS and gyrocompasses, measure the vessel's actual position and heading. These sensors provide the feedback to the closed loop control system. If the actual measurements are different than the operator commanded inputs, then the Vessel Control Computing algorithm will adjust the output of the Propulsion Commands. As a result, the vessel will remain in a fixed position and/or heading, despite the ever-changing environment. Environmental Sensors, such as wind monitors, provide feed-forward data to the DP System. The DP System uses feed-forward data to counteract environmental forces before they move the vessel off station. For example, if high wind forces are sensed, the DP System will adjust the Propulsor Commands accordingly.

The dynamic positioning system can operate as a minimum in the following modes:

- **Standby Mode:** In this mode the vessel's position is not actively controlled by the DP system. The system is in standby and ready to be switched into one of the active control modes.

- **Manual Mode (Joystick):** In this mode the vessel's position can be controlled by the operator, Operators can manually control the vessel with the Operator Workstation POSITION CONTROL JOYSTICK and HEADING CONTROL KNOB. The thrusters respond to the manual

- **Auto Mode:** In the auto mode the system keeps the vessel at the given position and heading (set point) with high accuracy. The position is measured by the use of the position reference systems.

- **Mixed Manual Auto Mode:** The operator may select a combination of manual and automatic positioning. In this mixed mode, the operator can control one or more of the three axes (surge, sway and yaw) manually as in the manual mode, while the remaining are controlled automatically by the system as in auto mode.

- **Track Follow Mode**: In the track follow mode the vessel is able to follow a predefined track of way-points.

- **Freeze Integrals Mode**: When the leg lowering operation started and leg has touched the sea bed, operator put the vessel in Integrals Freeze mode, which avoids the thruster mal operation of DP operation or thrust action even when it is not required. This is very critical and Master/DP operator will play major role in deciding about thruster power demand and PMS power limitation as per vessel load analysis.

- **Quick Current Update Mode -** Unknown or unpredictable environmental forces, such as current and waves, that affect the vessel are compensated for by the Integral, The Integral Force builds over time to offset the environmental forces. However, if there is a sudden change in current, as may happen around rivers and channels, the Integral may not build up quickly enough to keep the vessel on station. Therefore, the DP Operator has the ability to manually adjust how the Integral builds to compensate in the event of a rapid or unexpected change in current or other environmental forces. The vessel must first be in Hold Heading/Hold Position in order for this feature to be available

- **Remote Center Of Rotation (COR)** The Remote Center of Rotation (COR) mode allows the operator to define arbitrary center of rotation. It is measured offset from the vessel's nominal *Center of Rotation*. When the operator selects the 'Remote COR' mode, the DP System rotates the vessel around the Remote COR rather than the vessel's nominal *Center of Rotation.*

6.12.1.1 Sensors

The DP System shall interface with the position, heading, and environmental sensors described in this section below

- Position reference: - Two Differential Global Positioning System DGPS 1(GPS Nav), DGPS 2(GPS compass) and one Local Position reference CYSCAN (Beam characteristics 16°- vertical, 0.23°- horizontal, Operating range 10 to 800m with rotation uni-directional 360°/sec)
- Heading reference: - GYRO 1, GYRO 2 and SAT COMPASS
- Environmental Sensors – MRU 1, MRU 2, WIND 1 and WIND2
- The CYSCAN working sector is shown in the figure below

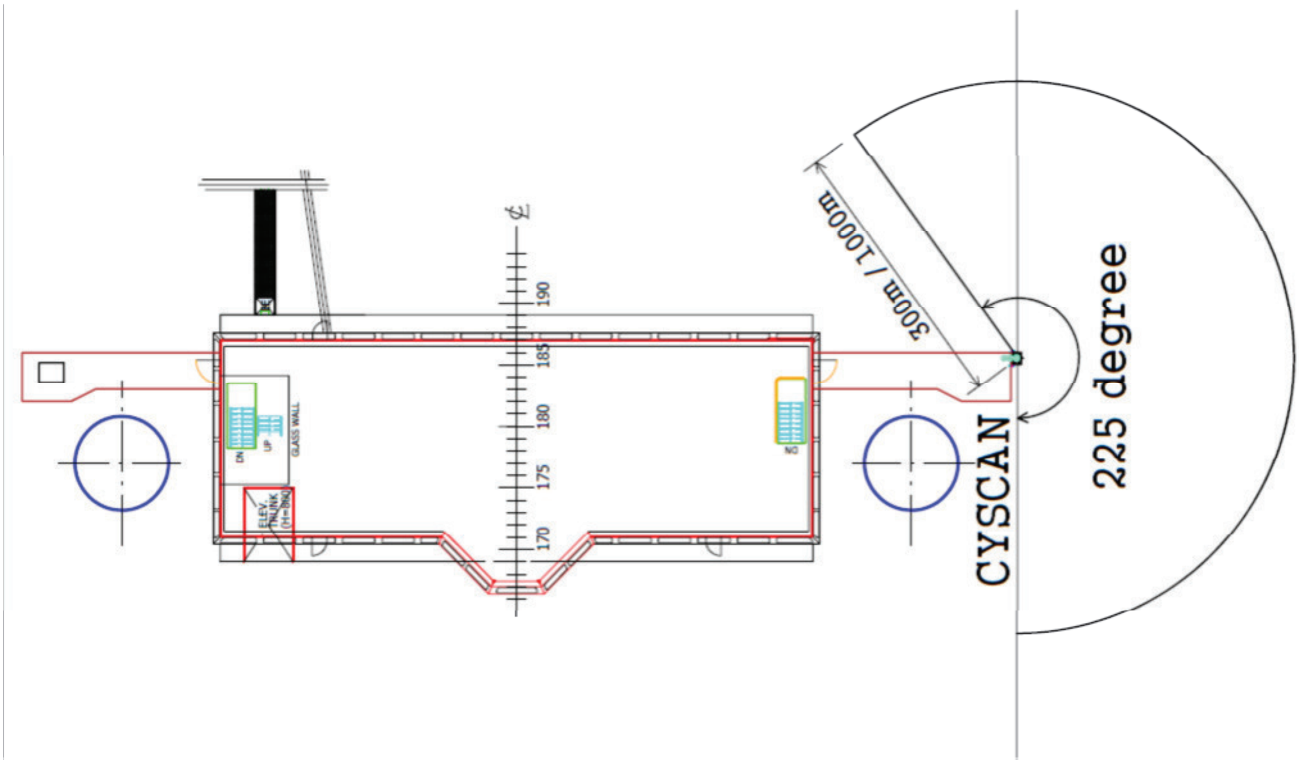


Figure 6-28 CYSCAN Working Sector

6.12.1.2 Computer Control

The DP system has a redundant computer control system to perform the following operation

- DP System's Control Process (CP) computer controls the vessel's propulsions.
- DP System's UI (user interface) computers UI Application allows the operator to interface with the Control Process Application
- Automatic Thruster Operator Workstation (AT OW)
- DP Operator Workstations (DP OW): DPOW1, DPOW2.
- DP Operator Chair housing computer, touch screen, and joystick for DP operation.

6.12.2 DP Arrangement

The vessel is a dynamically positioned, jackup vessel with 6 azimuth thrusters arranged as shown in the drawing below. The vessel has six generators providing power to jacking system, accommodation load, Thrusters and their auxiliary systems. The vessel is fitted with an MCS Platinum integrated monitoring and control system and a duplex DP control system.

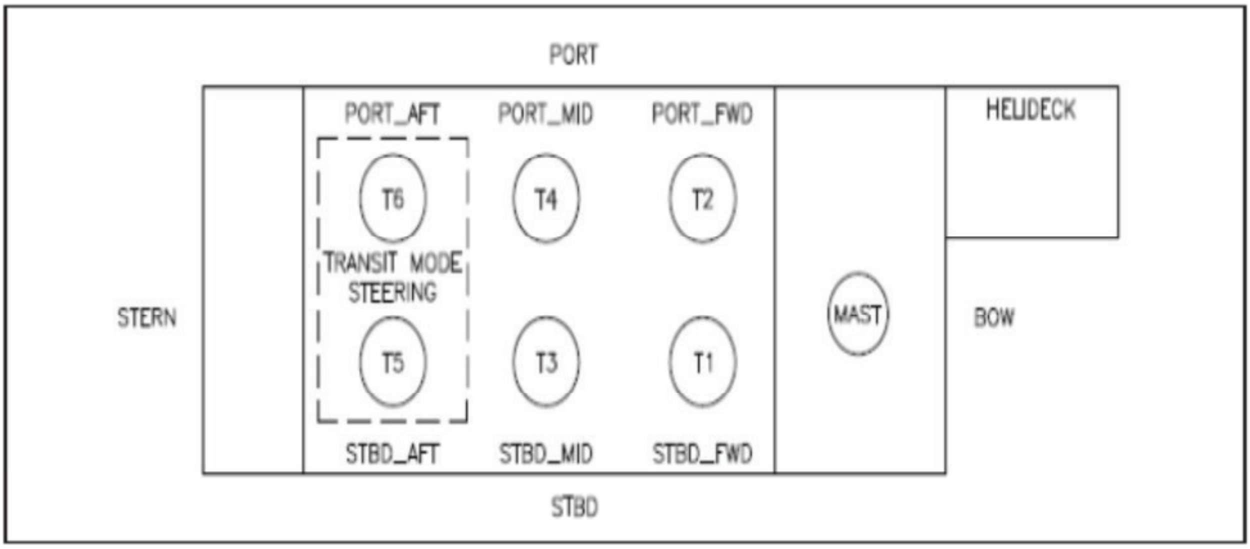


Figure 6-29 Arrangement of the Vessel (Top View)

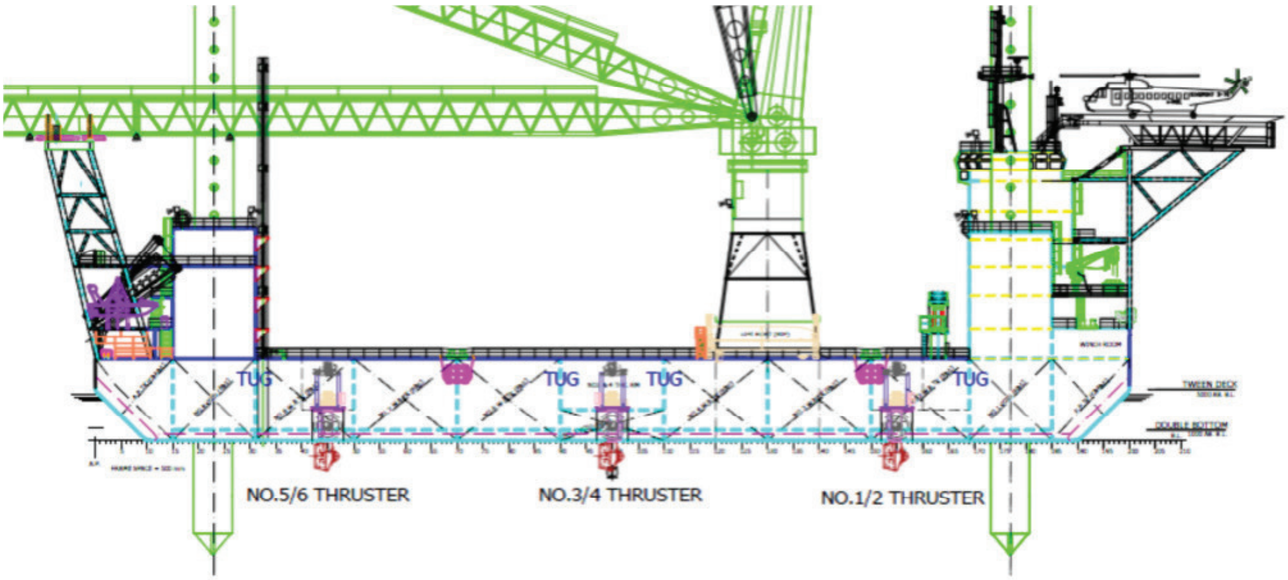


Figure 6-30 Vessel's Starboard Side

6.12.3 Main Machinery Details

Main Generators	:	5× 690 V, 60 Hz, 2.08 MW Diesel generators & 1× 690 V, 60 Hz, 1.58 MW Diesel generator (containerised DG (DG 6) on main deck)
Emergency Generator	:	1× 690 V, 60 Hz, 350 kW Diesel generator
Main switchboards	:	3 × 690 V, supplying heavy consumers and feeding: 2 × 450 V & 2 × 230 V main switchboards
Emergency switchboards	:	1 × 690 V & 1 × 230 V
Thrusters	:	6 × azimuth thrusters, each driven by ABB 1.6 MW motors, controlled by ABB STADT 6-AC-2-0, 2,000A frequency converters
Vessel management	:	MCS Platinum
DP system	:	L3 NMS-6000

6.12.4 Power Generation and Distribution

The vessel's power generation is done by 6 generating set, power is distributed to the all thrusters as shown in bellow figure. The six diesel generators that feed three 690 VAC buses. Between each bus, there are two bus tie breakers that are normally OPEN during DP2 operation. Whereas in DP1 operation all the tie breaker may be closed. For complete details regarding the vessel's power distribution and Load flow analysis, refer to the DSME Drawing: DA880E011.

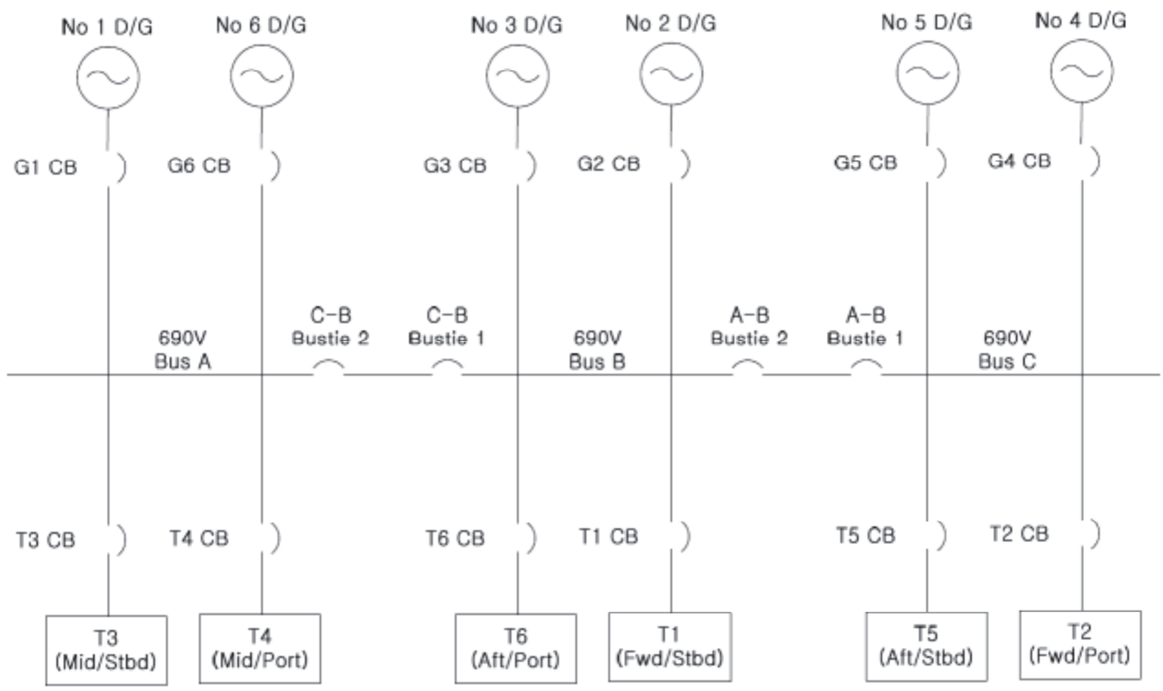


Figure 6-31 Power Generation and Distribution System

6.12.5 Auxiliary System

REF DWG: Fuel transfer and overflow system DA700M001-3

REF DWG: Fresh water cooling system DA700M001-8

REF DWG: Lubricating oil transfer and service system DA700M001-6

Auxiliary systems for the engine are:

- Engine Fuel oil System,
- Engine Fresh water cooling System
- Engine Lubricating System

6.12.6 Propulsion and Thruster Control System

REF DOC: Manual Thruster Operator Workstation (MTOW)

REF DOC: Automatic Thruster Operator Workstation (ATOW), also known as Independent Backup Joystick (IBJS)

REF DOC: Dynamic Positioning Operator Workstation (DP OW)

REF DOC: 27005000PS-387T-S System Specification NMS6000 Thruster Control System

Vessel propulsion system is consisting of six azimuth thrusters, each rated at 1600 kW. Each thruster has a fixed pitch propeller driven by ABB 1.6 MW motors and controlled by ABB STADT 6- AC-2-0, 2,000 A frequency converters.

The Thruster Control System (TCS) is integrated propulsion, manoeuvring and steering control system used to control of a vessel’s azimuth thrusters and electrical propulsion units. The primary function of the TCS is to perform starting and stopping of the drive motor and auxiliaries as well as provide control station arbitration for propulsion and steering commands. Closed loop servo control of pitch and azimuth circuits may also be provided as an option. Interfaces to the TCS are provided by operating stations located at key vessel manoeuvring locations distributed throughout the vessel. These include the following:

6.12.7 DP- Control System

This Section provides a general description of the Dynamic Positioning Control System. The DP System automatically maintains the vessel’s position and/or heading without anchors or mooring equipment. The DP System is a closed loop control system that adjusts the thrusters’ magnitude and direction in order to respond to changes in the environment.

The input to the DP System is the Operator Commanded Position/heading. This command, which is manually entered by the operator, tells the DP System what the desired vessel position and/or heading set points are. The outputs of the DP control system are the Propulsion Commands, which are the thrust magnitude and direction commands. The Reference Position / heading Sensors, such as DGPS and gyrocompasses, measure the vessel’s actual position and heading. These sensors provide the feedback to the closed loop control system. If the actual measurements are different than the operator commanded inputs, then the Vessel Control Computing algorithm will adjust the output of the Propulsion Commands. As a result, the vessel will remain in a fixed position and/or heading, despite the ever-changing environment. Environmental Sensors, such as wind monitors, provide feed-forward data to the DP System. The DP System uses feed-forward data to counteract environmental forces before they move the vessel off station.

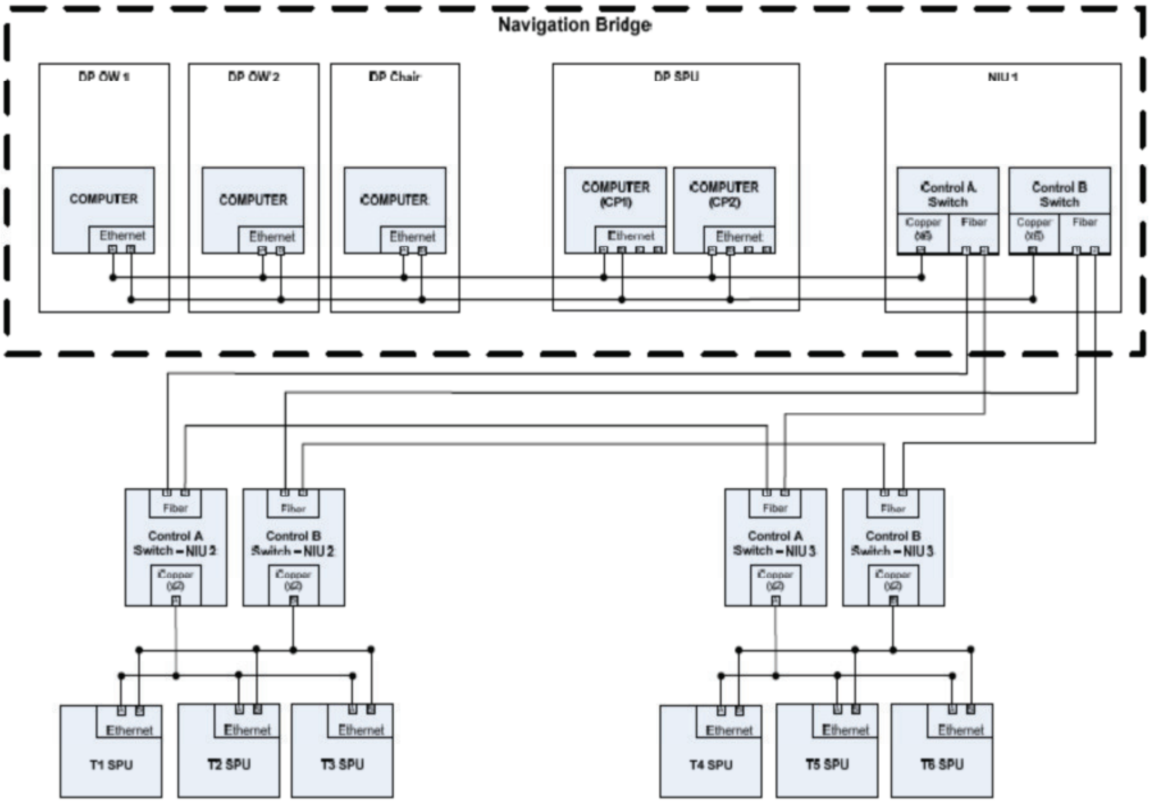


Figure 6-32 DP Control Network

6.12.8 Communications

Dynamic Positioning Operators (DPOs) put commands into the system at one of the DP Operator Workstations (OWs). These commands are communicated to the DP Controller, which is comprised of two control processors (CPs) located in the DP Signal Processing Unit (SPU). Thrust (rpm) and azimuth commands are sent from the DP SPU to the thruster SPUs over fibre optic cables between the Network Interface Units (NIUs) as illustrated in the figure 4 DP control Diagram.

6.12.9 DP Operations

REF DOC: Operating manual for the DP system

REF DOC: Company IMS manual for DP operations

Refer to above mentioned reference documents for detailed procedures on DP Operations including the following:

- Normal DP 1 / DP 2 Operations
- Emergency DP Operations
- Organization, Responsibility and Training
- Records
- DP Checklists
- Priorities in DP emergency
- Responsibilities
- Training

6.12.10 Limitations

REF DOC: Failure Modes and Effects Analysis (FMEA) NMS6000 DP and TCS Systems27005418PS-387-S

For all limitation of the DP system Refer the DP FMEA report and Section 3.3

6.12.11 DC 24V UPS for DP/AMCS

(No.1 / 2 are Located in the MCC Room and No.3/4 are in each FWD 1st Deck PORT and STBD)

There is no alarm at the failure of breaker to battery banks. So, the battery maintenance check has to be conducted periodically every three (3) month.

To $6.12.11: The breaker of the battery shall be checked before starting DP operation. We take it for granted that a suitable verification check is included in the respective DP checklist before starting the DP operation. (old comment from rev. 7 of OM)

6.13 Crane Operations

REF REG: MODU-CODE 14.1.2.16, 14.1.3.12

REF DOC: Guideline for Crane Operations from Company IMS Manual.

REF DOC: Company IMS manual for Simultaneous Operations

REF DOC: Main Crane (Liebherr) operating manual, BOS 35000–1000 LITRONIC Serial No.170564, 170565

REF DOC: Main Crane (Liebherr) Technical data sheet 170 564 – 565 – 050 Rev 3

REF DOC: Main Crane (Liebherr) Load charts 170 564 – 565 – 100 Rev 0

REF DOC: Crane Stability Booklet DA101Z034

6.13.1 General

The crane is designed for lifting, transporting, unloading and assembly of large, heavy components, for wind energy installation in an offshore environment.

All crane operations shall be done in the safest manner. It is the responsibility of the Master to ensure that cranes are only operated by those people authorized to do so.

The operation of the cranes during periods of high wind velocity is dangerous. Damage may occur from high stress on the crane structure or suspended loads being tossed about and colliding with the crane or other structures.

In general, the following operational modes of the cranes are possible:

- Main hook operation
- Auxiliary hook operation
- Subsea operation
- Man riding
- Personnel rescue
- Boat handling

Applications other than those described above is not intended uses of the crane.

- Mechanical modifications of the crane which influence the operational safety.
- Using the crane to tear/rip away loads that are fixed down, by using the hook or the slewing gear.
- Lifting a load that is laying on the ground by only using the luffing winch/gear.
- Dragging a load across the ground.
- The max. Trim / Heel inclination during lifting operations in elevated mode are limited to 0.5 /0.5 deg.
- Using the crane without complying with the relevant load chart (in regards to load and outreach).
- Installation and use of spare parts, equipment and fluids that are not approved by the original equipment manufacturer.
- Duty cycle operation without reducing safe working load.

6.13.2 Limitations

For crane load limitations refer to Section 1.3.6.

For vessel limiting condition for the crane operations refer to Section 3.6.

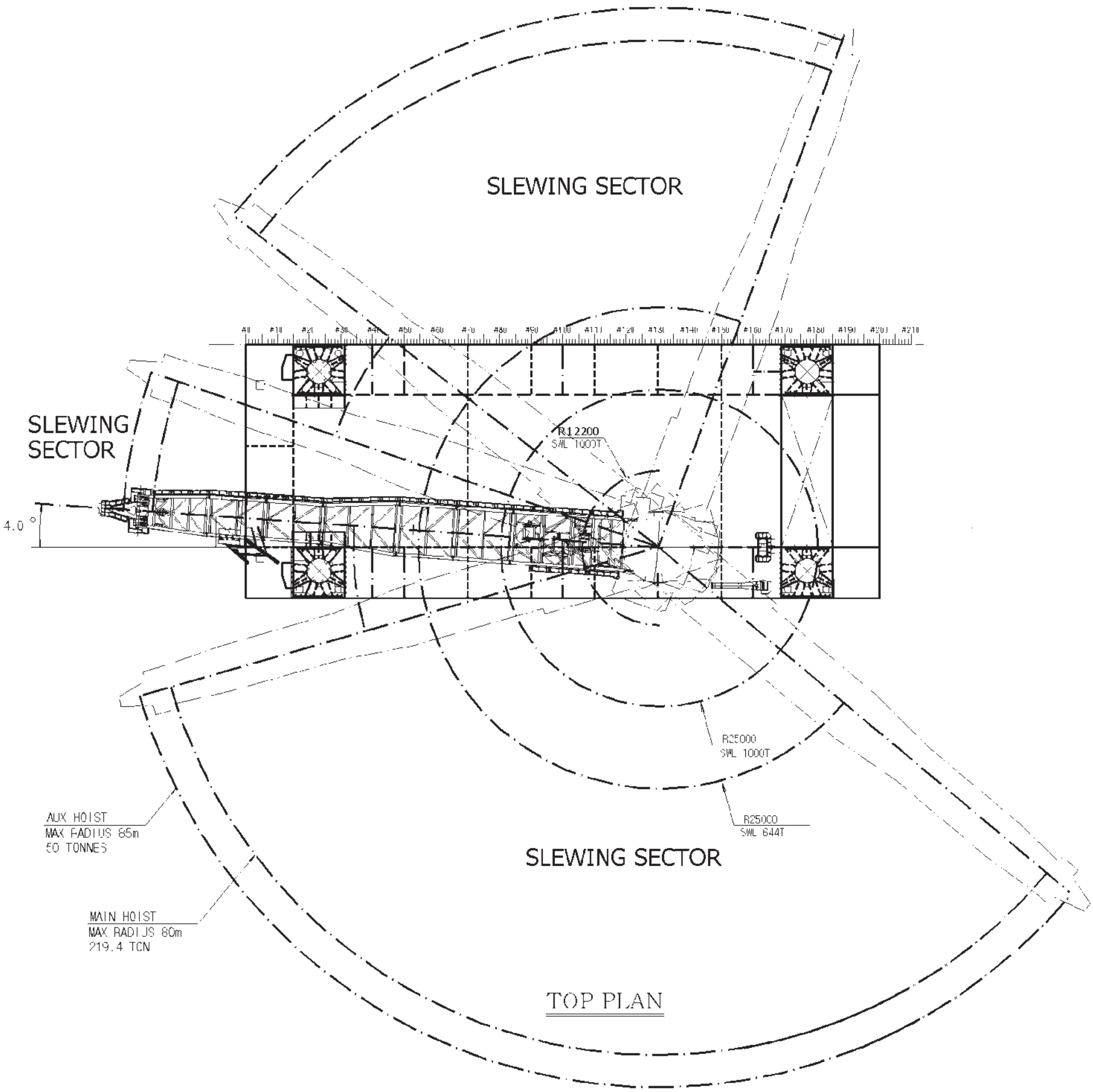


Figure 6-33 Main Crane Loading Circle

6.13.3 Crane Operational Precautions

- The crane operators and other persons, designated by the Master, shall make sure that each crane is operated and maintained in accordance with the Company guidelines for Crane operations.
- Only trained qualified, experienced and competent personnel (including crane operators and support personnel like banks-man, slinger, lifting supervisor) in a competent physical and psychological condition shall be designated for using the cranes.
- The Master & crane operators must make sure that the tables with safe working loads, boom angles, and/or boom radii, as well as maximum and minimum boom radius are visibly displayed near the controls of each crane.
- Lifting operations are calm weather operations. No lifting operations should be started in inclement weather or in deteriorating weather conditions.
- The crane environmental and operating limits should be observed at all times.
- The dynamic response of the vessel should be monitored at all times before attempting any lifting operations to ensure that the lifts can be completed safely. No lifting should be attempted under excessive vessel motions even if the weather conditions are within the limits.
- During operation of the helicopter near the vessel, crane operations should be stopped and the crane booms must be positioned so that there is no possibility of interference with the aircraft. For the details of simultaneous crane operation refer to company IMS SIMOPS manual.

6.14 Turbine and Foundation Erection Procedures

REF DOC: Cargo Handling & Securing Manual

REF DOC: Project Specific Construction Manual

REF DOC: Company IMS manual for lift and handling of heavy cargo.

Vessel will load wind turbine construction parts in port with onboard main crane and support of shore cranes in elevated condition. After completion of loading operation vessel will transit to designated construction field and start the installation in elevated condition. The vessel will be equipped with site specific tools (Lifting/erection tools, pile drive etc) for the handling and installation of the construction parts. For detailed procedures on loading, stowage, discharge and erection of cargo like wind turbine components and foundations refer to above mentioned reference documents.

6.15 Diving Operations

REF DOC: Diving Operations manual

REF DOC: Company IMS manual for diving operations

For detailed procedures on Diving operations refer to above mentioned reference documents.

6.16 ROV Operations

REF DOC: ROV Operations manual

REF DOC: Company IMS manual for ROV operations

For detailed procedures on ROV operations refer to above mentioned reference documents.

6.17 Ballasting Procedure

REF REG: MODU-CODE 14.1.2.16, 14.1.3.5

REF DWG: P/D of Ballast/Anti Heeling/ Jetting System DA800D101

REF DWG: Capacity Plan DA101Z031 Rev P1

REF DOC: Company IMS Ballast Management Plan

REF DOC: Company Ballast Logbook

REF DOC: Water Ballast Calibration Table DA101Z061 Rev 1

6.17.1 General

Ballast operations or liquid transfers are of vital importance to the safety of the vessel. These include:

- Level the vessel.
- Compensate for consumables used.
- Prevent water coming over the bow.
- Facilitate inspections/repairs carried out during the move.

In case the vessel is trimmed/listed intentionally for the purpose of inspections or repairs, actual forecasted weather conditions have to be monitored to ensure no adverse condition materialize while the vessel is in an exposed condition.

The design should allow the possibility to transfer ballast water:

- From sea via suction device into the buffer tanks and vice versa
- From forward tanks to aft tanks and vice versa
- From Port tanks to Stbd tanks and vice versa
- For trimming and correction of heel of the platform
- With the full capacity of one ballast pump.

Ballast system will be of ring main line type.

The Heeling system operates separate from this in- and out of a designated Heeling tanks. Heeling correction will be run in automatic duty. Heeling tanks to be heated at 5°C min temperature to provide water to emergency fire pumps and ballast system for crane operations.

The heeling tanks are designed as buffer tanks for platform in elevated position for fire fighting and sea water cooling system.

The water ballast tanks to be connected to the ring main line by means of branch lines and remotely controlled valves of electro-pneumatic type. The system remotely controlled from the Engine Control Room and from Control Bridge. The tanks are provided with Remote Level Indication System. The water level inside the tanks shall be rechecked with tank sounding plan.

All the ballast operations have to be done and recorded in advance with IMS Ballast Management Plan.

6.17.2 Description

The vessel has the following ballast tanks

Tank Name	Volume (m^3)	Sounding Location	Note
F.P. TK (C)	341.9	Deck Workshop Right Side	
F.P. TK (CP)	199.1	Behind Hydraulic unit (P)	
F.P. TK (CS)	199.2	Behind Hydraulic unit (S)	
F.P. TK (P)	372.40	Behind Heli A1 Tank	
F.P. TK (S)	372.4	Switchboard room FWD	
No.2 W.B. TK (P)	273.1	Aft Accom., near vent	
No.2 W.B. TK (S)	238.8	Before entry of jacking house	
No.3 W.B. TK (P)	629.5	Opposite to crane house fwd	
No.3 W.B. TK (S)	471.9	Before crane house	
No.4 W.B. TK (P)	629.5	Opposite to crane house aft	
No.4 W.B. TK (S)	471.9	Aft of crane house	
No.6 W.B. TK (P)	629.5	Midships of working stage(P)	Heeling Tank
No.6 W.B. TK (S)	629.5	Midships of working stage(P)	Heeling Tank
No.7 W.B. TK (P)	314.3	Aft of midships, near out board(P)	
No.7 W.B. TK (S)	304.9	Aft of midships, near out board(S)	
No.8 W.B. TK (P)	374.6	Near Suction Mast	
No.8 W.B. TK (S)	380.2	Before aft decks house	
A.P. TK (C)	374.4	Aft midship	
A.P. TK (CP)	144.7	Aft border line of decks house port side	
A.P. TK (CS)	144.7	Aft border line of D/G 6 house	
A.P. TK (P)	289.4	Behind after decks house port, near vent	
A.P. TK (S)	289.4	Behind after decks house port, near vent	
Total Capacity of Port Side Tanks		3,856.1 m^3	
Total Capacity of Starboard Tanks		3,502.9 m^3	
Total Capacity of Centre Tanks		716.3 m^3	
Total Capacity of All Tanks		8,075.3 m^3	

Main Deck

Tank Name	Volume (m^3)	Sounding Location	Note
MDO Storage TK(S)	194	Working stage, near twin poller(S)	
MDO Storage TK(P)	194	Working stage, near twin poller(P)	
LO Storage TK	21.4	Between aft decks house, more to (P)	

Tween Deck

Tank Name	Volume (m^3)	Sounding Location	Note
MDO Serv. TK 1	38	Near of Thermal Oil Ex. TK	
MDO Overflow TK 1	9.5	Out of Thermal Oil Ex. Tk area	
MDO Serv. TK 2	19	Out of Thermal Oil Ex. Tk area	
MDO Overflow TK 2	9.5	Passage way before ECR	
MDO Serv. TK 2	19	Passage way before ECR	

Double Bottom

Tank Name	Volume (m^3)	Sounding Location	Note
Sludge TK	11	Near Air bottle 1	
Dirty Oil TK	9.5	Near Air bottle 2	
Oily Bilge Water TK	18.9	Behind Main Bilge P/p 1	
CW Drain TK for D/G	2.4	Near D/G 4	
CW Drain TK for FWC	1.6	Near D/G 3	
Thermal Oil Drain TK	6.3	Near Heeling Pump	
Thermal Oil Storage TK	6.3	Near Thermal Oil P/p area	

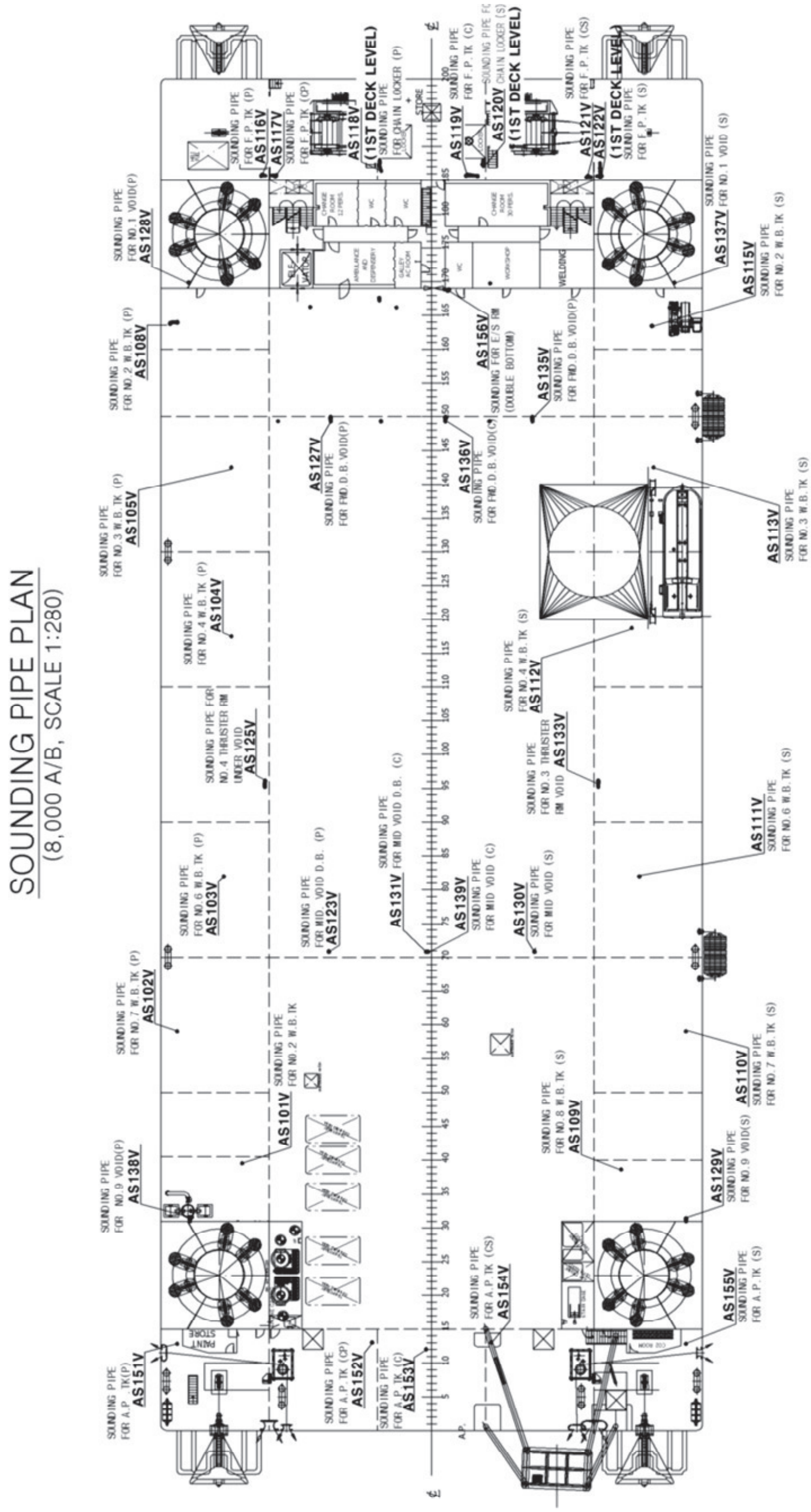


Figure 6-34 Sounding Locations

6.17.3 Procedure

6.17.3.1 General Guidelines

Ballasting is necessary to correct the trim and list of the vessel caused by unbalanced distribution or variable load. Ballasting may also be necessary to counteract flooding of a tank or machinery space in the event of damage.

- Complete loading calculations to plan the ballast weight distribution.
- Two sea chests are installed low / high is provided for seawater supply while afloat.
- In elevated mode seawater supply for ballast operation will be provided by suction mast
- Verify the tank soundings and ensure that all valves are closed before starting the ballasting operation.
- Assign trained personnel to assist by observing drafts and soundings.
- Maintain communication between the person in charge of the operation and all personnel involved.
- After the vessel is trimmed, record the tank soundings and secure the ballast manifold valves.
- Compare the calculated ballast distribution and drafts with the actual ballast distribution and drafts. Find the reason(s) for any discrepancies.

6.17.3.2 Ballasting Processes

- Ballasting
- De-ballasting
- Stripping
- Anti-Heeling

NOTE: Ballasting and De-ballasting processes utilized the same ballast pumps. The stripping and anti-heeling process will have separated pumps.

6.17.3.3 Ballasting Procedures

During ballasting operation, the main water supply is the sea chest. Sea water is pumped to the ballasting tanks. The ballasting procedures are calculated and done automatically by the system. However, the following should be checked to ensure proper operation:

- Confirm that the Ballast stripping educator is isolated. The valves BAE13, BAE42, BAE59 and BAE14 should be closed.
- Check that the following valve is closed: BAE020, BAE03 & BAE06
- Check that the following valves are open: BAE01, BAE02, BAE11 & BAE12
- Make sure that the anti-heeling pump is isolated by closing the isolating valves on the inlet and outlet sides of the pump.
- Valves BAE17, BAE18 & BAE19 should be opened.
- Confirm that the valves for the duty pump are open:
- BAE04 and BAE07 for No.1 Ballast Pump or
- BAE05 and BAE08 for No.2 Ballast Pump
- The valves for the tank/s that should be filled up should be opened accordingly.

- The ballast pump should run until the required level of water in the tanks has been achieved.

6.17.3.4 De-Ballasting Procedures

During de-ballasting operation, the connection to the sea chest main closed and the water is now discharged off the vessel. The de-ballasting procedures are calculated and done automatically by the system. However, the following should be checked to ensure proper operation:

- Confirm that the Ballast stripping educator is isolated. The valves BAE13, BAE42, BAE59 and BAE14 should be closed.
- Check that the connection to the sea chests are closed: BAE04 & BAE05
- Check that the following valves are open: BAE020, BAE01, and BAE02 & BAE12
- Check that valve BAE11 is closed.
- Make sure that the anti-heeling pump is isolated by closing the isolating valves on the inlet and outlet sides of the pump.
- Valves BAE17, BAE18 & BAE19 should be opened.
- Confirm that the valves for the duty pump are open:
- BAE03 and BAE07 for No.1 Ballast Pump or
- BAE06 and BAE08 for No.2 Ballast Pump
- The valves for the tank/s that must be de-ballasted should be opened accordingly.
- The ballast pump should run until the water in the tanks has been cleared.

6.17.3.5 Stripping Procedures

Stripping procedures is done to remove the water in the tanks that could not be taken out by the ballast pumps during de-ballasting. The Ballast stripping educator shall be used for this purpose.

- Open valves surrounding the stripping eductor:BAE13,BAE14,BAE42 & BAE59
- Check that the ballast pumps are isolated by closing the valves:
- BAE03, BAE04 and BAE07 for No.1 Ballast Pump or
- BAE05, BAE06 and BAE08 for No.2 Ballast Pump
- Check that the following valves are closed:BAE01, BAE02, BAE11, BAE12& BAE020
- Make sure that the anti-heeling pump is isolated by closing the isolating valves on the inlet and outlet sides of the pump.
- Open the valve for the tank/tanks where stripping is required.

6.17.3.6 Anti Heeling Procedures

The Heeling system operates separate from this in- and out of a designated Heeling tanks. Heeling correction runs in automatic duty. Heeling tanks to be heated at 5℃ min temperature to provide water to emergency fire pumps and ballast system for crane operations.

The heeling tanks are designed as buffer tanks for platform in elevated position for fire fighting and sea water cooling system.

The heeling system operates automatically, however, the following valves should be checked for proper operations.

- During anti heeling operations, the following valves should be closed:BAE17, BAE18 & BAE19
- The pumps should now make the necessary water adjustments on the heeling tanks by transferring the necessary amount of water between the two heeling tanks.

6.17.4 Limitations

Ballast system equipment limitations are as follows:

Ballast Water Pump 1 & 2 (Centrifugal)	450 m^3/hr x 2.5 bar
Ballast Stripping Eductor	80 m^3/hr
Net Positive Suction Head (NPSH)	3.5 m
Speed	1,780 rpm
Power required	55 kW
Power supply	690 V/60 Hz
Operating temperature	-20 to 55 deg. C
Anti Heeling Pump	1,500 m^3/hr x 1 bar

6.18 Fuel Oil Storage and Transfer

REF REG: MODU-CODE 14.1.3.6

REF REG: GL Section 11 Part G

REF REG: MARPOL Annex 1 Chapter 2 & 3

REF DWG: Fuel Oil Filling, Transfer and Overflow System P&ID

REF DWG: Helideck Re-fuelling system P&ID

REF DOC: Company IMS Manual for Fuel Storage & Transfer Procedures

REF CKL: Company Checklist for Fuel Storage & Transfer Procedures

6.18.1 System Description

REFDWG: Fuel Transfer and Overflow System Drawing No: DA700M001-3.

This system is composed of the following:

- 2 Storage Tanks
- 3 Service Tanks
- 2 Overflow tanks
- 2 transfer pumps
- Valves and instruments

Equipment	Description
No.1 MGO Service Tank	19 m^3
No.2 MGO Service Tank	19 m^3
No.3 MGO Service Tank	38 m^3
No.1 MGO Storage Tank	194 m^3
No.2 MGO Storage Tank	194 m^3
No.1 Screw Transfer Pumps	8 m^3h x 2.5 bar
No.2 Screw Transfer Pumps	8 m^3h x 2.5 bar
No.1 MGO Overflow Tank	9.5 m^3
No.2 MGO Overflow Tank	9.5 m^3
Cross over valve	Between Storage Tank 1 & 2
Discharge manifold crossover valves	Between Pumps 1 & 2

- No.1 and No.2 MGO storage tank store the marine gas oil used to run the plant.
- Fuel can be loaded into either tank from the port or starboard bunker station.
- In normal operations, fuel is transferred automatically to the MGO service tanks by the allocated MGO transfer pumps. No.2 MGO transfer pump is allocated to No.3

MGO service tank and No.1 MGO transfer pump is allocated to No.1 and No.2 MGO service oil tank

- When the level in the associated service tank falls to the lower level switch, the associated transfer pump would start up to fill the service tank, alternately the pump stops when the level in the service tank reaches the upper level switch.
- Each storage and service tanks is fitted with a pneumatically operated quick closing valve through which fuel oil is supplied.

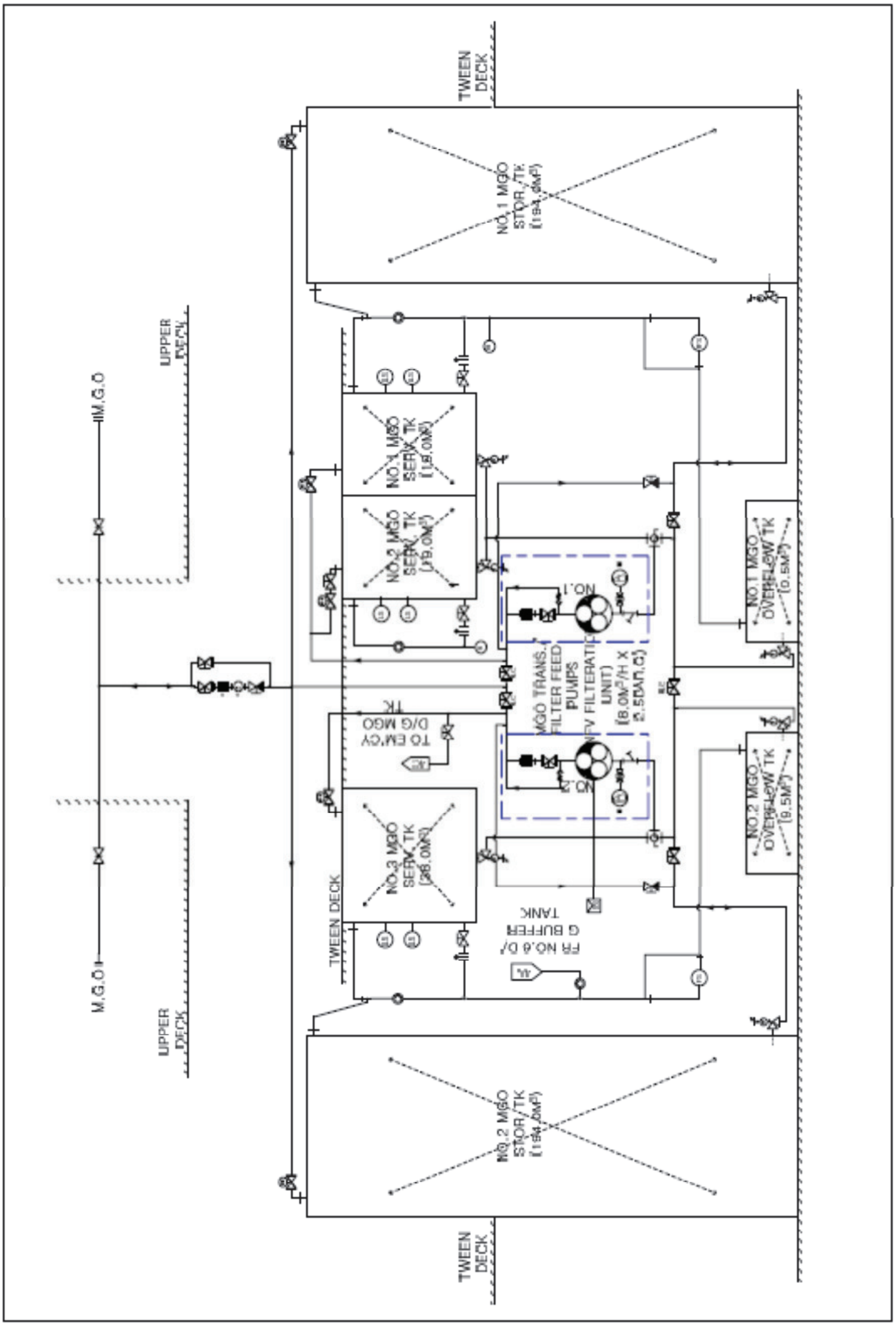


Figure 6-35 Fuel Oil Transfer & Storage Schematic

6.18.2 Procedure

6.18.2.1 Filling FO Storage tanks from Loading Station

- Connect the loading station to the Bunker Station on either Port or STBD side of the Upper Deck.
- Make sure all connections are properly secured.
- Open valve OF021 and OF023. Make sure that by-pass valve OF022 is closed.
- Check that valves OF061 and OF062 are closed as well.
- Make sure the valves OF039 (for No.2 MGO Storage Tank) and OF056 (for No.1 MGO Storage Tank) are open during the filling operation.
- Open valve OF006 (STBD Bunker Station) and OF005 (PORT Bunker Station) to start the filling up operations.
- As soon as the level meter registers that the required quantity of fuel has been transferred to the tanks, valves OF039 (for No.2 MGO Storage Tank) and OF056 (for No.1 MGO Storage Tank).
- Close valve OF006 (STBD Bunker Station) and OF005 (PORT Bunker Station).
- Finally, close valve OF021 and OF023.
- Disconnect the loading station to the PORT and STBD Bunker Station.
-
- **NOTE:** Automatic closing of valves OF039 & OF056 causes inadmissible pressure rise in the bunker line during bunkering operations, such incidents should be avoided.

6.18.2.2 Offloading Fuel via Loading Station

- Connect the loading station to the Bunker Station on either Port or STBD side of the Upper Deck.
- Ensure that valves, OF043, OF044, OF049, OF050 and OF053 are closed.
- The following inlet valves for the tanks should be closed as well:
- OF056 for No.1 MGO Storage Tank
- OF039 for No.2 MGO Storage Tank
- OF027 for No.1 MGO Service Tank
- OF098 for No.2 MGO Service Tank
- OF026 for No.3 MGO Service Tank
- Open valves OF061 and OF062.
- Close valves OF021 and OF023.
- Open by-pass valve OF022.
- Open valve OF006 (STBD Bunker Station) and OF005 (PORT Bunker Station).
- Start the No.1 and No.2 Transfer Pumps to commence fuel offloading operations.
- After the No.1 and No.2 MGO Overflow tanks has been emptied, stop the pump.
- Close valves OF061 and OF062.
- Close by-pass valve OF022.
- Close valve OF006 (STBD Bunker Station) and OF005 (PORT Bunker Station).
- Disconnect the loading station to the PORT and STBD Bunker Station.

6.18.2.3 Transferring Fuel between tanks

Case 1: No.1 MGO Storage Tank to No.2 MGO Storage Tank

- Close valves OF021, OF023 and bypass valve OF022.
- The following inlet valves for the tanks should be closed as well:
- OF056 for No.1 MGO Storage Tank
- OF039 for No.2 MGO Storage Tank
- OF027 for No.1 MGO Service Tank
- OF098 for No.2 MGO Service Tank
- OF026 for No.3 MGO Service Tank
- Close valves OF044 and OF053.
- If No.1 Transfer pump shall be used, then open valves OF050, OF061, OF062, OF043 and close valve OF049. If No,2 Transfer pump shall be used, keep OF043, OF049 and OF050 open. Close valves OF061, OF062, and OF044.
- Start pump (whichever was selected based on the valve setup) to commence fuel transfer.
- As soon as transfer operation has been completed, close the pumps and all valves that were opened.

Case 2: No.2 MGO Storage Tank to No.1 MGO Storage Tank

- Close valves OF021, OF023 and bypass valve OF022.
- The following inlet valves for the tanks should be closed as well:
- OF056 for No.1 MGO Storage Tank
- OF039 for No.2 MGO Storage Tank
- OF027 for No.1 MGO Service Tank
- OF098 for No.2 MGO Service Tank
- OF026 for No.3 MGO Service Tank
- Close valves OF043 and OF050.
- If No.2 Transfer pump shall be used, then open valves OF053, OF061, OF062, OF044 and close valve OF049. If No,1 Transfer pump shall be used, keep OF053, OF049 and OF044 open. Close valves OF061, OF062, and OF050.
- Start pump (whichever was selected based on the valve setup) to commence fuel transfer.
- As soon as transfer operation has been completed, close the pumps and all valves that were opened.

6.18.2.4 Transferring Fuel to day tanks

- Close valve OF043, OF049, OF053, OF061 and OF062.
- Close the valve OF060 which is for the Emergency D/G MGO Tank.
- To open the pipe line for the No.1 MGO Tank, No.1 Transfer pump and No.1 & No.2 MGO service tanks, open the valves:
- OF027 for No.1 MGO Service Tank
- OF098 for No.2 MGO Service Tank.
- OF050

- To open the pipe line for the No.2 MGO Tank, No.2 Transfer pump and No.3 MGO service tanks, open the valves:
- OF026 for No.3 MGO Service Tank
- OF044
- Start the pumps to commence operation.
- As soon as transfer operation has been completed, close the pumps and all valves that were opened.

6.18.2.5 Transferring Fuel to Emergency generator tank

- Close valve OF043, OF049 and OF061.
- Close the valve OF026 for No.3 MGO Service Tank
- Open the valve OF044 and OF060 which is for the Emergency D/G MGO Tank.
- Start the No.2 Transfer pump to commence transfer operation.
- As soon as transfer operation has been completed, close the pumps and all valves that were opened.

6.18.2.6 Transferring Fuel to Helideck Refueling Tank

REF DOC: Helicopter Refuelling System (Operating & Maintenance Manual) by SYPACK

REF DWG: 2970-01 P&ID for Refuelling, Tank Skid, Pump Skid and Dispenser Skid

The following items should be completed when filling the fixed storage tank by using a bunker boat:

- Draw fuel from bunker boat sample line and discard until the samples appear water free.
- Carry out check for fuel quality in the following manner:

Samples must be drawn at full flush into scrupulously clean; clear glass sample jars (4 litres capacity).

The fuel should be of the correct colour, visually clear, bright and free from solid matter and dissolved water.

The helicopter refuelling station handles heli fuels of flash point above 60 deg.C ONLY, therefore, fuel type and flashing point should be noted carefully before re fuelling the Helideck fuel tank.

Un-dissolved water will appear as droplets on the sides, or bulk water on the bottom of the sample jar. It will also appear as a cloud or haze.

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

- Testing for suspended water must be done with a syringe and capsule detector test. Fit a capsule to the syringe and immediately withdraw a 5 ml fuel sample into the syringe. Examine the capsule for any color change. If there is a distinct color change the fuel should be rejected. (Capsules must be used within 9 months from the date of manufacture). Tubes or capsules are marked with the relevant expiry date.

Capsules must not be re-used.

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

- Once satisfied that the fuel is free from water, draw off sufficient fuel to measure its specific gravity with a clean hydrometer. The fuel temperature must also be noted in order to correct the measured specific gravity to a relative density (this is done using a correction graph).
- First connect the bonding wire from the bunker boat to the deck (if applicable) then connect the transfer hose coupling to the filling point of the fixed storage tank and start the transfer pump to fill the fixed storage tank. It should be noted that the inspection hatch must be opened prior to filling. When the meter register head indicates that the required quantity of fuel has been transferred, stop the transfer pump, remove the transfer coupling from the filling point of the fixed storage tank and then remove the bonding connection (if applicable). The dust cap must then be replaced on the filling point. A further sample should be drawn from the bunker boat once it has been filled. This sample should be labeled with the tank number, the fuel batch number and date of filling and should then be retained safely until the next filling. This sample will be required as a proof of fuel quality in the event of an aircraft incident where fuel may be considered to be a causal factor.

6.19 Procedure for Helicopter Operations

REF REG: MODU-CODE 14.1.2.14, 14.1.3.11

REF REG: UK-CAA CAP 437, 6th Edition

REF DOC: Helicopter Operating Company operations manual.

REF DOC: Company IMS manual for Helicopter operations

6.19.1 Limiting Condition for Helicopter Operation

For vessel specific limitations for helicopter operations refer to Section 1.3.5

Helicopter specific limitations for helicopter operations shall be set by the Helicopter Operating Company (HOC) for the area of vessel operation.

6.19.2 General Safety Procedures

Rules and regulations issued by the HOC or government regulatory bodies, relating to the safety of the craft, vessel, and personnel must be followed. Enforcement of these rules and regulations at the shore base is the responsibility of the HOC chief pilot. Enforcement at the vessel is the responsibility of the Master in conjunction with the pilot in charge of the aircraft landing on or taking off from the vessel.

The following general safety procedure should be followed:

Warning !

It must be ensured that before commencing helicopter operations the “Mast Head Light Post” must be lowered. The starter unit for the same is placed at door to the Compass/Helideck. The operating unit for the same is placed at mast foundation on compass deck.

- Personnel are not permitted on or near the helicopter deck while the aircraft is landing or taking off.
- During operation of the helicopter near the vessel, crane operations should be stopped and the crane booms must be positioned so that there is no possibility of interference with the aircraft.
- Smoking is not permitted on the helicopter deck while the aircraft is present.
- Notify the standby boat at least 15 min in advance of arrival or departure of the helicopter. Move the boat to the location assigned until the helicopter is clear or secured.
- All passengers must wear life jackets provided by the helicopter during flight to and from the rig.
- Firefighting equipment is to be checked and ready for service.

- Personnel at no time shall pass below or near a helicopter tail rotor.
- Rope nets are to be inspected for condition and proper servicing (when applicable).
- The helicopter landing officer (HLO) shall be present near helideck, at the time of landing and takeoff.

6.19.3 Helideck Procedures during Strong Wind

The wind force on the helideck may differ from the data obtained from the wind gauges. Because of the special conditions on the helideck, severe turbulence may occur, which changes the wind patterns in an unpredictable way.

These conditions will vary from platform to platform and also according to the wind direction. The below procedure regulates preventive measures and limitations in connection with transportation of personnel by helicopter during strong winds. The procedure includes:

- Monitoring and notification of wind force;
- Criteria for when preventive measures must be implemented;
- Criteria for when transportation of personnel by helicopter shall cease.

Upon notification that the wind force exceeds that specified limitations for particular type of helicopter, the vessel shall try to limit the passengers' exposure to the wind.

Relevant measures may be:

- Careful evaluation in order to select the entrance / exit which is least exposed to wind.
- The helicopter landing officer (HLO) shall accompany the passengers to and from the helicopter.
- The passengers shall bring along one piece of baggage only in order to have one hand free.
- The HLO and HDA-team shall handle all baggage on the helideck.

If the HLO considers it impossible to assure the passengers' safety in a satisfactory manner, he shall halt all helicopter operations on the vessel temporarily until the situation has been assessed by the Master

The helicopter pilot shall inform his passengers about the conditions before landing and tell them how to act when leaving the helicopter.

A decision to halt all helicopter traffic on the field temporarily shall be made by the Master in consultation with the Offshore Operations Manager & HLO in each individual case, whenever the wind velocity reaches specified limits.

6.19.4 Arrival / Departure

The Helicopter Landing Officer (HLO) is in charge of all helideck operations.

For detailed information on safety instructions during arrival and departure for first-time and experienced passengers, refer to company IMS procedures for helideck operations.

6.19.5 Re-fuelling

REF REG: Offshore Helicopter Refuelling Systems, UK Offshore Operators Association (UKOOA) & CAP 748, July 2004.

REF DWG: Helideck Re-fuelling system P&ID

REF DOC: Helideck refuelling system operation and manual

6.19.5.1 Introduction

It is vital that care is exercised during fuelling operations because of the potential for fire, injury to personnel and introduction of contamination into the helicopter fuel system. This procedure underlines the procedure for helicopter refuelling on board the vessel to avoid hazards and reduce the risk of accidents.

6.19.5.2 Aim

To conform to OPITO guidelines for the operation of Offshore Helicopter Refuelling Systems, published by the UK Offshore Operators Association (UKOOA) and CAP 748, July 2004.

6.19.5.3 System

For refuelling of the helicopter a fuelling facility provided with tank capacity 8 m^3 for the Agusta / Westland 139 Helicopter

The vessel incorporates a pressure refueling system whereby essentially fuel is added to the helicopter through a closed connection between the pressure refueling nozzle and the helicopters fuel tank. The system mainly comprises of transport tanks, jet fuel storage skid with pump unit and dispensing unit.

6.19.5.4 Procedure

Refuelling is to be conducted whilst the helicopter is static i.e. with the engines and rotors secured. Any fuel leaks are to be repaired before refuelling operations. Fuel shall not be transferred to the helicopter until the samples taken from the fuel nozzle for testing are within required limits. Any time the fuel is pressurized any personnel involved are to wear eye protection

Prior to Refuelling

- Ensure that the service tank contains sufficient fuel for refueling the helicopter.
- Inspect the fuel hose and nozzle.
- Use oily water separators to ensure that water does not contaminate the Heli fuel.
- Filling the helicopter
- Prior to installation system should be flushed effectively.
- Flushing shall be done using clean and dry jet fuel.
- The system shall be flushed using the fuel pumps until samples taken from the sample points are dry and clean as per CAP437 requirements.
- Make sure that all the valves that are normally open are in the open position.
- Pull out the main bonding cable and attach the clip to the helicopter bonding point.

- Prior to filling, draw a 4L sample from the monitor.
- Pull out the hose with relevant fuelling nozzle and attach the bonding cable to the second helicopter bonding point.
- The lamp located on top of the dispenser cabinet will be illuminated when the pump is started.
- Turn the fuel nozzle handle in open position and start pump in the dispenser unit.
- Deliver the required amount of Jet-A. During filling read the differential pressure on the monitor and add to fuel log book.
- PDI reading should be done for the separator every week.
- Stop the pumping by pressing the stop push button on the start panel in the dispenser unit.
- If needed bleed off the pressure by holding the nozzle in the open position.
- Disconnect the fuel nozzle.
- Disconnect the nozzle bonding cable.
- Disconnect the main bonding cable.
- Fully rewind the hose on the hose reel.
- Check for contamination (see what to do if contaminated below).

Fuel Contamination

- Water, dirt and sediments must not be present in the fuel area. If fuel in the helicopter is suspected of being contaminated, a sample shall be taken from the helicopter's fuel tank drains and tested to verify the quality before conducting any flight operations. If the helicopter is airborne, the suspicion of contamination shall be reported to the pilot immediately by radio. The helicopter's journey shall be aborted, and the helicopter recovered at the closest safe landing area.

Safety

- Make daily inspections and also before commencing helicopter operations.
- Store refueling units away from the sun and other weather.

Fuel Logs

- Relevant fuel logs will be kept in accordance with CAP437.

6.19.6 Storage (Lashing)

The helideck has sufficient lashing points in its deck area to secure any type of helicopter in case of adverse weather during shutdowns of the Helicopter or in case of an endured stay on board the vessel.

The lashing material is stored in the service locker on the wall of the staircase housing on 7th upper Deck or service locker on the stairs to the helideck next to the refuelling dispenser unit.

6.20 Personnel Transfer

REF REG: MODU-CODE 14.1.3.10, 14.5.1

REF DOC: Company IMS guidelines for Personnel transfer operations

Preferred method of personnel transfer will be by helicopter. For the details of helicopter operations refer Section 6.19. Other methods as stated below shall be used as per requirements.

6.20.1 In Port

The vessel's gangway should be installed between the vessel and the nearest dock such that personnel can walk safely on and off the vessel.

6.20.2 Floating / In Transit

Personnel transfer during afloat condition or while the vessel is underway should be avoided. These transfers should be restricted to special situations like pilot transfer using the pilot ladders, etc.

6.20.3 Elevated (Personnel Transfer Basket)

The Master may decide to use a personnel transfer basket for the transfer of people in cases where the use of other means of transferring people is impractical or less safe.

However for the transfer of personnel to/from locations which are subject to motion (e.g. vessels/barges/supply vessels etc.) the use of personnel transfer baskets could be appropriate provided the requirements set out in these guidelines are followed.

6.20.3.1 Procedure

The procedure to be followed for the transfer will depend on the type of basket being used. Personnel being transferred should follow the manufacturer's instructions, taking into account any special precautions stipulated by the installation. The person in charge of the transfer must be familiar with the type of unit being used and should be satisfied that everyone is correctly positioned and ready for the transfer to commence.

During transfer to/from an installation or vessel, it is good practice to minimize the height of the basket above the deck (generally to a maximum of two meters) before swinging over the open sea. Consideration should also be given to restricting the height of the basket above the open sea; this will be dependent on the prevailing sea sate.

Detailed procedures including risk assessment, checks, precautions, responsibilities, lifting procedures, rigging procedures, communication procedures, etc. relating to personnel transfer using basket as mentioned in Company IMS manual should be followed.

6.20.3.2 Limitations

For limitation of crane for man riding refer to Section 1.3.6 and 3.7.

6.21 Receiving Vessel Alongside

REF REG: MODU-CODE 14.1.3.16

REF DOC: Company IMS guidelines for receiving vessel alongside

The following general guidelines are to be followed for taking another vessel alongside in floating mode:

- The Master of the approaching vessel should notify the duty officer of the arrival and intent to position alongside the mother vessel.
- The approaching vessel should be advised as to which side should she approach and tie fast.
- The mother vessel crew should be ready to pass/ receive mooring lines.
- The arriving vessel must be advised to approach the mother vessel by backing up to the vessel while maintaining safe distance.
- Once mooring lines have been passed and they are secure, operation like transfer of goods, bunkering etc. may begin.
- During approach, material transfer and departure the vessels crew must maintain visual surveillance to avoid hard contact or damage to hull.

Guidelines given in ‘Company IMS manual’ for receiving vessel alongside should be followed.

6.22 Towing Operations

REF REG: MODU-CODE 14.1.3.17, 14.1.2.16

REF DOC: Company IMS manual for emergency towing

REF DWG: Arrangement of Mooring/Towing Plan DA 430D002 Rev 1

REF DOC: Guidelines for emergency towing operations in Company IMS manual.

6.22.1 Description

The vessel is equipped with two towing gears, positioned fore and aft of the vessel. The same equipment can also be used for emergency vessel towing.

Details of vessel tow gear are as follows:

- 4 towing chock with 150 t SWL
- 4 towing bracket with 150 t SWL
- 3 towing shackle with 75 t SWL
- 1 triangle piece chock with 150 t SWL

Guidelines given in ‘Company IMS manual’ for emergency towing should be followed

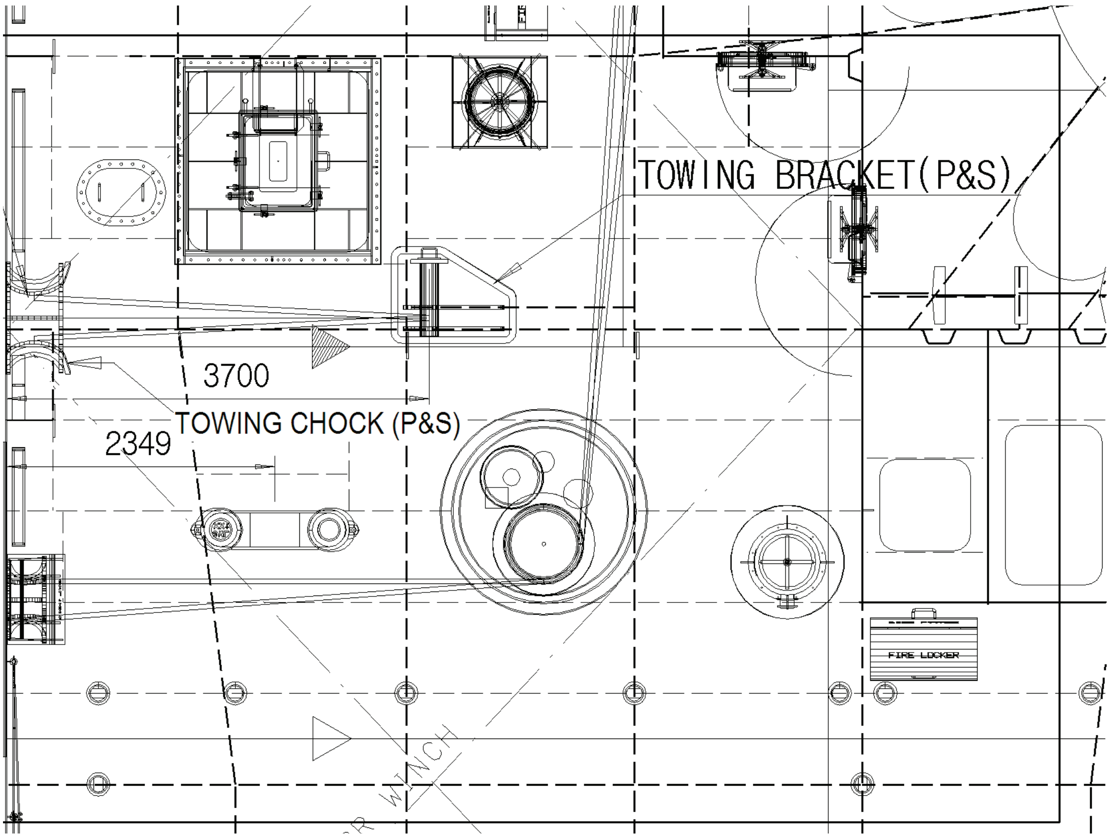


Figure 6-36 Aft Towing Arrangement

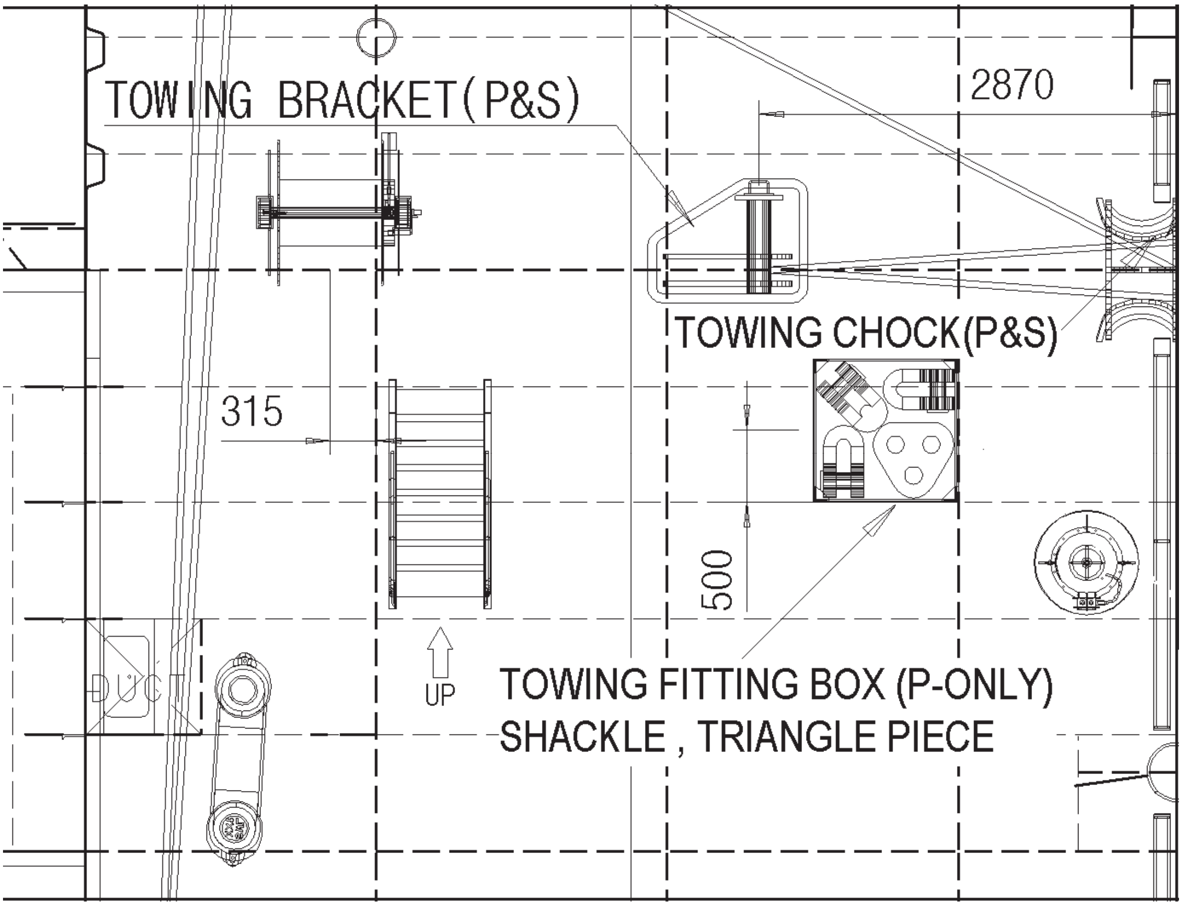


Figure 6-37 Forward Towing Arrangement

6.22.2 Limitations

Limitations for floating condition given in Section 0 shall be applicable.

6.23 Anchoring Operations

REF REG: MODU-CODE 14.1.3.9

REF REG: IACS UR A1/A1.1 Design of the anchoring equipment

REF DWG: Arrangement of Mooring/Towing Plan DA 430D002 Rev 1

REF DWG: Arrangement of Anchor handling DA431D001

REF DOC: Windlass (HATLAPA) operating manual.

REF DOC: Anchoring guidelines as per Company IMS manual.

6.23.1 Description

For anchoring of the vessel, it is provided anchors and anchor handling equipment with the following details:

Anchor Windlass	2 Nos., electric type
Anchors	2 Nos. x HHP Type, 5.85 t each
	1 No. Spare in warehouse
Anchor Chain	Dia. 68 mm x 632.5 m
	Port: 12 Shots
	Stbd: 11 Shots

Other anchoring equipment like chain stoppers, chain compressor, anchor stopper etc. are also provided as should in reference drawing 'Arrangement of Anchor handling'.

6.23.2 Anchoring Procedure

Prior to any crew member taking part in anchoring (or mooring) operations they shall be trained in the correct use of the anchoring windlass and associated equipment.

The existence of "snap-back" or "danger" zones shall be emphasized as shall the need for extreme care when anchoring, mooring and/or working with tugs.

Anchoring should be carried out as per guidelines given in 'Company IMS Manual'.

For details of operating the windlass, refer to the 'Windlass Operating Manual'.

6.23.2.1 Readiness

- The anchor must be cleared ready for use prior to arrival at location or off port, or when navigating in restricted or confined waters.
- The anchor must not be cleared when the vessel is in deep water where retrieval of an anchor and wire, if lost, would not be possible.

6.23.2.2 Clearing

- Clear any wire lashing or stopper.
- Loosen the manual brake (turn brake stop handle in anticlockwise direction)

- At control station, move control handle forward *(push) to lower anchor
- The anchor should be lowered until on the bottom and then the wire slowly paid out with the vessel going gently astern until the Master is ensured the vessel is safely anchored
- At control station, move handle aft (pull) to take up any wire Slack
- Re tighten manual brake

6.23.2.3 General Guidance

- When anchoring a vessel, the operation should be planned ensuring that there is sufficient water for the vessel but not of a depth that will hinder or prevent the recovery of the anchor when leaving the anchorage.
- Prior to anchoring, the chart should be studied to ensure that the anchor will not foul any obstruction on the sea bed.
- The vessel should not anchor in prohibited anchorages or near undersea cables and pipelines. Cables and pipelines may be damaged by the vessel's anchors and cause pollution which would incur considerable repair costs. They could also foul the anchor
- The Master is to ensure that the officer supervising the anchoring operation on the forecastle head is fully briefed as to the depth of water, the method of anchoring to be adopted and the amount of wire to be paid out.
- Close communication between the bridge and the forecastle head must be maintained during the anchoring operation.
- The Master is responsible for ensuring that there is no possibility of the anchor fouling the seabed whilst the vessel is still making way.
- Prior to anchoring the Master and the Officer of the Watch are to ensure that the water depth indicated by the echo sounder corresponds to the charted water depth in the anchoring position.
- On letting go the anchor a GPS position is to be taken and the heading noted. These will prove very useful in the case where an anchor is lost.
- It is essential that all personnel involved have read and understood the maker's instructions regarding operation of the windlass and are aware of the capabilities and limitations of the equipment and operations

6.23.2.4 Securing of Anchors

- When sailing from an anchorage or port the anchor is to be heaved home and secured prior to proceeding into deeper water. The anchor and cable is to be washed clean of all mud residues prior to heaving home and securing.
- When securing an anchor the following procedure is to be followed:
- Anchor is to be heaved fully home
- Windlass brake is to be applied
- The anchor securing wires if fitted to be tensioned such that the anchor is held secure in the hawse pipe for the voyage.
- Regular inspections of the anchor stowage and securing arrangements are to be carried out during sea passages.

- Should the vessel encounter heavy weather, then inspections of the anchor securing arrangements are to be carried out as frequently as the Master considers safe and additional lashings are to be made if in any doubt as to the security of the anchors.

> **WARNING!**
>
> Due to vessel`s hull shape and anchor arrangement "anchor washing" must be done with care because the hanging anchor moving in the spray at the surface can damage the hull.

6.23.2.5 Emergency Anchoring

- Special care must be taken if dropping anchor in an emergency due to engine failure or other reasons.
- Initially, a short length should be let go then the brake applied strongly so that the anchor will dredge along the bottom and slow the vessel down.
- If the vessel is travelling at any speed and too much cable is let out, the anchor may well take hold but it is probable that the brake will not hold and may well burn out in the effort to check the vessel.
- If the brake does not hold, the windlass could suffer damage and probably will cause damage to the deck and under deck stiffeners in way of the windlass and the cable guide support.
- In the event that an anchor has to be let go in an emergency to stop a vessel, the minimum number of personnel should be used in the operation and once the anchor has been dropped and brake applied the forecastle should be cleared of personnel.
- If an anchor and/or cable is lost, the Master should note, as far as possible, the exact position so that it will enhance the possibilities of finding the equipment for recovery purposes.

6.23.2.6 Anchor Chain

- Regular inspection of the wire is essential:
- Especially around the eyes where synthetic tails are shackled as most wear is encountered in this area.
- It is important that periodically the whole wire is removed from the drum for greasing and inspection. Wires must be greased or oiled at regular intervals, as rusting will reduce their strength. A greasing and Inspection schedule is to be followed and records kept, unless this is part of a planned maintenance program.
- Wires should be considered for replacing if the number of broken strands (snags) exceeds 10% of the visible strands in any length of wire equal to 8 diameters

6.23.3 Limitations

The maximum anchoring limitations are as per IACS criteria. These are:

Current speed	2.5 m/s
Wind speed	25 m/s

6.24 Mooring at Port

In case when the vessel has to berth in port, normal mooring has to be used to fix the vessel. For the detail and arrangement of each mooring fitting, refer to the drawing, 3303DA430D002, Arr't of Mooring/Towing. Below are the clipped parts of that arrangement.

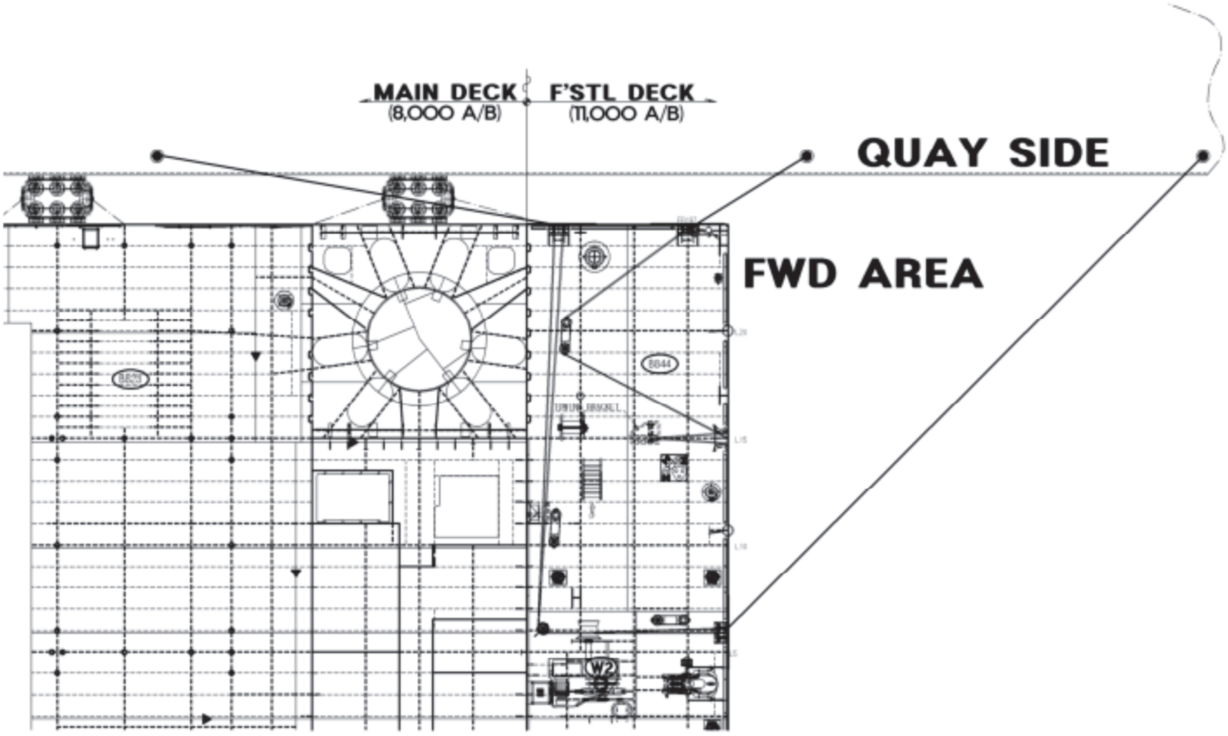


Figure 6-38 Mooring FWD

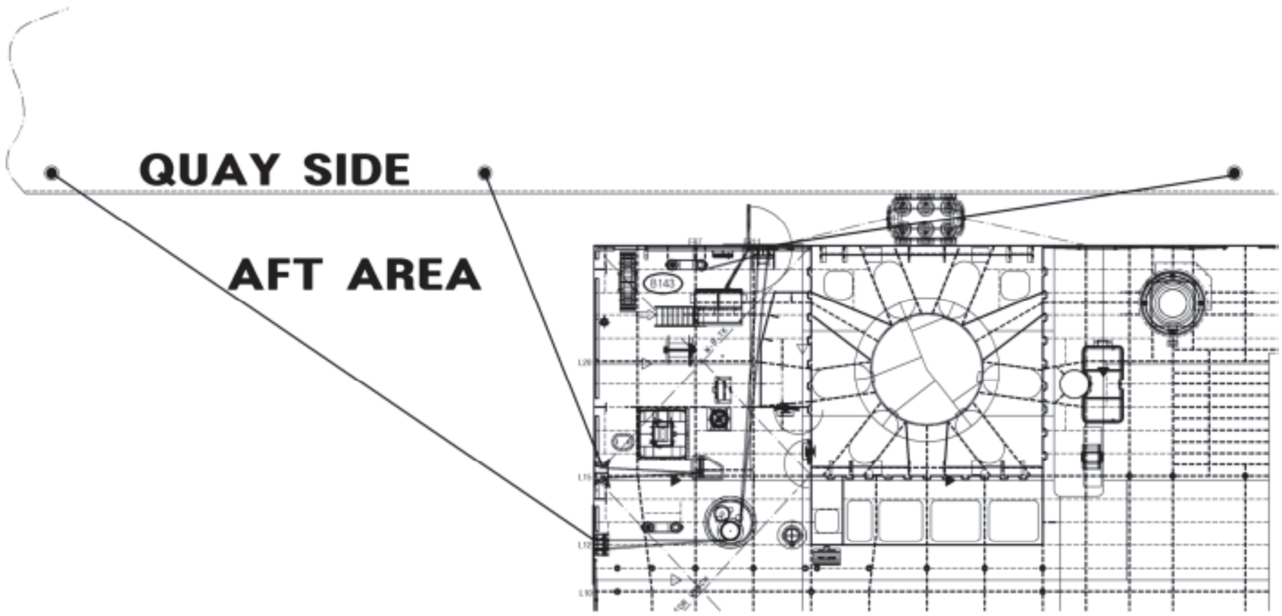


Figure 6-39 Mooring AFT

Because there are no mooring winch on-board, vessel mooring has to be done to bollards using the rope stopper as in below (4 mooring rope stoppers are supplied to each vessel).

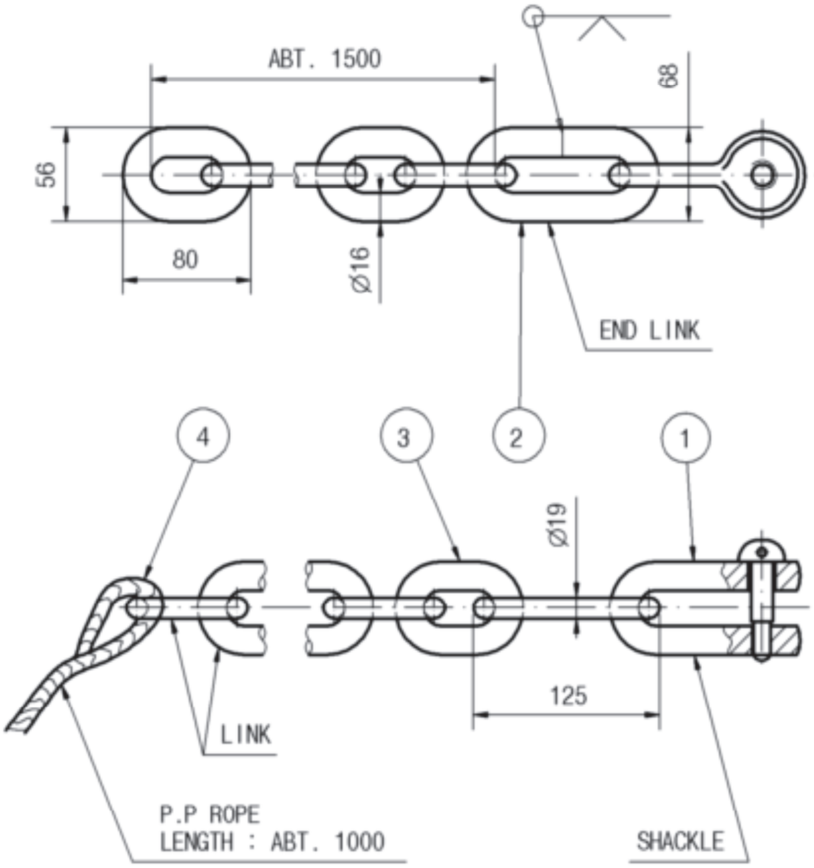


Figure 6-40 Rope Stopper Detail

6.25 Gangway Operations

For the access from the vessel to the foundation of windmill & shore, the Gangway is provided (One set/ship). Below is the arrangement and usage of the Gangway. For further information, refer to the drawing, 3303DV564D002 (V/D of Gangway).

There are provisions for placing the gangway at various locations, detachable handrail openings are provided.

General arrangement

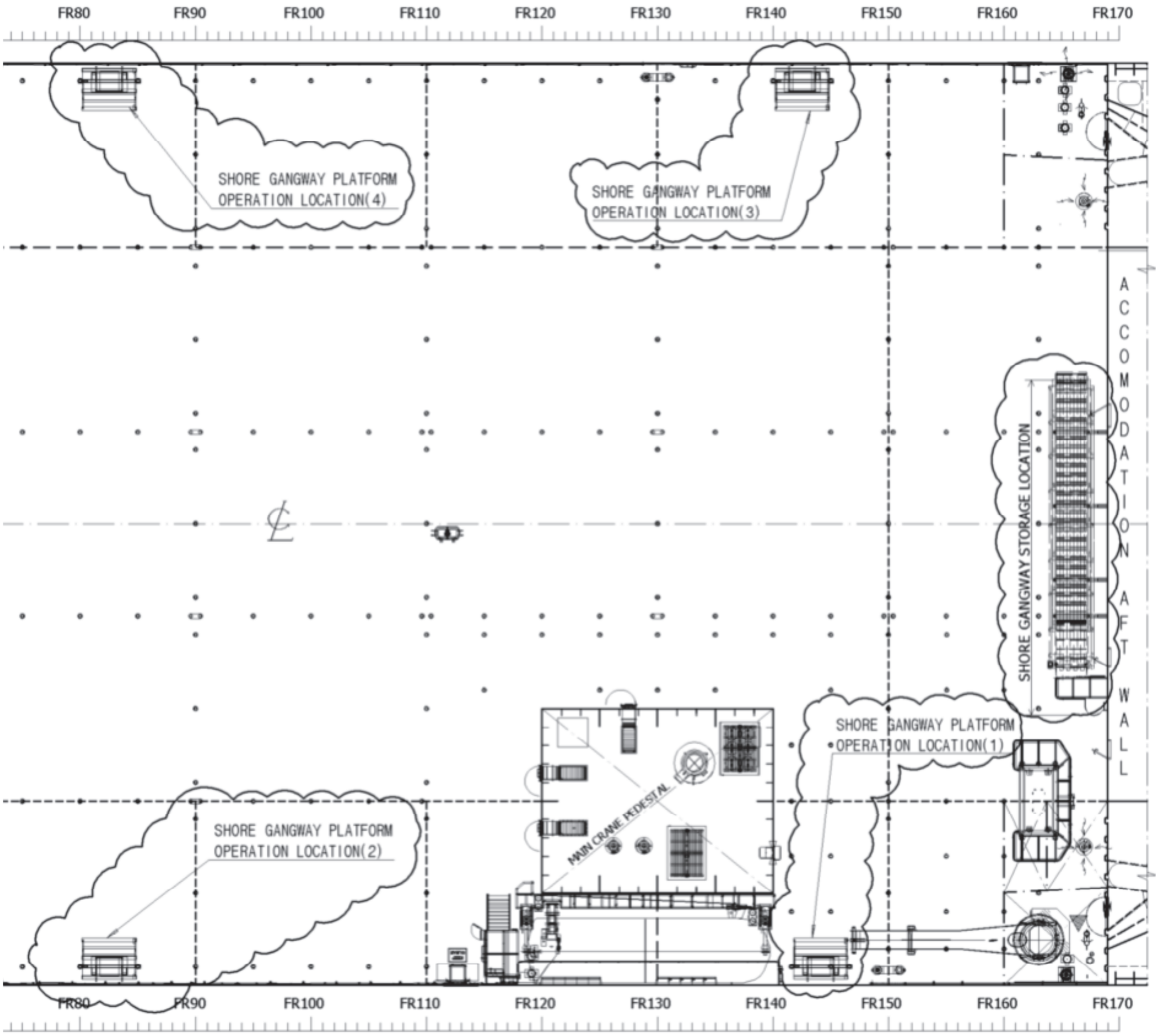
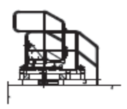
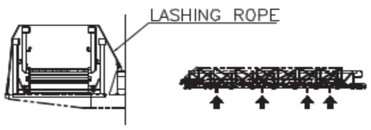
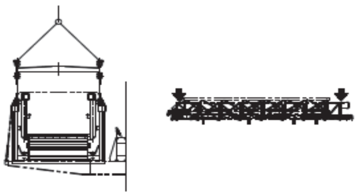
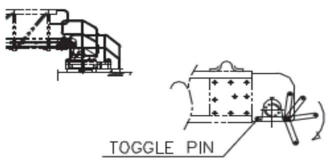
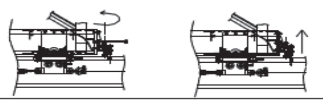
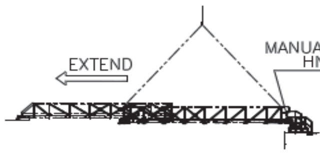


Figure 6-41 Gangway Operations Overview

How to handle the Gangway;

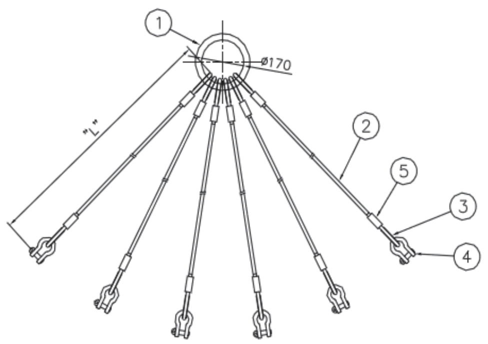
NO	PRECESS	
1		1. Shift the platform where gangway to be used by using a crane. 2. Fix the platform on the deck by using twistlock (two points)
2		1. Remove 4 points of lashing rope in storage 2. Refer to final drawing for lashing rope in detail.
3		1. Connect bridle and sling to gangway lifting eye. 2. Shift the gangway to where the platform is located by using a crane
4		1. Insert gangway hook into the platform. 2. Rotate the bar on the gangway hook and insert toggle pins (two points) in order to prevent separation of gangway and platform.
5		1. Remove stopper on the gangway. 2. Stoppers consist of two type such as pin and screw 1 set each.
6		1. Extend gangway length up to another vessel or port by using manual handle. 2. Check safety. 3. Remove sling and bridle from the gangway hook.
7		Carry out reverse procedure in order to be back to storage status

<u>Using</u> Condition of the Gangway;

NO	I T E M	DESIGN
1	SWL of Gangway & Load Test	3525Kg (47 persons), 75Kg x 1 PERSON /STEP LOAD TEST : ISO 7061 in the presence of GL's surveyor
2	Orientation of Upper Landing Platform on Upper deck in the Horizontal	15 degrees
3	Max usage angle	0-30(downward), upward angle is not allowed
4	Min/Max extension time	Time for extension from min to max : 30~40 min.

DETAIL OF SLING

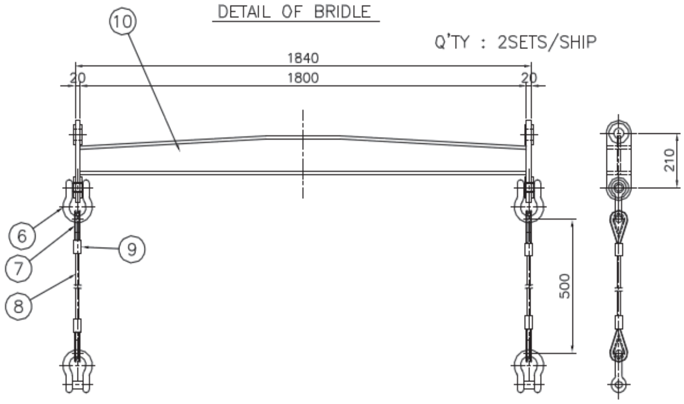
Q'TY : 1SET/SHIP

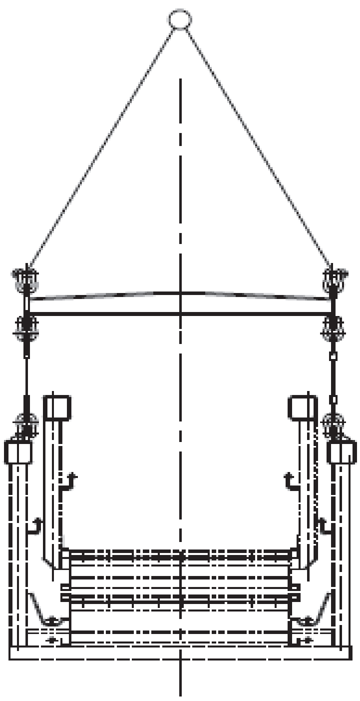


" L "	Q'TY
9 M	4EA/SET
10.2 M	2EA/SET

DETAIL OF BRIDLE

Q'TY : 2SETS/SHIP





VIEW "A"

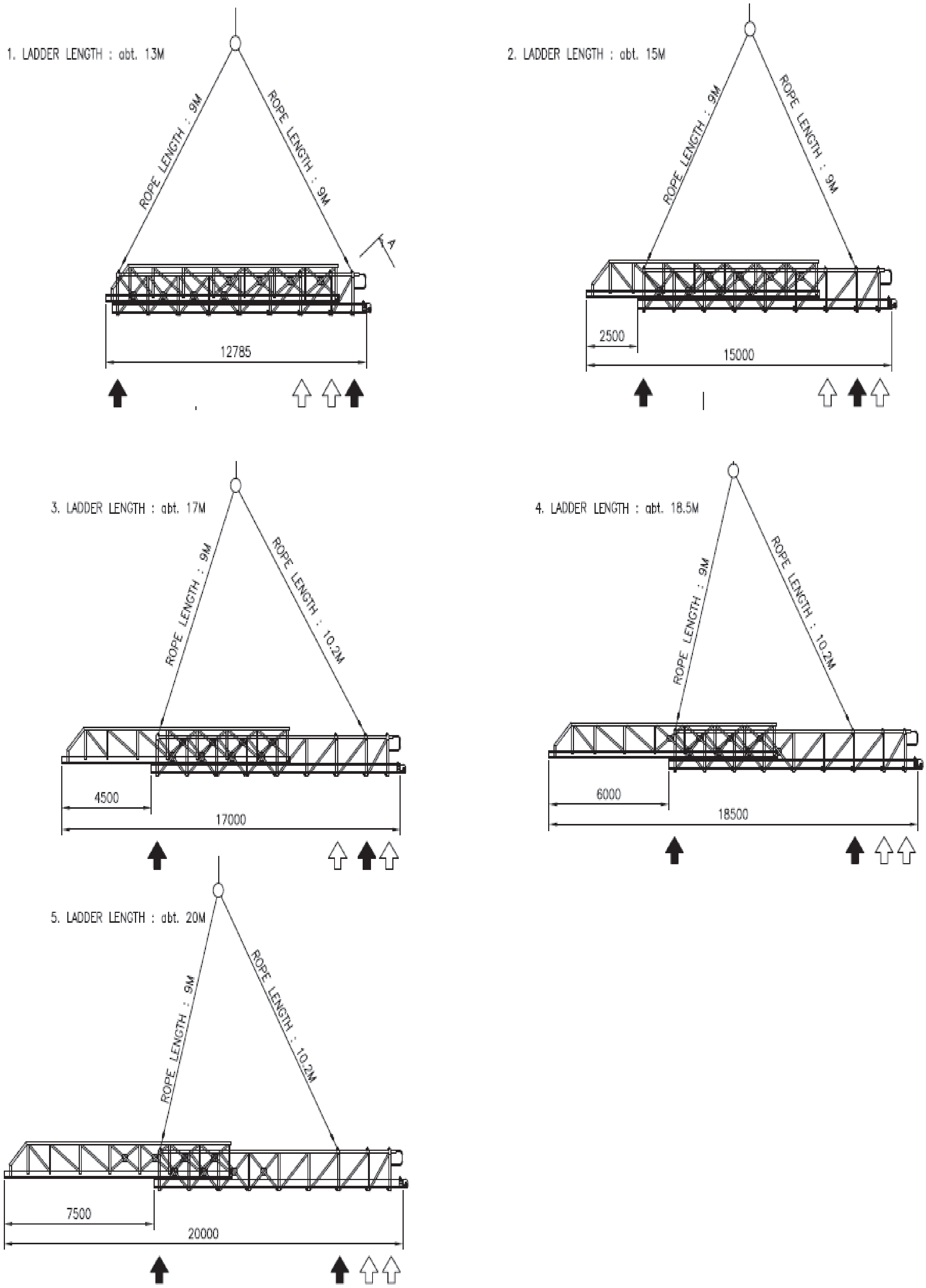


Figure 6-42 Lift-Up Shore Gangway as per Condition for Lifting Lug Position

PROJECT : 3303 SHORE GANGWAY

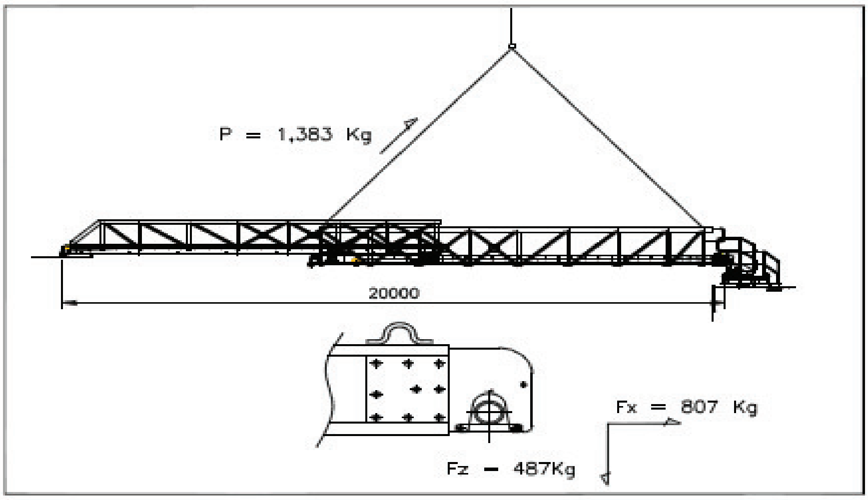


Figure 6-43 Strenth of Lifting kits

A. WIRE ROPE STRENGTH

- Provided wire rope size : Φ12 (6x24)

: Actual Breaking Strength of Wire Rope - 7100 Kgf

- Gangway Condition

P = 1383 Kg (two rope)

Safty factor S = 7100 / (1383/2) = 10 (Results : O.K)

B. Strength Calculation (for Hinge part)

Force : Fx = 807Kg, Fz = 487 Kgf

1) Hinge Bar

- Size : Plate 30 x 10t x 170L (Mat'l : SS400 σa = 4100 Kg/㎠)

Mmax = Fx' x L / 4 = ((807/2) x 17) / 4 = 1715 Kg-cm (Fx' = Fx/2)

Z = $1 \times 3^2 / 6$ = 1.5

σ = Mmax / Z = 1715 / 1.5 = 1143

Safty factor S1 = $\sigma a / \sigma$ = 3.5 (Results : O.K)

2) Hinge Pin

- Size : R/B Φ12 (Mat'l : SS400 τa = 1650 Kq/㎠)

A= πD = π x 1.2 = 3.77 ㎠

τ = Fx' / A1 = 403.5/1.2 = 336.25 (A1=A/2)

Safty factor S2 = $\tau a / \tau$ = 4.9 (Results : O.K)

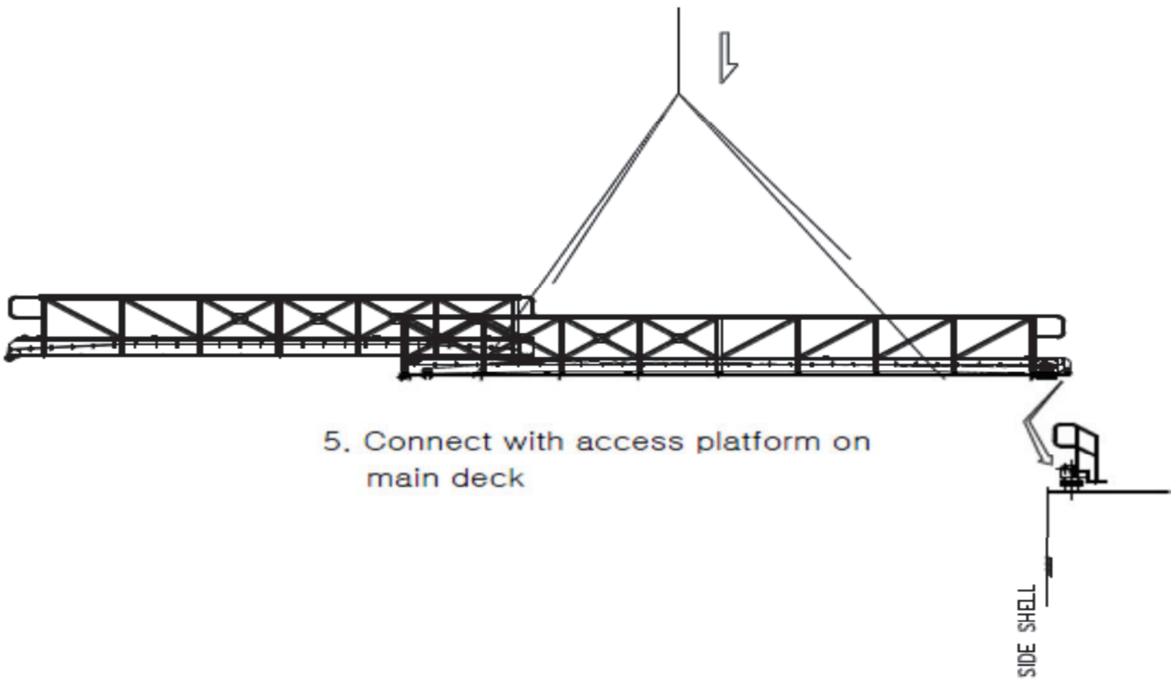


Figure 6-44 Adjusting Gangway Length

Figure 6-45 Connecting Gangway

6.26 SIMOPS (Simultaneous Operations)

REF DOC: Company IMS manual for Simultaneous Operations

Vessel is limited in simultaneous operations due to safety, equipment and personnel reasons. For detailed procedures on Simultaneous Operations refer to above mentioned reference documents.

6.27 Drainage System

The drainage procedure for the different systems is described below.

6.27.1 Jetting System

The following drain valves and procedure are to be done for drain out the water for jetting system. After drain service, all drains valves shall be closed and relevant valves shall be kept at the original positions.

6.27.1.1 FWD STBD SIDE

Drain of Jetting Pipe 200A

- Open BS093(isolation valve for NO. 5 Void(P)) in Mid Void Space
- Close BAE78 on Jack House Top
- Open BA088 and BA057 for drain of Jetting Pipe200A

Drain of Jetting Pipe 65A

- Open BS093(isolation valve for NO. 5 Void(P)) in Mid Void Space
- Close BAE45 on Jack House Top
- Close BAE49 in machinery space.
- Connect a flexible hose to the BA091 in front of Jack House for air blowing by air compressor
- Compressed air is supplied to the BA091 for 5min to ensure drain of the jetting pipe.

6.27.1.2 FWD PORT SIDE

Drain of Jetting Pipe 200A

- Open BS093(isolation valve for NO. 5 Void(P)) in Mid Void Space
- Close BAE77 on Jack House Top
- Open BA089 and BA059 for drain of Jetting Pipe200A

Drain of Jetting Pipe 65A

- Open BS093(isolation valve for NO. 5 Void(P)) in Mid Void Space
- Close BAE44 on Jack House Top
- Close BAE48 in machinery space.
- Connect a flexible hose to the BA090 in front of Jack House for air blowing by air compressor
- Compressed air is supplied to the BA090 for 5min to ensure drain of the jetting pipe.

6.27.1.3 AFT STBD SIDE

Drain of Jetting Pipe 200A

- Close BAE80 on Jack House Top
- Open BAE74 (downstream of jetting pumps) in machinery space

Drain of Jetting Pipe 65A

- Open BAE65 and by-pass through PSV unloading valve(downstream of jetting nozzle cleaning pumps) in machinery space

6.27.1.4 AFT PORT SIDE

Drain of Jetting Pipe 200A

- Close BAE79 on Jack House Top
- Open BAE74 (downstream of jetting pumps) in machinery space

Drain of Jetting Pipe 65A

Open BAE65 and by-pass through PSV unloading valve (downstream of jetting nozzle cleaning pumps) in machinery space

6.27.2 Air Vent System

- Open Drain Valve(AS046) for No.3 W.B.TK(P)
- Open Drain Valve(AS045) for No.4 W.B.TK(P)
- Open Drain Valve(AS044 and AS043) for No.6. W.B.TK(P)
- Open Drain Valve(AS042) for No.7 W.B.TK(P)
- Open Drain Valve(AS050) for No.3 W.B.TK(S)
- Open Drain Valve(AS49 and AS048) for No.6 W.B.TK(P)
- Open Drain Valve(AS047) for No.7 W.B.TK(P)

6.27.3 Fire Water System

- Open BS093(isolation valve for NO. 5 Void(P)) in Mid Void Space
- Close WDE80 and WDE82 of discharge pump main fire pumps
- Open WD040 and WD041 in aft mid void space
- Open WD027 in fwd mid void space

After the drain service, WDE80/WDE82 shall be closed and other drain valves shall be kept at the original positions (closed positions). In any case, if there is a service of the deck wash and fire water system, the fire water lines shall be emptied, main isolation valves (WDE80 and WDE82) and drain valves shall be closed after the service.

6.27.4 Fresh Water System

- Open BS093(isolation valve for NO. 5 Void(P)) in Mid Void Space
- Close FW021(NC) and Open FW020(for Drain of fresh water branch connection of fwd(p) jack hose
- Open BS094(isolation valve for NO.5 Void(S)) in Mid Void Space
- Close FW018(NC) and Open FW019(for Drain of fresh water branch connection of recess box)
- Close FW017(NC) and Open FW016(for Drain of fresh water branch connection of near life boat ringing connection

VOLUME III–ABNORMAL & EMERGENCY PROCEDURES

Table of Contents

7 ABNORMAL PROCEDURES

7.1 Storm Survival – Elevated Condition

REF REG: MODU-CODE 14.1.2.8, 14.1.3.8

REF DOC: Company IMS Procedures for Storm in Elevated Condition

REF CKL: Company IMS Checklist for Storm in Elevated Condition

7.1.1 Definition

The vessel is designed to normally operate in the limiting environmental conditions defined in Section 0. If the environmental limitations defined in 'Operational Elevated Conditions' (Section 0) are exceeded, then all operations must be stopped and the vessel is regarded as being in 'Elevated Storm Survival Condition'.

On receiving the advance weather forecast where severe weather is predicated, the Master shall decide to go to elevated storm survival mode taking into consideration the length of time required to go from operating mode to elevated storm survival mode. This procedure describes the instructions for preparing the vessel for a storm between the operational limits (as per Section 0) and the survival limits (as per Section 3.4.4) in elevated condition.

If the environmental limitations for 'Elevated Storm Survival Condition' (as defined in 3.4.4) are also expected to be exceeded, then the Master should consider contacting shore side personnel and following procedures for excessive storm as given in Section 8.8

7.1.2 Procedure

Company guidelines for storm condition given in IMS manual should be followed and respective checklist should be filled up, if a storm is expected.

The ability of the vessel to meet the storm criteria is dependent on the proper preloading of the legs, proper engagement of the hydraulic jacking pins, keeping the unit level, and ensuring that the environmental conditions, leg reactions, and loads do not exceed the appropriate values specified in this manual. The following procedure describes the key items that should be followed during storm survival elevated condition:

- The Master must ensure the safety of the personnel at all times and shall notify all personnel on board about the impending storm. He/ She shall issue any special instructions and precaution as deemed necessary at the time of the storm notification.
- Suspend lifting operations well in advance of the anticipated storm and crane booms should be stowed and secured in their boom rests.
- Close and secure all watertight and weather tight doors, hatches, openings, valves, and overboard discharge appliances.
- Verify that all communications, lifesaving, navigation, and safety equipment are functioning satisfactorily.
- Test the emergency sources of power.
- Any kind of loose cargo or equipment should be safely stowed and secured.

- Any cargo with large exposed areas that can attract strong wind loads should be lowered to the lowest possible height.
- Ensure that all the hydraulic jack pins for both frames on each leg are engaged securely with legs and the jacking system is in 'Holding' condition.
- Use loading computer or manual calculations to find leg reactions on each leg. The leg reactions can be lowered by the reduction or relocation of the variable loads.
- Ensure that the hull is kept in a level and it is at the approved elevated storm survival condition air gap for the location.
- Leg loads, hull inclination and hull sway should be monitored during the storm and records made of any large values of such parameters recorded for future reference.
- Jacking operation with DG6 and suction mast operation in case of emergency are described in section 6.1.6 & 6.9.8 respectively

7.1.3 Other options for Sea Water Cooling Supply

In Case of failure of sea water suction mast and the Emergency hose reel pump other options can be used for cooling and fire fighting

- Ballast Tanks
- External submersible pumps if on board.

If it is not possible to supply cooling water DG6 can be used for emergency jacking operations since it is air cooled.

7.1.4 Time Requirement to Prepare the Vessel

Twelve hours is estimated time to prepare for storm in elevated condition. The following list of times is for guidance only. The total preparation time is not the sum of all the times given below because a number of preparations can be carried out simultaneously and some preparations will not be necessary depending on the platform operation.

Item	Approximate Time
Check communication & navigation equipment	1 hr
Check safety & lifesaving equipment	1 hr
Check all hatches and vents	1 hr
Check jacking system	0.5 hr
Secure all loose cargo & equipment	6hrs
Secure crane booms and hooks	1 hr
Reposition variable load	1 hr
Brief crew	0.5hr
Total Estimated Time	**12 hr**

7.1.5 After the Storm Passes

- The legs and jacking system should be visually inspected to ensure no damage occurred during the storm. Any damage reported for repair or further assessment.

- Hull inclination should be measured to ensure that no settlement of the legs took place during the storm. Where settlement had taken place, the hull should be leveled.
- In case it is suspected that scouring might have occurred during the storm, the Master may consider repeat preloading procedure.

7.2 Storm Survival – Floating Condition

REF REG: MODU-CODE 14.1.2.8, 14.1.3.8

RED DOC: Approved - Final Trim & Stability Booklet DA101Z035

REF DOC: Company IMS Procedures for Storm in Floating Condition.

REF CKL: Company IMS Checklist for Storm in Floating Condition.

7.2.1 Definition

The vessel is designed to normally operate in the limiting environmental conditions defined in Section 3.2.1. If the environmental limitations defined in 'Normal Floating Condition (Transit or On Location)' as per Section 3.2.1 are exceeded, then additional safety measures must be taken and the vessel is regarded as being in 'Floating Storm Survival Condition'.

If severe weather is forecast the vessel should seek shelter. It is essential that storm plans are made well in advance, so as to provide for sufficient time to seek shelter or evacuate if necessary. Continuous monitoring weather forecasts should provide sufficient time for safe implementation of the emergency response plan. This procedure describes the instructions for preparing the vessel for a storm between the normal limits (as per Section 3.2.1) and the survival limits (as per Section 3.2.2) in floating condition.

Any conditions beyond the stability limitations described in the 'Approved – Final Trim & Stability Booklet' shall be verified by class approved stability calculations and strength calculations (if required). If the environmental limitations for 'Floating Storm Survival Condition' (as defined in 3.2.2) or stability limits from the 'Approved – Final Trim & Stability Booklet' are expected to be exceeded, then the Master should consider contacting shore side personnel and following procedures for excessive storm as given in Section 8.8.

The procedures described below are not subject to the approval of the operating manual.

7.2.2 Procedure

Company guidelines for storm condition given in IMS manual should be followed and respective checklist should be filled up, if a storm is expected.

Good seamanship is essential at all times while afloat and shall be especially observed during periods of storms or heavy weather. The vessel shall be prepared for storms before beginning a sail. Complete the following, if weather is expected to deteriorate:

- The Master must ensure the safety of the personnel at all times and shall notify all personnel on board about the impending storm. He/ She shall issue any special instructions and precaution as deemed necessary at the time of the storm notification.
- Be certain to maintain weather surveillance on at least two broadcasting channels and place the vessel in the desired mode before the weather becomes too severe. Should there be any doubt as to the weather forecast during the voyage; additional forecasts should be obtained from reliable forecasting sources for the specific area in which the vessel is located.

- Verify that all operational instructions for the afloat condition and 'Approved - Final Trim & Stability Booklet' have been followed and preformed and verify that the vessel is 'Strom Ready'.
- Close and secure all watertight openings and not essential vent openings to maintain the integrity of the watertight boundaries and deck.
- Verify tank soundings for reference if it is suspected the integrity of the vessel has been compromised.
- Verify that all communications, lifesaving, navigation, and safety equipment are functioning satisfactorily.
- Test the emergency sources of power.
- Ensure that crane booms are stowed and secured in their boom rests.
- Any kind of loose cargo or equipment should be safely stowed and secured.
- Any cargo with large exposed areas that can attract strong wind loads should be lowered to the lowest possible height.
- Check the calculated stability of the vessel and ensure it is satisfactory. Consider transferring liquids to reduce free surface effects.
- Maintain a heading that minimizes vessel motions.
- Move to an area sheltered from wind like leeward side of an island and avoid areas where accidental running aground is more likely.
- Reduce thruster speed to avoid overloading of thruster motors.
- Ensure that all the hydraulic jack pins for both frames on each leg are engaged securely with legs and the jacking system is in 'Holding' condition.
- All leg must be positioned and secured as per procedure given in Section 6.7.1.
- As an emergency counter measure during a storm during floating condition, the Master may consider lowering the legs considering the water depth and sea state as per guidelines given in Section 3.2.2 (Lowering by Approx. 15 m). Lowering the leg shall help reduce the VCG of the vessel, reduce the dynamic forces acting on the hull structure and the legs themselves. They will also help to increase damping and thus maintain stability.

CAUTION!

Lowering the legs increases the roll-damping of the vessel, thus possibly leading to more water on deck as the vessel's capability to follow the wave slopes decreases. Also the possible water intake into the koker compartments as described in chapter 5.3 may increase. Therefore, the master is to be advised to closely observe the effect of lowering the legs on the vessel's roll motion and stability when exercising this counter measure.

7.2.3 Time Requirement to Prepare the Vessel

Twelve hours is estimated time to prepare for a storm in afloat condition. The following list of times is for guidance only. The total preparation time is not the sum of all the times given below because a number of preparations can be carried out simultaneously and some preparations will not be necessary depending on the platform operation.

Item	Approximate Time
Check communication & navigation equipment	1 hr
Check safety & lifesaving equipment	1. hr
Check all hatches and vents	1 hr
Secure all loose cargo & equipment	6 hrs
Position and Secure Legs	1 hr
Check stability of vessel and afloat operations	1.5 hrs
Brief crew	0.5 hr
Total Estimated Time	**12 hrs**

8 EMERGENCY EQUIPMENT, SYSTEMS & PROCEDURES

8.1 Emergency Alarm & Communication Systems

REF REG: MODU-CODE 14.1.2.7

REF DWG: Fire Control & Safety Plan DA500D001 Rev 1

8.1.1 Emergency Alarm Systems

8.1.1.1 Public Address & General Alarm System

REF DOC: Public Address & General Alarm System User Manual

REF DWG: Public Address & General Alarm System single line diagram

The vessel is provided with a public address and general alarm system so installed as to be clearly perceptible in all parts of the unit.

Public announcements can be made using the system by microphone given on the bridge and Master's office. The system is also connected to the telephone system which can also be used to make public announcements.

The general alarm system is also part of the same system with alarm activation panels provided on the bridge and Master's office.

For further details on use of the system refer to Public Address & General Alarm System User Manual.

8.1.1.2 Manual Call Points

The vessel is provided with manual alarm call points at various locations as shown on the fire control and safety plan.

8.1.1.3 Fire Alarm System

The fire alarm system is integrated with Fire detection system. Refer to Section 8.2 for further details.

8.1.1.4 Other Emergency Alarm Systems

Dead Man Alarm System

The machinery space and bridge provided with a dead man alarm system which can be activated from the ECR or Bridge respectively and answered from any visual alarm panel.

CO_2 Release Alarm

CO_2 release alarms are provided in Galley Duct, Emergency Generator Room, Paint Store Room and containerized DG6 room as described in the following sections. CO_2 release alarms get activated when CO_2 system cabinets are opened.

NOVEC 1230 Alarm

Each cabinet of NOVEC 1230 system has equipped with audio visual fire alarm.

8.1.2 Emergency Communication Systems

8.1.2.1 Talkback System

The vessel is provided with a talkback system at bridge and muster stations for emergency communication.

8.1.2.2 Emergency Battery Powered Telephone

REF DWG: Internal Communication System Line diagram DA410E012 Rev 1

The vessel is provided with an emergency battery powered telephone system for emergency internal communication.

8.1.3 Duty Alarm Systems

REF DWG: E/R Extension and bridge watch alarm system DA381E011

Duty alarm panels are distributed in different locations as listed below

Cabins:

The following cabins are fitted with remote duty alarm panels for technical alarms:

- Chief Engineers Cabin
- 1st Engineers Cabin
- 2nd Engineers Cabin
- 3rd Engineers Cabin
- Electrical Engineers Cabin

The following cabins are fitted with remote duty alarm panels for navigation alarms:

- Master’s Day Cabin
- Chief Officer Cabin
- 2nd Officer Cabin
- 3rd Officer Cabin
- JackO Cabin (4th deck)

The following cabins are fitted with remote duty alarm panels for medical alarms:

- 2nd Officer Cabin
- Bridge
- ECR
- Mess Room
- TV Room
- Gymnasium
- Office

8.2 Fire-Extinguishing Systems & Equipments

REF REG: MODU-CODE 14.1.4.1

REF REG: SOLAS II-2

REF DOC: Company IMS Manual / Procedure for Fire Fighting

REF DWG: Fire Control & Safety Plan DA500D001 Rev 1

8.2.1 Fire Control Plan

The Fire control plan is part of the Fire Control and Safety Plan which is placed at the following locations on the vessel:

- Accommodation
- Main Deck
- Tween Deck
- Wheelhouse

8.2.2 Fire Main System

REF DWG: Fire & Deck Wash System P&ID

8.2.2.1 System Description & Equipment

The vessel is equipped with following pumps for fire fighting:

S. No.	Description	Qty.	Location
1	No. 1 Main Fire Pump (110 m^3/hr x 100 MTH)	1	AFT Machinery Space D. Bottom
2	No. 2 Main Fire Pump (110 m^3/hr x 100 MTH)	1	AFT Machinery Space D. Bottom
3	Emergency Fire Pump (166 /110 m^3/hr x 2.5/10 bar)	1	FWD Machinery Space STP Room

The pumps serve the following systems:

- Main Water Fire System including fire hydrants (Refer Fire control and safety plan for hydrant locations)
- Helideck Foam Fire System.

The Emergency fire pump serves the dual function as fire fighting as well as bilge pump. The fire pumps take suction from sea chests cross connection. The main fire line runs underneath the main deck and serves for accommodation spaces, exposed deck, helicopter deck and machinery spaces. The sea water fire fighting system consisting of sea waterlines, stop valves, hydrants, fire hoses, nozzles and other necessary fittings provided.

For the operation of fire pump in elevated and jacking up / down operation, the submersible sea water riser pump should be in operation for supplying sea water to heeling tank.

NOTE:

- The ballast system is connected to the sea water cooling system. During jack up conditions, the No.6 WB TK (buffer for the fire pump) can get its sea water supply from the Sea water cooling system.
- In elevated conditions the volume for No.6 WB TK has to be at any time a minimum of 185m^3 seawater. During elevated operation this volume will provide sufficient capacity for fire figthing for at least one hour.
- In case of fire, either emergency DG or one set of D/G with minimum load (no jacking/crane operation) shall provide power for running main fire pump or emergency fire pump.

8.2.2.2 Operating Procedure

All valves for fire main system to supply fire water must be kept open at all time. The pump can be operated remotely from following locations:

S. No.	Description	Qty.	Location
1	Remote control for Main Fire Pump	2	Wheelhouse & ECR
2	Remote control for Emergency Fire Pump	2	Wheelhouse & ECR

8.2.3 Low Pressure Water Mist system

REF DOC: Low pressure water mist system operations manual

REF DWG: Fixed Local Water based fire fighting system (Water Mist) DA700M001-2

8.2.3.1 Minimum Fresh Water requirements (Fire Fighting Purposes)

Based on 88 l/min flow rate for 20 min and 15% safety margin only 2024 Liter of fresh water required to be preserved at all times to cover the low pressure water mist system.

8.2.3.2 System Description & Equipment

The vessel is equipped with a low pressure water mist fixed fire fighting system for protection of the category ‘A’ machinery spaces:

Protected Area	Nozzle Type x Q’ty	Flow Rate (l/min)	Pipe diameter
Main D/G Engine	M5 (10 L) x 3	30	15A
Hydraulic Power Pack	M5 (10 L) x 8	80	25A

Maker	NK Co., Ltd.
Nozzle type and flow	M5 / 10L
Nozzle flow rate	10 L @ 4 bar, 15 L @ 9 bar
Pump model / capacity	KSB VF4-7 / 5.28 m^3h x 70m x 2.2kW
Fresh water tank 2	211.5 m^3
Min. Quantity of Water to be maintained during Jacking	2,024 L / 2.1 tonnes

Low level alarm at 20% (40 tones) is provided, there is no further low-low level alarm available to alert if the water level is below 2024 liters.

8.2.3.3 Operating Procedure

This system can be operated both automatically and manually. When the engine room is unmanned, the select switch for the system start should be confirmed to be in automatic position.

For the manual start in main control panel:

- The system shall be operated when system start select switch is on at manual position.
- In case of fire system start switch shall be pressed for the related protected area. It should be confirmed that the low pressure water pump is activated and mist is released with indication lamp on the panel.

Automatic Start

- The system shall be operated when system start select switch is on at auto position.
- Mist shall be released automatically when fire detectors are operated and visible and audible alarms are all operated. Any operation related to the system is not necessary.
- In this mode, remote release panel and local release box are in function and when the release push button is pushed, the system is activated same as auto start procedure.

System stop switch shall be pressed only after confirming that the fire has been extinguished. When manual position is selected the system cannot be started automatically, thus in case of fire ensure that the system start selection switch is in automatic position.

For further details on system operation refer to user manual.

8.2.4 Independent High Pressure CO_2 Flooding System

REF DOC: Independent CO_2 system operations manual

REF DWG: Independent CO_2 system DV815M007 Rev 0

8.2.4.1 System Description & Equipment

The vessel is equipped with a CO_2 Independent flooding system for protection of the emergency generator room and the paint store.

Maker	NK Co., Ltd.
Medium	CO_2
Capacity CO_2 storage cylinder	45 kg
Quantity of cylinder	2 (Emergency gen. room) with 2 nozzles 1 (Paint store) with 2 nozzles

The units are coloured Red and situated at the entrance of the emergency generator room and paint room.

8.2.4.2 Operating Procedure

The CO_2 package unit for the Emergency generator room contains two cylinders connected with CO_2 manifold pipe assembly. The cylinders are fitted with safety pins for valve actuation. Main ball valve is fitted into a cabinet outside the unit. In the event of fire the instructions listed on the instruction plate of the valve cabinet shall be followed.

In the event of fire in Paint store area the similar procedure shall be followed. Refer to the instruction plate of the package units for detail. In order to operate the ball valve, the cabinet has to be opened for which the key is located next to the units in Red box. In order to obtain the key the procedures mentioned on the operating plate outside the box need to be followed.

After CO_2 discharge, the area should be thoroughly ventilated before re-entry.

For further details on system operation refer to user manual.

8.2.5 NOVEC 1230 Fire Fighting System

REF DOC: NOVEC 1230 System operations manual

REF DWG: NOVEC 1230 Fire Fighting System for Aft Machinery DV815M013 Rev 0

8.2.5.1 System Description & Equipment

This fire extinguishing system is a Tyco Fire System which uses a NOVEC 1230 fire protection fluid. This fluid is stored in pressurized cylinders. The NOVEC release can be done through the cabinet on the NOVEC control space and the Aft machinery space.

Maker	TYCO Fire & Security Marine Service
NOVEC Cylinder	180 L x 10 147 L x 2

Arrangement of NOVEC 1230 Fire Fighting System is as follows:

Aft Machinery Space	Total Gas Qty (kg)	Cylinder size (L)	Filling Qty as per cylinder (kg)	Cylinder Qty	Nozzle Qty
Engine Space #1	1,790	180	179kg x 10	10	14
Engine Space #2					5
Port Funnel					2
Hyd. Power Pack Space	640	180	160kg x 4	4	8
No. 6 Thruster Room	160	180	181kg x 1	1	2
Void	21				1
Engine Control Room #1	48	180	192 kg x 1	1	1
Engine Control Room #2	110				2
Electric Workshop & Store	34				1
Engine Workshop & Store	173	180	173 kg x 1	1	2
Thruster VFD	624	180	196kg x 4	4	7
No. 5 Thruster room	160				2
Switch Cabinet Space	276	147	138kg x 2	2	4
Total	4,036			23	51

8.2.5.2 Operating Procedure

In the event of fire the NOVEC 1230 fire extinguishing system for AFT machinery space can be operated remotely from machinery space safety station :1 near entrance door of AFT machinery space:1.

Similarly in event of fire for switch cabinet space the NOVEC 1230 system can be operated remotely from machinery space safety station:1 near entrance door:1.

In the event of fire the NOVEC system can be activated on site by following the simple steps mentioned below:

- The NOVEC system in the area can be easily located by following the Table listed above.
- Opening of the cabinet door will activate the alarm in the area.
- Initiate ventilation shutdown manually.
- Personnel's shall be cleared of the affected area and all opening shall be closed.
- After time delay has elapsed, the main actuation cylinder shall fully open automatically.
- In the next step actuation control valve "A" shall be opened.
- If NOVEC cylinder fails to operate, control valve "B" shall be opened.
- NOVEC must be retained in the compartment for a minimum of 15 min.
- Cabinet door must remain in open position (Alarm Condition), until area has been certified safe.

Entrance to the area is prohibited until it is certified safe. Product of NOVEC decomposition may be harmful. Breathing apparatus and protective clothing must be worn when entering the area after NOVEC discharge.

For further details on system operation refer to user manual.

8.2.6 CO_2 System for Containerized DG 6

The containerized DG6 is equipped with a CO_2 cylinder for fire fighting.

Maker	MINIMAX GmbH & Co., KG.
Medium	CO_2
Required CO_2 Supply Capacity	45 kg
Quantity of cylinder	One with nozzle

The unit is coloured Red and situated at the entrance of the DG 6 container room.

The CO_2 package unit for the DG6 container room contains one cylinder connected with CO_2 hose assembly and nozzle. The system cylinder is fitted with check valve and acoustic sound alarm.

8.2.7 Helideck DIFFS System

REF DOC: Deck Integrated Fire Fighting System for Helideck Operations Manual

REF REG :Germanischer Lloyd 2002 Rules I - Part 1, Chapter 2, Section 120

REF REG :ICAO (International Civil Aviation Organisation) CAP 437

8.2.7.1 System Description & Equipment

The system is a compact DIFFS with pop-up nozzles and skid designed to mix foam concentrate type AFFF in to fire water carrying foam tank and proportioner.

The system proportions an exact rate of foam concentrate directly to the fire water line close to the nozzles only using some of the energy in the water. Only to be hooked up to the water line and control signal from the control panel.

Special designed for systems using Matre pop-up nozzles, but also suitable to be installed in other applications.

The system can carry tanks from 550 L. Calibrated to 3% insertion rate. Proportioner capacity 1,400 L using pipe size DN100 to be calculated according to deck size, coverage requirements and pressure. Nozzles according to deck size each covering a diameter of 7 meter and with exact K-factor calculated according to proportioner performance. Main components are tank for foam concentrate, proportioner and nozzles. The proportioner will when the water flow is activated mix foam at 3%. An actuator valve will activate the system down during continues running of fire pumps. Foam insertion can be shut of for test run. One operation panel and one or more remote control panels can be placed indoor or outdoor according to applicable rules and requirements. Nozzles are exactly calculated according to pressure and flow to give the correct coverage.

8.2.7.2 Operating Procedure

The instructions to be followed in case of fire while working on Helideck integrated fire fighting system are as mentioned below:

Manual Operation

Push the RELEASE button on Main Control Panel or Local Release Box.

- The sea water supply valve and foam supply valve will be opened.
- After 5.00 s, foam pump will be started automatically and proportioner will mix foam at 3%.
- When the system is released, the nozzle will be lifted up by the water pressure and make an effective spray distribution of water/foam mixture to the entire area.

Emergency Operation

In case of failure in the manual operation, the system can be operated as follow,

- Open the foam supply valve by manually.
- Start foam pump by manually.
- Open the water supply valve by manually.

Proportioner will mix foam at 3% and the system is released, the nozzle will be lifted up by the water pressure and make an effective spray distribution of water/foam mixture to the entire area.

Reset: When the fire is extinguished, the system must be reset manually by pressing the reset button.

After Use: Flush the pop-up nozzle and HFPU with water only. And fill the foam storage tank with foam concentrate.

For further details on system operation refer to user manual.

8.2.8 CO_2 System for Galley Duct

8.2.8.1 System Description and Equipment

The system consists of a CO_2 cylinder with a release cabinet and micro switch. As per the CO_2 required by the system the nozzle size is defined.

One CO_2 cylinder of 8.90 kg capacity is located at the galley duct.

8.2.8.2 Operating Procedure

Remote release station for Galley duct is stationed in galley duct area itself. The system is connected to the duct through a ½” line. In case of fire the fire dampers shall be ensured to be closed and fans to be shut off.

For local operation the screw down valve shall be opened for 3 – 5 seconds and should be closed after that. The operation can be continued as per the requirement.

8.2.9 Deep Fat Fryer Fire Suppression System (Galley)

8.2.9.1 System description

The fire extinguishing system on deep fat fryer consists of ANSULEX low pH liquid fire suppressant. The fitting location for the system is the galley. ANSULEX low pH liquid fire suppressant is potassium based solution designed for fast knock down and suppression of grease related fires. The system consists of agent, cartridge, compression seal adaptor, electrical switches, remote manual pull station, agent tank assembly, pulley elbow, nozzles, rubber blow off caps, swivel adaptor assembly and regulated release assembly.

8.2.9.2 Operating procedure

In case alarm activates:

- Ensure all personnel have vacated the protected space.
- Close all vents / fans, doors and fire dampers
- Pull the pulley handle of the wet chemical
- System is under operation.

8.2.10 Sprinkler System for Garbage Room

An automatic sprinkler system is provided for fighting Garbage room fires. The system is connected to the fresh water system and can be activated by opening the valve outside the garbage room.

8.2.11 Helicopter Fire Fighting Equipment

A fire fighting kit for helideck fire fighting is provided near the helideck. For details of equipment contained in the kit Fire Control & Safety Plan.

8.2.12 Portable Fire Extinguishers

For locations and types of fire extinguishers on board this vessel refer to Fire Control & Safety Plan.

8.2.13 Fire Fighting System on Main Crane

REF DOC: Main Crane (Liebherr) operating manual, BOS 35000–1000 LITRONIC Serial No.170564, 170565

Fire extinguishers are placed inside main crane cabin and main crane machinery house.

8.2.14 Fire man Outfit & Breathing Apparatus

Fire man outfits and breathing apparatus are placed at various locations on the vessel. For locations of these items on board this vessel refer to Fire Control & Safety Plan.

8.2.15 EEBD

Emergency escape breathing devices have been provided at various locations on the vessel. For locations of these items on board this vessel refer to Fire Control & Safety Plan.

8.2.16 Fire & Gas Detection Systems & Equipments

8.2.16.1 Fire Detection System

REF DOC: Operator's Handbook for the Autoprime Fire Detection & Alarm System.

REF DWG: Wiring Diagram & Arrangement of Fire Detection & General Emergency Alarm System DA381E015

The vessel is fitted with a Fire Detection and Alarm system. The system monitors heat, flame and smoke in the machinery spaces and in the living areas. Detectors are located throughout the vessel as shown on the Fire Control & Safety Plan.

The main control panel for the Fire Detection and Alarm system is located inside the Wheelhouse. A repeater panel for the system is also located in the engine control room.

For further details on the fire detection system refer to fire detection system operations manual.

8.2.16.2 Gas Detection System

There is no fixed gas detection system provided on the vessel, however two portable gas detectors are provided.

8.2.17 Quick Closing Valves System

REF DWG: Quick Closing Valve system P&ID

The vessel is provided with quick closing valve system for closing fuel line valves in case of an emergency. The system is divided into two parts:

- Main Engine fuel line valves which is activated from the machinery space control station.
- Emergency Engine fuel line valve which can be operated from outside emergency generator room.

8.2.18 Emergency Stop System

REF DWG: Wiring Diagram of AC690V Power System DA881E011

REF DWG: Main One-line diagram of Elec. Distribution System DA880E021

REF DWG: Vendor Drawing of Main Switchboards DV961E001

For stopping various pumps and ventilation system in case of emergency, the manual emergency stop provisions are provided at the following locations.

Depending on consumer's location and its type, they are designated with several groups, such as ES1, ES2, ES3.

Wheelhouse	"ES1", "ES2", ES3"
FWD Workshop	"ES1", "ES3"
AFT Main Deck Port & STBD	"ES1", "ES3"
ECR	"ES2"
Machinery safety station (NOVEC Room)	"ES1", "ES2"

For the details of consumers for each group, the following table shall be referred to.

Emergency stop (ES-1) For vent fns for aft mach. space	**Emergency stop(ES-2)For oil pumps for aft mach. Space**	**Emergency stop(ES-3)For accommodation fans**
No.1/2 engine room vent fan Aft winch room sup.fan (port) Aft winch room sup.fan(stbd) No.5/6 thruster motor cool fan Packaged air condition(SWBD room & E/R W/s) Packaged air condition(ECR) Packaged air condition(HPU space)	No. 1 to 9 jack up hyd. Pump No. 1/2 jack up system oil cooler No. 1/2thermal oil heater No. 5/6 thrusters main hyd. Pump No. 5/6 thruster lifting pump No 1 to 5 pre priming device for D/G No. 1/2 NFV filtration unit	A/C mach. Room & Lift trunk sup. fan No. 1/2 air handling & Pkgd. air cond.(Galley) Galley exh. Fan & sup. fan Fwd. Winch room store sup. fan (Port & Stbd) No. 1/2 & Deck workshop store sup fan Battery room, welding & sanitary exh. fan Mid void sup. fan W/hr room & defrosting heaters Ambulance exh. fan

Also there are dedicated emergency stop pushbuttons for the confined space, if any ventilation fan(s) or oil pump(s) are installed. Examples are No.1/2/3/4 thruster rooms and Mooring winch spaces.

In case of manual stop pushbuttons for group controlled motors, one pushbutton switch has 3 NC (Normal Closed) contacts and each contact is connected to internal control circuits inside the AC 690V switchboard so that relevant consumers are to be tripped by shunt trip coil.

These three NC contacts are connected to each dedicated main bus bar (Main bus bar A, B, C) by means of internal control source from main bus bar Section independently. This means that there are individual three control relay logics for main bus bar (one for each main bus bar).

8.3 Life Saving Appliances

REF REG: MODU-CODE 14.1.4.1

REF REG: SOLAS II-2

REF DWG: Fire Control & Safety Plan DA500D001 Rev 1

8.3.1 Shipboard Safety Plan

The Shipboard safety plan is part of the Fire Control and Safety Plan which is placed at the following locations on the vessel:

- Accommodation
- Main Deck
- Tween Deck
- Wheelhouse

8.3.2 Life-Boats

REF DOC: Life boat user manual

The vessel has been provided two totally enclosed life-boats. One of these is a gravity davit launching type and other is a freefall type.

8.3.2.1 Lifeboat No. 1 (Davit Type)

A gravity davit launch type lifeboat(No.1) is provided beside the main crane foundation on Stbd side FR 130,

Key details of the lifeboat are:

Type	Fiberglass reinforced plastic (FRP) totally enclosed type
Engine	Fresh water-cooled diesel engine with electric and manual starting devices
Capacity	80 persons
Speed	6 knots in smooth water

Lifeboat No.1 is tested to an air gap up to 24.5 m. It has to be noted that during heavy lifting crane operation it may occur that lifeboat No. 1 cannot be lowered due to its proximity to the load to be lifted.

8.3.2.2 Life Boat No.2 (Free Fall Type)

A free fall launch type lifeboat(No.2) is provided aft under the crane boom foundation.

Key details of the lifeboat are:

Type	Fiberglass reinforced plastic (FRP) totally enclosed type
Engine	Fresh water-cooled diesel engine with electric and manual starting devices

Capacity	60 persons
Speed	6 knots in smooth water
Maximum launching Height	36 m from water surface
Minimum launching Height	7 m from water surface to bottom of boat.

The maximum hieght of the life boat No.2 at maximum air gap of 23.9 m is expected to be 36 m above the water line.

For details of lifeboat launching and operations refer to user operations manual.

8.3.3 Fast Rescue Boat

REF DOC: Fast Rescue boat operations manual

The vessel is provided with One set of fast rescue boat on the platform behind the stbd aft Jack-Up-Leg.

Details of rescue boat are as follows:

Type	Rigid fast boat type
Engine	Inboard diesel engine with water jet
Capacity	6 persons
Speed	Abt. 32 knots with 3 persons

For details of rescue boat launching and operations refer to user operations manual.

8.3.4 Life raft

REF DOC: Life raft operations manual

The vessel is provided with seven davit launched life rafts with capacity of 27 persons each.

For the life raft locations refer to fire fighting and safety plan. For details of life raft launching and operations refer to user operations manual.

8.3.5 Life Jackets & Immersion Suits

The vessel has been provided with life jackets and immersion suits in each cabin and other commonly manned spaces. For details of life jackets and immersion suit locations refer to Fire control and safety plan.

8.3.6 Lifebuoys

The vessel has been provided with life buoys at various open decks. For details of different type of lifebuoys and their location refer to Fire control and safety plan.

8.3.7 Other Safety Equipment

8.3.7.1 SART

The vessel is provided with four Search and Rescue Transponders (SART) with two located in lifeboat and two at wheelhouse.

8.3.7.2 Rocket Parachutes

The vessel is provided with one set (12 cartridges) of Rocket Parachutes which are located at wheelhouse.

8.3.7.3 LTA

The vessel is provided with one Line Throwing Apparatus (LTA) which is located at wheelhouse.

8.3.7.4 Two Way VHF Radio Apparatus

The vessel is provided with four sets of Two Way VHF Radio Apparatus which are located on the 7th Deck.

8.3.7.5 EPIRB

The vessel is provided with one of Emergency position indication radio beacon (EPIRB) which is located on the 7th Deck.

8.3.7.6 Survival Craft Distress Signal

The vessel is provided with two sets (12 cartridges) of Survival Craft Distress Signal which are located at main deck.

8.3.7.7 Embarkation Ladder

The vessel is provided with three embarkation ladders which are located on 2nd deck and Main Deck.

8.3.7.8 Stretcher

The vessel is provided with one stretcher that is located in the Hospital.

8.3.8 Means of escape

REF REG: MODU-CODE 14.1.4.2

REF DWG: Fire Control and Safety Plan DA500D001 Rev 1

Personnel must be instructed to familiarise themselves with the escape routes from all compartments of the lifeboat, and the locations of the life saving appliances such as the life boats, life rafts, escape ladders, and escape ropes.

For details of available means of escape from each area refer to the markings shown on fire control and safety plan drawing.

8.4 Emergency Signals & General Preparations

8.4.1 Emergency Signals

The following emergency signals, either by audio visual alarm or by verbal announcements on public address system are used depending on the type of emergency.

Emergency Situation	Signal
General Alarm	7 short blasts followed by one long blast. This alarm signal shall continue until it switched off manually.
Abandon Ship	short blasts followed by long blast repetitively . This alarm signal shall continue until it switched off manually.
Pollution	Announcement by Public Address System
Damage to hull	
Excessive Storm Approaching	
Ice Alert/Low temperature	
End of emergency	

To avoid confusions, all signals by alarm bells should be confirmed also by Public Address System by platform Master, radio operator or by another designated person. Signals could be repeated several times, taking between them an enough interval to be clear understood.

The Master is responsible for reporting of any accident, incident, damage or other limitation of the vessel operation capacity. Establishing and maintaining of quick and efficient communication connections between vessel and the Company, national authorities and Rescue Co-ordination Centre are essential in an emergency situation. The persons who conduct the response action on board the platform must co-ordinate their actions with those who ensure the support from shore for the rescue/salvage and/or cleaning operations, maintaining a permanent change of information.

8.4.2 General Preparations for Emergency Situations

REF DOC: Company IMS Contingency Plans

An emergency situation can occur at any time without notice whether the vessel is afloat or in the elevated condition. In all cases it is important for the personnel involved in the operation of the vessel to have a sound knowledge of the vessel's systems, the location of principle equipment, controls, valves etc. Successful damage control is said to be 90% preparation before and 10% action after damage.

The following preparatory actions to be followed during normal operations include the following (mostly while floating):

- Know about the vessel's reserve buoyancy and stability. Reserve buoyancy is the buoyancy of the vessel above the floating draft that always acts in opposition to forces trying to heel or trim the vessel.
- Be familiar with the vessel's ballast, bilge, & seawater systems and their controls.
- Maintain the vessel and it's equipment in a proper working condition. All the bilge/ballast valves shall be in good condition.
- Maintain maximum watertight subdivision while floating. Any manholes should be closed as soon as the work relating their opening is completed.
- At all times be aware of the loading conditions of the vessel. Know what must be done to successfully counteract damage to prevent the vessel from sinking and capsizing.
- All Personnel must be familiarize themselves with the escape routes from all compartments of the vessel, and the locations of the life saving appliances such as the life boats, life rafts, escape ladders, and escape ropes.

8.5 Man Overboard

REF DOC: Company IMS Procedure for Man over board

REF DWG: Fire Control & Safety Plan DA500D001 Rev 1

Man overboard is an emergency situation in which a person has fallen off the vessel into the water. Emergency alarm signals are given by general alarm bell and are followed by public address (PA) announcement with additional details of the emergency. A MOB-UV light system is also provided on the vessel for search operation at night. In the event of a person falling overboard, take the following actions, generally in the order indicated:

- Throw life buoy as close to the person overboard as possible.
- Post a lookout to keep the person constantly in sight.
- Hail and pass the words "Man Overboard" (also indicate the location) to the radio operator on watch and notify the Master.
- Alert the standby boat at the platform and other vessels in the area.
- Muster a recovery crew to man the rescue boat.
- Recovery crew will prepare to launch the fast rescue boat to recover the person.
- Alert the medic on duty.
- Notify the designated shore side personnel (who will dispatch a helicopter and physician, if required).
- As soon as possible after recovering any person who falls overboard, have the medic examine him for injuries, hypothermia and, if necessary, make a recommendation to send the person to shore for a thorough examination by a physician.

Additionally Company guidelines for Man Overboard given in IMS manual should be followed.

8.6 Pollution

REF REG: MARPOL – Annexes I, II, IV, V and VI

REF DOC: Company IMS procedures for pollution prevention and pollution containment

REF DOC: IOPP Certificate

REF DOC: Shipboard Oil Pollution Emergency Plan (SOPEP)

REF DOC: Oil Record Book

The vessel shall comply at all times with the relevant anti-pollution regulations. Discharge of oil and oily water directly to the sea is prohibited. The engine complies with NOx emission standards to burn MGO (Marine Gas Oil).The vessel has equipped with bilge water separator with 5 ppm below and no incinerator provided in the vessel.

The following are some instructions to make sure that no oil is ever discharged overboard:

- It is good practice to limit the filling of the fuel oil tanks to approximately 98% capacity to allow room for expansion of the fluid and to avoid pollution.
- Oily water from machinery spaces should be discharged through the approved oily water separator provided on the vessel.
- Precautions shall be taken to avoid spilling on deck or overboard.
- Catchment pans shall be provided under all connections to catch any spilled liquid.
- Spilled liquids shall be cleaned immediately and not washed overboard.
- All valves opened for the filling shall be closed tightly after the transfer has been completed.
- If hoses are used, they should be checked before connected for kinks, bulges, soft spots, cuts or slashes that penetrate the inner hose reinforcement.
- Where comings are provided to catch any spillage the drain plug must be in place.
- Hoses shall be blown clear after every use.

Other Company IMS procedures for pollution prevention should be followed.

In case there is an oil spill, it should be reported immediately as per Company IMS procedures. Instructions as per Ship Oil Pollution Emergency Plan (SOPEP) should be followed. A spill containment kit is provided on the vessel. It must be kept in good condition and readily available on board at all times.

8.7 Damage to Hull

REF REG: MODU-CODE 14.1.4.5

REF REG: MODU-CODE 14.1.4.6

REF DOC: Damage Stability Booklet

REF DWG: Damage Control Plan

8.7.1 General

In the event of a compartment being flooded through damage it is imperative to that all efforts are made to minimize the change in the vessel's trim and heel and to take corrective action to restore the vessel to an acceptable condition of trim and heel. Damage stability is a term used to describe the stability condition of a vessel after the watertight integrity of the vessel has been breached due to damage. Damage can be the result of collision with another vessel i.e. a workboat or tug, collision with a fixed object i.e. quay wall, or running aground.

8.7.2 Procedure

It is impractical to establish a set procedure to follow if the vessel sustains damage resulting in flooding of a hull compartment. Correct action taken in one case could be detrimental in another. However, the three basic steps to consider are:

- Determine the extent of damage.
- Minimize additional flooding.
- Return the vessel to an acceptable trim and heel
- Assess possibilities for soft pining the legs into the sea bed to prevent ship sinking.

The Damage Stability Booklet in conjunction with the Damage Control plan contains the various details of watertight subdivisions, watertight doors, hatches, pumping arrangement, counter flooding and down flooding arrangements. It serves the purpose to give the Master and the crew guidance in the case of damage. These instructions would help the crew in assessing the situation and determining the necessary actions to be taken in order to minimize consequences of the damage with respect to safety of persons on board and protection of the marine environment.

8.7.2.1 Actions to be taken Immediately after Damage

Once damage occurs, it is important to determine its location and extent. The following steps shall be followed:

- Sound the appropriate alarm and commence the appropriate muster procedure
- Stop all pumping of liquids.
- Ascertain which compartments are affected and determine the cause of flooding.
- Isolate the source of flooding. Use of any material to close and secure an opening in the hull is recommended. The free flow of water into the hull or the free flow of liquids between tanks must be isolated and stopped.
- Close all access doors, ventilation trunks, and bilge/ballast lines serving the affected compartments and the ones immediately adjoining them.

- Ensure that all other watertight and weather-tight closures are closed
- Take soundings of one compartment at a time to determine the extent of flooding. If unable to sound voids/tanks etc, apply de-ballast suction to the suspected damage area.
- Pump out flooded compartments and take other corrective action as appropriate to the situation. If the compartment is an oil tank, use anti-pollution measures as appropriate.
- As soon as possible, organize a roll-call to determine if any person is missing, and organize appropriate rescue operations.
- Start recording at regular intervals the draft of water at available reference points and maintain a continuous plot to determine:
- The after-damage drafts, heel, and trim.
- Whether the flooding is continuing or has been halted by the measures taken.

For details of pumping system for de-ballasting refer to the Damage Control Plan. Where permissible depending on water depth and time availability, consider jacking up the vessel to drain the water.

If flooding continues, and the heel and trim on the vessel is excessive, the following options are available to return the vessel to an equilibrium state in which the heel and trim are acceptable:

8.7.2.2 De-ballasting Other Compartments

De-ballasting from a tank at the same corner as the damaged compartment may be considered.

8.7.2.3 Counter flooding

Counter ballasting the space opposite to the damaged compartment may be used as a last resort to reduce list and/or trim if the increased draft and calculated stability will not further reduce the GM to a negative condition.

If all else proceed towards the nearest anchorage or safe haven or consider abandoning the vessel as per procedure given in Section 8.8

8.8 Excessive Storm

REF DOC: Company IMS Procedures for Excessive Strom

REF CKL: Company IMS Checklist for Excessive Strom

8.8.1 Definition

Utmost care must be taken to ensure that the storm survival limitations in elevated or floating modes given in Section 3.2.2 & Section 3.4.4 are not exceeded. However in the event that the survival limits of the vessel will be exceeded and an escape to shelter is not possible, the vessel is regarded as being in 'Excessive Storm Condition'.

8.8.2 Procedure

Once the Master has confirmed the impending excessive storm condition, the Master should contact designated shore side personnel like Company 'Designated Person Ashore' and/or other local authorities to consider evacuating the vessel. The Master should also organize transportation and logistics for evacuation. The Master must brief the crew to prepare the vessel for complete evacuation as per 'Dead Ship' procedures given in Section 8.10.

Based on vessel conditions and available time, the Master should prepare a schedule for evacuation of personnel. The schedule should be such that evacuation of all personnel is completed prior to arrival of excessive storm condition.

Time permitting; the Master may consider evacuation in a two phase manner. In such a case, a list of non-essential personnel to be evacuated in the first phase should be prepared. As a guide this should include all service personnel, stewards & cooks and any other additional person as determined by the Master.

Additionally, Company IMS procedures for excessive storm should be followed and respective checklist should be filled.

The evacuation of personnel from the vessel should be conducted in a safe and orderly manner as per procedure given in Section 8.9.

8.9 Vessel Evacuation & Abandon Ship

REF DOC: Company IMS Procedures for Evacuation

REF CKL: Company IMS Checklist for Evacuation

8.9.1 General

In an event where the emergency situation deteriorates or is expected to deteriorate to a level where the life of personnel is at risk, the Master should consider evacuating all personnel and abandoning the vessel. The Master shall have the absolute final authority regarding the decision to evacuate and shall order the evacuation by activation of the 'Abandon Ship' alarm followed by a special public announcement on the PA system to reconfirm his orders.

The Master should contact designated shore side personnel like Company 'Designated Person Ashore' and/or other local authorities to seek their assistance for evacuating the vessel. The mode of vessel evacuation should be decided by the Master based on the available options and the suggested weather window for their use. Major transportation alternatives are listed below in decreasing order of preference. Evacuation using lifeboats should only be considered as a last resort.

- Evacuation by Helicopter.
- Evacuation by Stand-by vessel.
- Evacuation by Lifeboats or other Life Saving Appliances.

If time permits, 'Dead Ship' procedures as given in Section 8.10 should be followed before evacuating the vessel.

The evacuation of personnel from the vessel should be conducted in a safe and orderly manner. Detailed procedures for vessel evacuation as per Company IMS manual should be followed and respective checklist should be filled up to ensure proper and safe evacuation.

8.9.2 Guidelines for Evacuation by Helicopter

8.9.2.1 Mustering Procedure

The mustering procedure and the instructions given by the Master shall be strictly adhered to. Personnel shall be instructed to report to the designated muster points and be checked off or recorded on the muster or POB list. The Master or designated person in charge of evacuation will assign personnel to each helicopter flight; personnel shall proceed to the helicopter reception area where further instructions will be given. Minimal personal possessions will be permitted to be carried on board the emergency evacuation helicopters.

8.9.2.2 Action Requirements for Staff Personnel

Master

- Contact the designated shore side personnel and advise them of action being taken including details of evacuation and the required helicopter facilities.
- Determine availability of helicopters from shore and adjacent installations (in conjunction with the designated shore side personnel).
- Decide between a partial evacuation of non-essential personnel and complete evacuation of all personnel on board.
- Make P.A announcement stating:
- Helicopter evacuation will be required.
- Issue specific instructions and the order of personnel to be evacuated.
- Location of mustering area (as per the station bill).
- Specific mustering procedures and timetable.
- Advise Field Control, standby boat and nearby installations of pending action. Request use of suitable nearby facilities for landing of the helicopters and discharging of personnel.
- Make sure that all personnel are accounted for. Order appropriate searches for missing persons, if it is safe and if time allows.
- Agree on equipment and system shutdown requirements.
- In the event of a total evacuation, inform the shore base, the standby boat when the last helicopter flight is ready to leave the helideck of vessel. The passengers shall include the Master, Client / Company representative, Radio operator and remaining emergency and crew members.
- Make sure essential vessel documents are taken:
- Log books including Electronic data log
- Vessel papers
- Up-to-date POB List

Designated Radio Operator

- On instructions from the Master:
- Continue to announce the personnel assigned to the evacuation flights.
- Dispatch Master messages to designated shore side personnel advising of impending action and helicopter assistance required. Standby for handling all further communications to and from shore base or other installations.
- Maintain contact with standby boat and other installations giving details of helicopter traffic.
- On instruction from Master, proceed to the helicopter reception area.

Designated Medical Officer

- Prepare casualties for helicopter transport.
- Supervise transportation and escort injured personnel to the helicopter.
- Ensure medical cards are attached to all casualties, showing:
- Name
- Nature of injury
- Medical treatment and drugs administered.

All Other Personnel

- Proceed to helicopter reception area as instructed.

8.9.3 Guidelines for Evacuation of Personnel by Standby Boat

8.9.3.1 Mustering Procedure

The muster point for evacuation by standby boat will be announced by Master. On announcement of evacuation by standby boat, all personnel not involved in emergency duties shall exit various compartments by the nearest exit and proceed to the muster point. All personnel must obtain and wear hard hats, work boots, warm clothing, and survival suits. Personnel must be instructed to refrain from re-entering the quarter's areas to retrieve personal items from their rooms. The means for transferring personnel from the vessel to standby boat will be one of the revolving cranes, while considering the maximum limitations for use of cranes with personal basket given in Section 6.20 and following personal transfer procedure given in Section 6.20.3.1. Special attention shall be given to the weather condition. Should the weather be too rough, alternative means of evacuation should be considered.

8.9.3.2 Action Requirements for Staff Personnel

Master

- Start evacuation preparations by making a PA announcement stating:
- Standby boat evacuation for personnel
- Specific instructions (muster point etc.)
- Advice standby boat Master of the plan of evacuation, confirm side of evacuation and crane to be used. Contact the designated shore side personnel and inform about the actions being taken and assistance required.
- Agree upon equipment and systems shutdown requirements.
- Inform standby boat, the number of personnel to be evacuated. Specify casualty, if any.
- Order the search for survivors in the water (in life-rafts) if necessary.

- Co-ordinate transfer of personnel with Master of boat and crane operator. No more than the allowable maximum number of people at a time in the personnel basket (Refer to Section 6.20).

Designated Radio Operator

- Remain in radio room until instructed by the Master to proceed to muster point.
- Liaise with shore base. Dispatch Master and Company representatives' messages to shore.
- Make the list of evacuated and remaining people.
- Proceed to muster point when instructed, carrying the lists of personnel.

Designated Medical Officer

- Prepare casualties for transport to muster point.
- Make sure medical cards are attached to all casualties, showing:
- Name
- Nature of injury
- Medication given
- Make sure that the hospital is cleared from any injured personnel.

Designated Muster Team Leader

- Lead the emergency team for the adequate action.
- Verify that all evacuated personnel are properly dressed.
- Keep the Master informed of the status of the emergency situation.

Crane Operator on Duty

- Call Radio operator to receive instruction on which crane is to be used.
- Stop all ongoing operations and start transfer of personnel as instructed by Master

8.9.4 Guidelines for Evacuation of Personnel by Life Boat

The evacuation of personnel from the vessel shall be conducted in a safe and orderly manner. The order to evacuate the lifeboat shall be given by the Master on activation of the "abandon ship" alarm.

8.9.4.1 Mustering Procedure

On sounding of the abandon ship alarm, all personnel not involved in emergency duties shall exit and proceed to the Muster Stations. All personnel must obtain and wear warm clothes and survival suites before embarking the life boat. Personnel must be instructed to refrain from re-entering the quarter’s areas to retrieve personnel items from their rooms. Personnel shall be directed to precede to their assigned life boat stations. If access to their station is blocked, or the assigned lifeboat cannot be launched, personnel shall be directed to the nearest alternate life boat/life raft and/or escape ladder or escape rope.

8.9.4.2 Action Requirements for Staff Personnel

Master

- Start evacuation preparations by sounding the abandon ship alarm (prepare to abandon the vessel).
- Make P.A announcement stating:
- Emergency evacuation will be required by life boat.
- Issue specific instructions.
- Advice Field Control, standby boat, if applicable, and any nearby boats and installations of actions pending. Arrange rendezvous point with standby boat and other vessels.
- Contact the designated shore side personnel and inform them of the action being taken and assistance required.
- Agree on equipment and systems shutdown requirements with the client representative and offshore construction manager.
- Ensure all personnel are accounted for. Order appropriate searches for missing persons, if it is safe and time allows.
- When all necessary shutdown actions have been completed, send remaining personnel to life boat muster points.
- Ensure essential vessel documentation is taken, i.e.:
- Log books including Electronic data log
- Vessel papers
- Up-to-date Personnel on Board (POB) list
- Proceed to muster station
- Contact other life boat muster points and when advised that muster checks are complete, give order to lower life boats (if dictated by the emergency), instruct life boats to depart.
- Embark into own lifeboat and order it's lowering.
- Inform standby boat and other vessels of the number of lifeboats and/or life rafts lowered and launched.
- Order the search for survivors in the water and in life rafts, if necessary.
- Proceed to the rendezvous point and co-ordinate transfer of personnel with Master of standby boat and other vessels.

Designated Radio Operator

- Dispatch Master / Company / Client representative messages to shore base, and contact nearby installations and any vessel in the vicinity.
- Transmit MAYDAY, and leave radio on automatic transmission.
- On instruction from Master, proceed to lifeboat station and operate emergency radio equipment.

- **Designated Medical Officer**
- Prepare casualties for transport by lifeboat.
- Supervise transportation and escort injured personnel to the life boat station(s), if necessary.
- Ensure medical cards are attached to all casualties, showing:
- Name
- Nature of injury
- Medication given
- Make sure that the hospital is abandoned.
- Proceed to lifeboat muster point with emergency medical supplies.

Designated Muster Team Leader

- On hearing abandon ship alarm; withdraw from fire or other emergency.
- Make sure all emergency team personnel are fully accounted for.
- Inform Master of the status of the emergency situation.
- Proceed to the lifeboat muster point with emergency medical supplies.

Second Person in Command of Life Boats

- Proceed to life boat station and prepare to check personnel muster lists.
- Check-off and record personnel against lists shown in POB's and advise the Master

8.10 Dead Ship Mode

REF REG: MODU-CODE 14.3

REF DOC: Company IMS manual for Dead Ship Mode

REF CKL: IMS Check List for Dead Ship Mode Operation

8.10.1 Definition

In the event that the vessel needs to be abandoned in elevated mode, it is important the vessel's equipment is shutdown and prepared for protection against adverse environment and water ingress during the shutdown period. This shutdown mode of the vessel is termed as 'Dead Ship' mode.

8.10.2 Procedure

The following procedure should be followed as a guideline to prepare the vessel for Dead Ship mode:

- Ensure that all procedures for 'Strom Survival Condition' have been followed.
- Secure workshops and storage spaces.
- Secure galley and living quarters and ensure that vents and dampers to these areas are shut.
- Shutdown all non-essential electrical equipments and cover them for protection if time permits.
- Seal off all vents and cooling air intake to electrical equipments.
- Start the emergency generator and shut-down the main generators. Close both supply and exhaust dampers to engine rooms.
- Close all vents, openings & dampers to the machinery deck.
- Close and Isolate Air receivers and Fuel oil tanks.
- Lift and secure the sea water suction mast.
- Verify that all ventilation openings, hatches and watertight doors are closed and secure.
- Secure all firefighting, life saving and safety equipment.
- Disable all radio room equipment with exception of hand held VHF radios.
- Leave the fog signal, obstruction and battery powered navigation lights operational.
- Stop the emergency generator and close the emergency generator room dampers before leaving the vessel.

The platform is now in dead ship mode.

8.10.3 Time Requirement to Prepare the Vessel

For a planned abandonment, a minimum of four (4) hours will be necessary to prepare the vessel.

8.11 Loss of Power / Black Out

8.11.1 Procedure in Case of Blackout

Blackout is detected if all main breakers to the main switchboard are opened, and the blackout inputs at the same time indicate no main switchboard voltage. The Blackout start generates a diesel generator start signal in the following way:

- If one or more diesel generators are already running offline, the diesel generator with the highest priority will be connected to the main switchboard when its frequency has reached a preset level (50 or 60 Hz).
- If no diesel generator is running, the first unblocked diesel generator in the standby sequence will be started and connected to the main switchboard when its frequency has reached a preset level.
- If the first diesel generator fails to start or fails to connect to the main switchboard, a subsequent diesel generator in the stand-by sequence will be started and connected. Main switchboard connection in this case means a PMS command executing an immediate closing of the diesel generator's main breaker to the main switchboard without synchronizing.

This procedure is independent if the tie breakers are closed or opened. Tie breakers will not be closed automatically by the PMS to supply a switchboard if no diesel generators are ready for blackout start on that section.

Sea water cooling pumps and FW cooling pumps will be started after blackout automatically by the automation system MCS PLATINUM.

Closing of feeder breakers for thrusters is not part of the PMS. They are controlled by interactions between the switchboard and the frequency converter.

8.11.2 Procedure for Restoring Mechanical, Electrical and Ventilation Systems

REF REG: MODU-CODE 14.1.4.8

The following guidance on the restoration of mechanical, electrical and ventilation systems after main power failure or emergency shutdown

When the main power supply has been interrupted and shut down, the following procedures should be used for restarting:

- Verify that the cause for the shut down has been corrected or is under control.
- Verify that the stability of the Unit has not been affected, and the mode of operation can be continued.
- Verify the safe condition of areas where conditions caused the initial shut down by checking safety systems, including fire alarm, General Alarm and public alarm system. Also check the bilge and ballast system, tank gauging system, and draft marks readings. Appropriately equipped personnel should be dispatched to any affected areas for verification of the situation.
- Restart trips and starters for the ventilation system and fuel oil pumps, as necessary.

- The main power can be restarted by using the platform air system. The main engines must be started by the diesel-driven cold start air compressor (battery started).
- When the correct r.p.m. and output of generator is obtained, transfer the main generator to on-line and shut down the emergency power system.
- Verify that the systems affected by the shut down are properly functioning and stable.
- Advice operations when the required power level is reached to resume operations.
- Note the time, duration, and problems occurred in the log book.

8.12 Ice Alert / Low Temperature

REF REG: MODU-CODE 14.1.4.9

The vessel is not designed for use in ice. Should the vessel encounter ice, following procedures are to be followed.

8.12.1 Ice alert procedures

REF DOC: Company IMS Guidelines for Ice Alert/ Low Temperature Procedure

There is no specific ice alert procedure. However, should the forecasts indicate temperatures may fall to zero or below then standard maritime vigilant watch procedures must be followed:

- The Master must review the weather conditions and instruct the other personnel to invoke cold weather precautions for the machinery, deck spaces and equipment. Such review should be conducted at a Vessel Management Meeting.
- A safety meeting attended by all personnel must be held prior entering the cold weather area, at which time all preparations and precautions should be discussed.
- To prevent damage to vessel and equipment, preventive measures must be adopted in freezing conditions.
- Location moves shall not be carried out or minimize vessel’s propulsion when snow or ice accumulations on the unit exist.
- Keep ballast tank below 95 % before arrival of cold weather areas.
- Avoid use of anchor in case of heavy accumulation in case of heavy icing, except emergency condition.
- All the snow or icing accumulation should be removed from the crane boom before the lifting operation commences.
- Should snow and icing conditions exist, snow or ice on the Helideck should be cleared immediately to prevent accumulations which are a safety hazard during helicopter landing.
- Special precautions will be taken to remove any ice or snow from main deck, Helideck, accommodation decks, roofs of jack houses and legs.
- Snow and ice accumulations on the hull should be treated as variable load and must be included in the loading conditions.
- Special care should be taken to prevent blocking of sea inlet by ice.
- All drain valves & strainers on all lines must be marked and numbered. Whenever draining is carried out, it must be done at all locations possible and air blown through to ensure complete drainage. In some cases, opening intermediate flanges may be required to ensure efficient draining.
- Proper lockout-tag out procedures must be followed to ensure that opening up a valve or starting up a pump does not inadvertently fill up, the lines that have been drained.
- Low temperature operating and maintenance instructions for all equipment on board should be followed.
- Since some components of the jacking system are not designed for ambient temperatures of below 0 ° C, jack house heating system should be activated.

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Figures

9 MACHINERY

REF DWG: Machinery Arrangement in AFT Machinery Space DA106M001

9.1 Main & Emergency Power Machinery & Systems

9.1.1 Main Generator Sets

The Platform is designed to be fully Diesel-Electrically driven. This way – due to the low overlapping of the high energy demanding load cases the overall capability is kept to an economically feasible minimum. However according to rules and to provide a minimum of redundancy, the system is just big enough to cope with load peaks in case they occur, without imposing operational restrictions to the main equipment or safety relevant operations in general.

Environmental conditions: All components and systems covered by the rules are to be designed to operate under the environmental conditions specified in Section 3.1

9.1.1.1 Engines

REF DOC: Genset's Technical Data 16V400M43S – 12V400P83

The diesel electric plant is based on 5 + 1 diesel electric generating sets. These generating sets are made by MTU Diesel Engine. The diesel engines are operated on Marine Gas Oil.

<table>
<tr><th>Maker</th><th colspan="3">MTU Diesel Engine</th><th>MTU Diesel Engine</th></tr>
<tr><td>Model</td><td colspan="3">16V4000M43S</td><td>12V4000P83</td></tr>
<tr><td>MCR</td><td colspan="3">2,080 kW</td><td>1,579 kW</td></tr>
<tr><td>Quantity</td><td colspan="3">5</td><td>1</td></tr>
<tr><td>Cylinder configuration</td><td colspan="3">V</td><td>V-LINE</td></tr>
<tr><td>Quantity of cylinders</td><td colspan="3">16</td><td>12</td></tr>
<tr><td>Speed</td><td colspan="3">1,800 rpm</td><td>1,800 rpm</td></tr>
<tr><td>Stroke</td><td colspan="3">210 mm</td><td>210 mm</td></tr>
<tr><td>Bore</td><td colspan="3">170 mm</td><td>170 mm</td></tr>
<tr><td rowspan="3">Specific fuel oil consumption in g/kW hr @100% MCR and ISO condition.</td><td colspan="3">Intake air temp. / Cooling water (raw) temp. deg.C</td><td>Intake air temp. / Cooling water (raw) temp. dg.C</td></tr>
<tr><td>25 / 25</td><td>45 / 32</td><td>10 /25</td><td>25 / -</td></tr>
<tr><td>205</td><td>209</td><td>205</td><td>209</td></tr>
<tr><td>High temperature cooling</td><td colspan="3">Fresh water</td><td>Fresh water</td></tr>
<tr><td>Low temperature cooling</td><td colspan="3">Fresh water</td><td>Fresh water</td></tr>
<tr><td>Start of engine</td><td colspan="3">Electric</td><td>Electric</td></tr>
<tr><td>Lube oil consum. (after 100h)</td><td colspan="3">0.3 to 1% of FOC</td><td>0.3 to 1% of FOC</td></tr>
</table>

9.1.1.2 Alternators

REF DOC: Genset's Technical Data 16V400M43S – 12V400P83

Each of the generating sets is composed of diesel engine with attached alternator which are mounted on a common bed frame with lube oil circulating tank and rubber chokes for a resilient mounting. The alternator data will be as follows:

Maker	**Leroy Somer**	**Leroy Somer**
Model	LSA 53 SB	LSA51.2 M60
Electrical Output	2,080 kW	1,579 kW
Quantity	5	1
Voltage	690 V	690 V
Frequency	60 Hz	60 Hz
Power Factor	0.8	0.8
Temperature Rise	F	F
Protection	IP44	IP44
Isolation Class	F	F

9.1.2 Emergency Generator

REF DOC: Genset's Technical Data MAN Diesel Engine D 2876 LE 203

Emergency generating set (diesel engine + alternator) is installed in the emergency generator room on upper deck.

MCR	350 kW
Speed	1,800 rpm
Quantity	1
Voltage	690 V
Frequency	60 Hz
Power Factor	0.8
Protection	IP23
Insulation Class	H

9.1.3 Description of Main Power System

REF DWG: Single Line Diagram DA880E021 Rev D

REF DWG: Electric Load Analysis DA800E001 Rev 2

9.1.3.1 Main Power System

The electrical power is generated by six generators at 690 v, 60 Hz frequency and fed to main 690 V switchboard. The 690 V main switchboard is installed in the electrical switchboard room which provides the power supply to all machineries and equipment. The main 690v switchboard is having three bus tie breaker sections each bus section is fed by two main generators. All thruster motors and jacking system are connected to the 690 Volt main switchboards. All the breakers in 690 Volt switchboards are Air circuit breakers and Molded Case Circuit Breakers. The emergency 690 V switchboard is connected to the main 690 V switchboard. Since the vessel is also operated on DP1 and DP2 mode therefore all the generator and thruster power distribution is done to achieve the 100% redundancy to satisfy the power requirement for DP operation as per rules and regulation. It means in any case of one bus failure or generator failure the proper DP operation can be achieved. Refer the load flow analysis and generator loading for each mode of operation, reference document: ELECTRICAL LOAD ANALYSIS - DA800E001 Rev 2. The voltage is step-down to 450 V through 2 x 1,000 kVA 690 V /450 V distribution transformers to feed the power to all auxiliary machineries which is operated at 450 V. The electrical voltage is further step-down to 230 volt via 300 kVA 450 V/230 V distribution transformer to provide the electrical power for lighting and all small power load at 230V.

9.1.3.2 Power Management System

All the 690V, 450V and 230Volt switchboards are centrally controlled and monitored by Power Management system (PMS system).The breakers for the DG-sets, the tie breakers in the 690 V MSB, the primary supply breakers for the 690 V/450 V transformers and the 450 V tie breaker in the MSB are controlled by the PMS. Transformer breakers on primary side can be controlled manually at the MSB or remote by the PMS. Transformer breakers on the secondary side will be automatically closed when primary CB is closed and power is available, 450 V Bus tie breaker is normally open and interlocked to the two secondary service transformer breakers. PMS system is also design for the synchronization of all DG set units, automatic start / stop functions, automatic synchronization and effective load sharing and it also design for parallel operation of the DG-Sets in closed bus bar and split bus bar configuration.

9.1.3.3 Modes of Operations

The following modes of operation are available on the PMS system.

- **Transit Mode of operation** - All the six DG set may be in working mode and all the tie breaker will be closed (single bus bar). In case of preferential trip all non essential consumers will be tripped.
- **DP Mode** - In this mode of DP operation all the six main generators are in working mode and all the tie breakers are opened (3 bus sections) and two thrusters are connected on each independent bus. In this mode the highest priority are for the thrusters and preferential trip is activated. Degradation from DP2 to DP1 is possible by switching from DP mode of operations to transit mode of operation.
- **DP and Jacking operation** - Under this mode of operation the leg lowering operation is also required while the vessel in DP mode. In this mode of operation DP system has higher priority than jacking system. The PMS shall limit the power available to minimum power instantly when preferential trip system is activated.
- **Jack Up Operation** - In this mode jacking system becomes essential in the vessel and no thrusters are running. Thus preferential trip system shall not activate tripping of jacking main hydraulic pump motors but all other non-essential consumers are tripped. In this mode, main switchboard shall have a single bus bar. This activity shall be done after standing-on which electrical load is stable synchronization of main bus bar sections is allowed.

  During DP operation, 450VAC & 230VAC bus tie breakers are normally opened but it will be better to isolate / rack-out the bus tie breakers from the bus bar to prevent mal- operation of tripping the bus tie into close position or the interlocking system failed.

9.1.4 Description of Emergency Power System

REF REG: MODU-CODE 14.1.4.3

The following description of the emergency power system and limiting conditions of operation

The emergency power distribution system is handled by 690 V ac and 230 Vac, 3 phase, 60 Hz, emergency switchgear. This switchgear protects and controls the emergency generator and provides starting control and running regulation for the emergency generator diesel engine. The emergency switchgear normally receives its power from the AC distribution switchgear through a feeder to an automatic transfer switch which forms part of the emergency switchgear. Upon loss of power, the emergency bus supply is transferred to the emergency generator.

The emergency generator has a rating of 437.5 kVA, 690 V, 3 phase, 60 Hz alternating current. The generator is driven by a MAN Diesel Engine diesel engine. Upon activation of emergency power, The 690 V Emergency Switchboard will power 230 V Emergency

Switchboard via 130 KVA, 690 V /230 V Transformer connected to 690V Emergency Switchboard Feeder. It is also recommended that all non essential loads connected to Emergency Generator must be shut off and only essential equipments should runs from Emergency Generator in the event of emergency.

In the event of a blackout or fault the power management system starts the diesel generator with the highest priority that is in automatic mode and ready for start. Sets are available if

- They are in automatic mode
- They are ready
- There are no unacknowledged circuit-breaker alarms preventing synchronization

Blackout can be happen only for a local net side (690 V bus A, B, C) or for more than one local bus in case of closed tie breaker. The tie breakers trips only in case of faults at one network side.

In addition to the respective diesel starter functions, the Blackout start system includes a blackout control for the diesel generator's main breaker. In order to execute a Blackout start, at least one diesel generator has to be in remote control and unblocked.

There exist 4 different power limitations in the PMS/ABB system.

ABB Frequency guard: If a frequency drop of 3 Hz on the main supply of the drive should occur, the converter will limit its power to 30%.

PMS power available signal to ABB drives: In TCS mode the PMS calculate the maximum available power for the ABB drives as follows:

The thruster drive shall receive a 4-20 mA signal, 20 mA=1,600 kW=100%. If available power is 800 kW, and no thrusters are running, the signal shall be 12mA.

If there are two thrusters running at 400kW each, on one bus with 800kW available power, the signal shall be (400 kW+800 kW) 16 mA. If one thrusters load is increased by500 kW, the available power decrease by 500 kW and the remaining is 300 kW. The signal shall be 400 kW (used)+500 kW(increase)+300 kW(available), still 16 mA. If the thruster is given rpm order 100% in this situation, the power will stop at 16 mA=1,200 kW. The rpm is not allowed to increase and "load reduced" signal is activated.

DP power limiting: When the ship is operated in either IBJS or DP mode the DP system

Makes a continuous power limiting of the thrusters Hardware:

- Digital Inputs to DP system: auxiliary contact of generator CB and coupling breaker f or breaker position
- Analogue Inputs to DP system: power transducer in 690 V-switchboard calculates the actual power of each generator, transmit the signal as 4 -20 mA to the DP system. The calculation is totally independent of the PMS.

The DP system calculates by these data the available power for the propulsion and a speed set value for the converters, which limits the propulsion power to in maximum of 95% of the available generator power. This set value is based on load balance of running generator in case all bus tie breakers are opened or closed. I.e. in case of loss of one generator, the speed set values will be reduced by the DP system to values which do not overload the generators.

Jack up system power limiting at 90%: The PMS sends a 4 -20 mA signal to the jack up system for max power available to the jack up system. Scaling of this signal is 0-1,330 kW.

9.2 Description of Control Room & Electrical Equipment

9.2.1 Engine Control Room

REF DWG: Arrangement of ECR DA891E010 Rev 1

The engine control room is equipped with the following equipments

Main Equipment	Functions
Engine Control Console	It is used to monitor and control all the Engines operation.
Field Stations	There are four no. of field stations in the ECR room which is having all the input and output modules. Field stations are connected with engines and engine control panel.
690V MCC MD-MCC05: AFT AC 690 V AUXILIARY MCC MD-MCC06: AFT AC 690 V AUXILIARY MCC	2 No. of 690 V MCCs
DC 24 UPS – For Automation System	2 nos. of Uninterrupted power supply automation equipments
230 V AC UPS – Thruster Control Panel	3 no. of UPS for the Thruster control system.
Signal Light Column	It gives the audio visual emergency information in the ECR room

9.2.2 Control Panels and Switchboards

For the details of control panel and switchboards refer following documents

REF DWG: Arrangement of Switch Cabinet Room DA891E020 Rev 2

REF DOC: Main switchboard DV691E001

REF DOC: Emergency switchboard DV691E002

REF DOC: Group Starter DV691E003

REF DOC: Distribution Board DV691E004

REF DOC: Local Starter DV691E005

REF DOC: Shore Connection Box DV691E006

Description	Voltage Level	Functions
690.00 V Main Switchboards	690 V	Feed power to the Thrusters, jacking system and main crane
Emergency Switchboard	690 V	Feed power to all emergency equipments such as fire pump, life davit, foam pump etc. Emergency lighting and other equipment on 230V
Group Starter: MD-MCC01,02: FWD AC & MD-MCC03 to 06: AFT AC	690 V	Group starters are named as Motor control centers (MCC) there are six no. of MCC to Centrally control all auxiliary machineries such as fire pump, bilge ballast system pumps, lube oil system, fuel oil system etc.
Distribution Board	690 V, 450 V & 230V	Feed power to equipments other than Pumps and motors such as normal power sockets, lighting fixtures etc.
Local Starter	690 V	Panel for Locally control of (on / off) auxiliary machinery pumps and motors.
Shore Connection Box 400V 50Hz 450V 60Hz 2 Set	450V 400 V	Connecting Shore Power to Vessel
Test Panel	450V	Using for testing of electrical equipments on the vessel

9.3 Lifting Equipment

9.3.1 Main Crane

REF DOC: Main Crane (Liebherr) operating manual, BOS 35000–1000 LITRONIC Serial No.170564, 170565

REF DOC: Main Crane (Liebherr) Technical data sheet 170 564 – 565 – 050 Rev 3

REF DOC: Main Crane (Liebherr) Load charts 170 564 – 565 – 100 Rev 0

REF DOC: Crane Stability Booklet DA101Z034

Refer Section 1.3.6.1for futher details of main crane.

9.3.1.1 Drive Details

Motor Manufacturer	ABB
Motor Model	M3BP 355 MLB-4
Main supply Supply Emergency power pack Auxiliary supply Emergency supply	690 V , 60 Hz 690 V , 60 Hz 230 V , 60 Hz 230 V , 60 Hz
Simultaneous motion	Three motions with full load and reduced speed.

Refer Section 1.3.6.1 for futher details of main crane

9.3.2 Auxiliary Crane

REF DOC: Operation manual technical description offshore crane 6.5T - 15M

REF DOC: V/D of provision crane DV563D001 Rev 0

Refer Section 0 for futher details of auxiliary crane.

9.3.3 Other Power Operated Lifting Crane / Devices

- Two (2) auxiliary cranes, for operation of the life raft, as well for handling the bunkering hoses, towing equipment and fender will be installed on the 2nd upper deck platform port side and starboard , to service 5.00 t SWL
- One (1) rescue boat davit STBD side for operation of the fast rescue positioned on the platform behind the STBD aft Jack-up leg.
- One (1) life raft davit at aft port side for operation of the life raft.
- Electrically operated I-beam hoist above the hydraulic power units
- One(1) electrically operated I-beam hoist abiove the hydraulic power units, and one(1) air chain hoist without trolley for maintenance of Diesel Sets.
- One(1) electric operated I-beam hoist placed in engine store and workshop and terminated engine room bulkhead.

9.4 Jacking System Equipment

REF DOC: MUNS Operation Manual for Jack up System DA101D030 Rev 0

9.4.1 Key Specification

Key specification for jacking equipment is given in section 1.3.3 and section 6.1.

9.4.2 Hydraulic Equipment Details

The hydraulic system is for the jacking system that is designed to lift a barge out of the water by means of four legs, standing on the seafloor.

The jacking system is driven by the hydraulic power pack unit (HPU). The hydraulic power pack is composed of Hydraulic fluid tanks, electrically driven hydraulic pumps, hydraulic fluid cooling unit, 3 central manifolds and leg jacking manifolds.

Other components of the jacking system are the hydraulic jacking cylinders, locking pin, and the hydraulic horizontal position system.

9.4.2.1 Hydraulic Pump

Maker	Parker
Model	PV270 (variable axial piston (triple) pump (3 Stage)
Quantity	18 sets (3 for 6 motor)
Nominal volume	270 cc
Nominal pressure	350 bar
Max pressure	420 bar

9.4.2.2 Hydraulic Pump Motor

Maker	ROTOR
Model	5RNN355-04B5
Nominal power	460 kW S1 Duty
Speed	1,780 rpm
Voltage	690 V, 60 Hz, 3phase
Standstill heating	200 W, 230 V, 60 Hz, 1 phase
Sensors	3 x PT100 sensors
Sensors	2 x PTC alarm/stop

9.4.2.3 Hydraulic Fluid Tanks

No. of Tanks	2
Capacity	Max:17,500 L Normal Operating: 13,000 L in each tank considering all cyl. pistons in mid position
Material	Stainless steel 1.4301 (AISI 304)
Components	2 manholes, Drain valve Air vents with air dryers
Instruments	Thermometer Level alarms (low, high, low low) Temperature alarm, Thermostat

9.4.2.4 Hydraulic Oil Cooling System

Water/oil coolers for fresh water	4 pcs
Heat dissipation	210 kW
Oil outlet temperature	40 °C approx
Required sea water flow	330 L/min
Maximum sea water inlet temperature	30 °C

Oil circulation pumps with electric motors	4 pcs
Make / Model	ROTOR / 5RN160M02K
Motor power	12.5 kW
Speed	1,774 rpm
Voltage	690 V, 60 Hz
Hydraulic pump flow	310 L/min
Electric dual starting gear/control box	2 pcs

9.4.2.5 Hydraulic Central Valve Manifold

Central valve manifolds	3 pcs
Location	Pump room
Components	Check valves, Safety valves

9.4.2.6 Hydraulic Leg Jacking Manifold

Hydraulic leg jacking manifolds	4 pcs
Location	Near the legs
Components	Cartridge v/vs, Directional v/vs Proportional flow control v/v, Safety v/vs

9.4.2.7 Hydraulic Jacking Cylinder

Hydraulic differential lifting cylinders	630 /280 mm Max. Stroke 3,000 mm
Quantity	48 pcs (12 sets per leg, 6 sets per ring)
Bore	630 mm
Piston Rod	280 mm
Stroke	3,000 mm
Design Pressure	370 bar
Test Pressure	4,480 bar
Outside diameter	810 mm approx

9.4.2.8 Hydraulic Horizontal Position System

Hydraulic differential horizontal cylinders	250 /180 mm Max. Stroke 100 mm
Quantity	12 pcs
Bore	250 mm
Piston Rod	160 mm
Stroke	100 mm
Design Pressure	250 bar
Valve manifold	Proportional valve, Check valve Directional valves, Pressure safety valve Accumulator
Instruments	Stroke measuring device Pressure transducer

9.4.2.9 Electronic and electric control equipment

Electric motor switchgear	3 pcs, IP 55 Soft starter 3,000 x2,200x500 mm
Electric Control boxes (placed on the cooling unit in pump room)	2 pcs, IP65, 600x800x300 mm
Electric Control boxes (near the leg hydraulic manifold)	4 pcs, IP65, 600x800x300 mm
Electric operating panel (near the jacking houses)	4 pcs, IP65
Electric operating panel (on the jacking bridge)	1 pcs (with PLC, 2 industrial PC with touch screen monitors, windows XP remote and LAN connections

9.5 Thrusters

REF DOC: Thruster Drawing AQM UL 2011FP Rev F

REF DOC: Service Manual Mechanical & Hydraulic AQM UL2011FP

REF DOC: Service Manual/User Guide Aquapilot Control System AzT UL2011FP

REF DOC: Operation Manual for Lifting / Lowering of AQUAMASTER Ul Unit

REF DOC: Thruster Interaction Test Manual MARIN Report 24067-3-VT.

9.5.1 Description

The vessel is equipped with six retractable fixed pitch azimuth thrusters driven by frequency converter-controlled motors. Thrusters are installed at the forward, aft and midship locations.

Thruster maker	Rolls-Royce
Model	AquaMaster UL2011FP (retractable)
Rating	1,600 kW
Quantity	6
Motor maker	ABB
Rating	1.6 MW
Insulation Class	F
Temperature Rise	F
Frequency converter	ABB
Model	ABB STADT 6-AC-2-0, 2000A
Motor speed range	0 – 1,200 rpm
Lifting / Lowering Time	160-200 / 180-220 sec
Location	2 @ FWD, 2 @ AFT & 2 @ midship

Thrusters are equipped with a hydraulic power pack (HPU) that provides the hydraulic power for the rotation and lubrication.

The HPU consist of a triple vane pump which includes lubricating oil/clutch pump.

Lube oil is drawn from the propulsion body and passes through a duplex filter equipped with a differential pressure switch. The mounting and de-mounting of thrusters can be done at the dry dock only.

9.5.2 Thruster Configuration and Forbidden Zones

- The forbidden zones arise from thruster-thruster interaction and thruster-leg interaction.

Transverse force increases when a (larger) forbidden zone is applied, which reduces the affectivity of the DP system.

DP system controller incorporates these forbidden zones and would automatically steer the upstream thrusters out of its forbidden zone

The table below shows the different forbidden zones.

Thruster-Thruster Interaction, Selected forbidden zones [deg]							
	Zone	SBA	PSA	SBM	PBM	SBF	PSF
Zone 1	direction aligned thrusters	-90.0	90.0	-5.4	5.4	-90.0	90.0
	½ forbidden zone	5.0	5.0	6.0	6.0	5.0	5.0
	Forbidden zone start	-95.0	85.0	-11.4	-0.6	-95.0	85.0
	Forbidden zone end	-85.0	95.0	0.6	11.4	-85.0	95.0
Zone 2	direction aligned thrusters	174.6	-174.6	-48.8	48.8	5.4	-5.4
	½ forbidden zone	5.0	5.0	6.0	6.0	5.0	5.0
	Forbidden zone start	169.6	-179.6	-54.8	42.8	0.4	-10.4
	Forbidden zone end	179.6	-169.6	-42.8	54.8	10.4	-0.4
Zone 3	direction aligned thrusters	-131.2	131.2	-90.0	90.0	-48.8	48.8
	½ forbidden zone	6.5	6.5	5.0	5.0	6.5	6.5
	Forbidden zone start	-137.7	124.7	-95.0	85.0	-55.3	42.3
	Forbidden zone end	-124.7	137.7	-85.0	95.0	-42.3	55.3
Zone 4	direction aligned thrusters	-	-	-131.2	131.2	-	-
	½ forbidden zone	-	-	6.0	6.0	-	-
	Forbidden zone start	-	-	-137.2	125.2	-	-
	Forbidden zone end	-	-	-125.2	137.2	-	-
Zone 5	direction aligned thrusters	-	-	-174.6	174.6	-	-
	½ forbidden zone	-	-	6.0	6.0	-	-
	Forbidden zone start	-	-	-180.6	168.6	-	-
	Forbidden zone end	-	-	-168.6	180.6	-	-

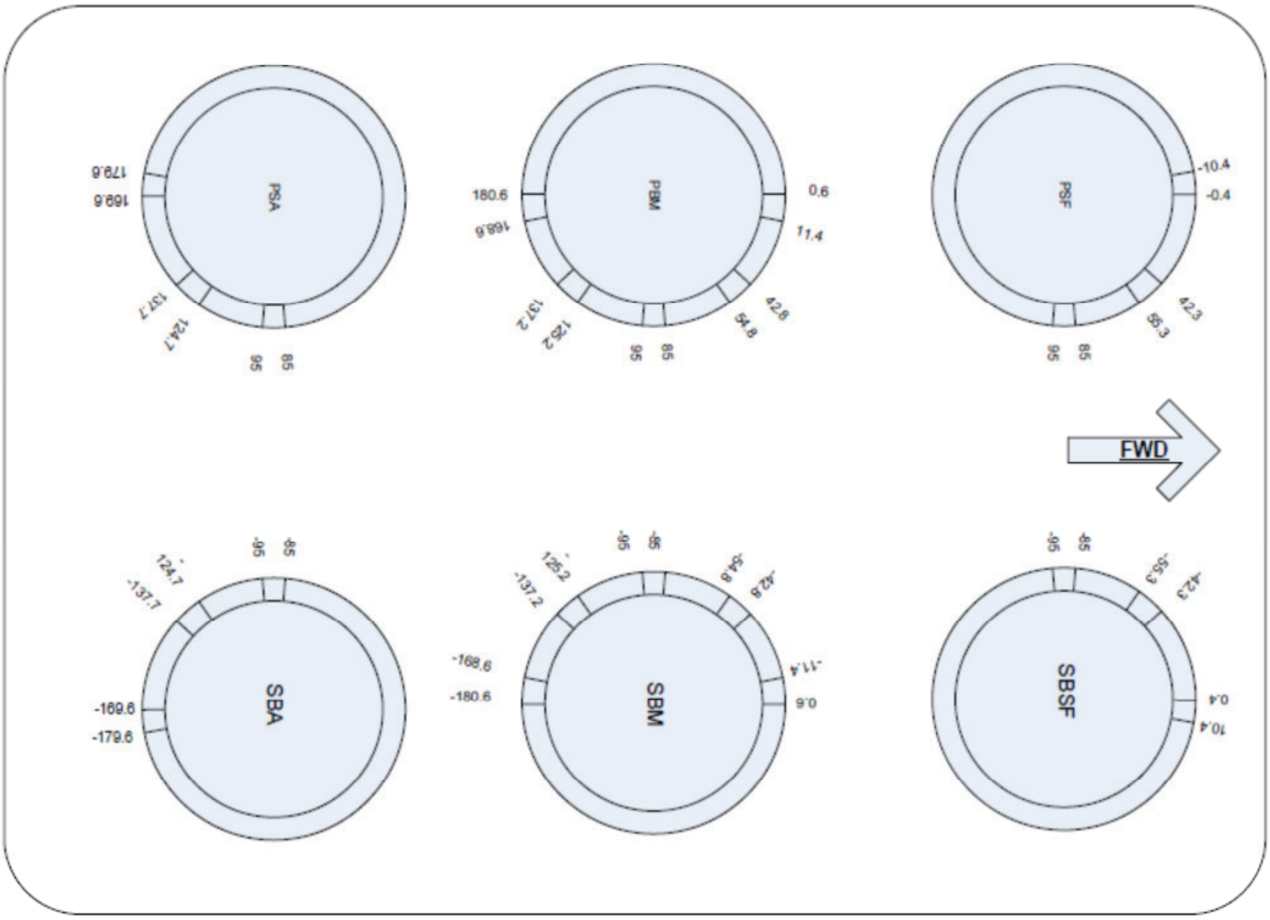


Figure 9-1 Thruster - Thruster Forbidden Zones

	Thruster-Leg Interaction, Selected forbidden zones [deg]						
	Zone	SBA	PSA	SBM	PBM	SBF	PSF
Zone 6	direction aligned thruster	6.8	-6.8	-	-	173.2	-173.2
	½ forbidden zone	16.0	16.0	-	-	16.0	16.0
	Forbidden zone start	22.8	9.2	-	-	157.2	170.8
	Forbidden zone end	-9.2	-22.8	-	-	-170.8	-157.2
Zone 7	direction aligned thruster	-69.9	69.9	-	-	-110.1	110.1
	½ forbidden zone	6.0	6.0	-	-	6.0	6.0
	Forbidden zone start	-63.9	75.9	-	-	-116.1	104.1
	Forbidden zone end	-75.9	63.9	-	-	-104.1	116.1

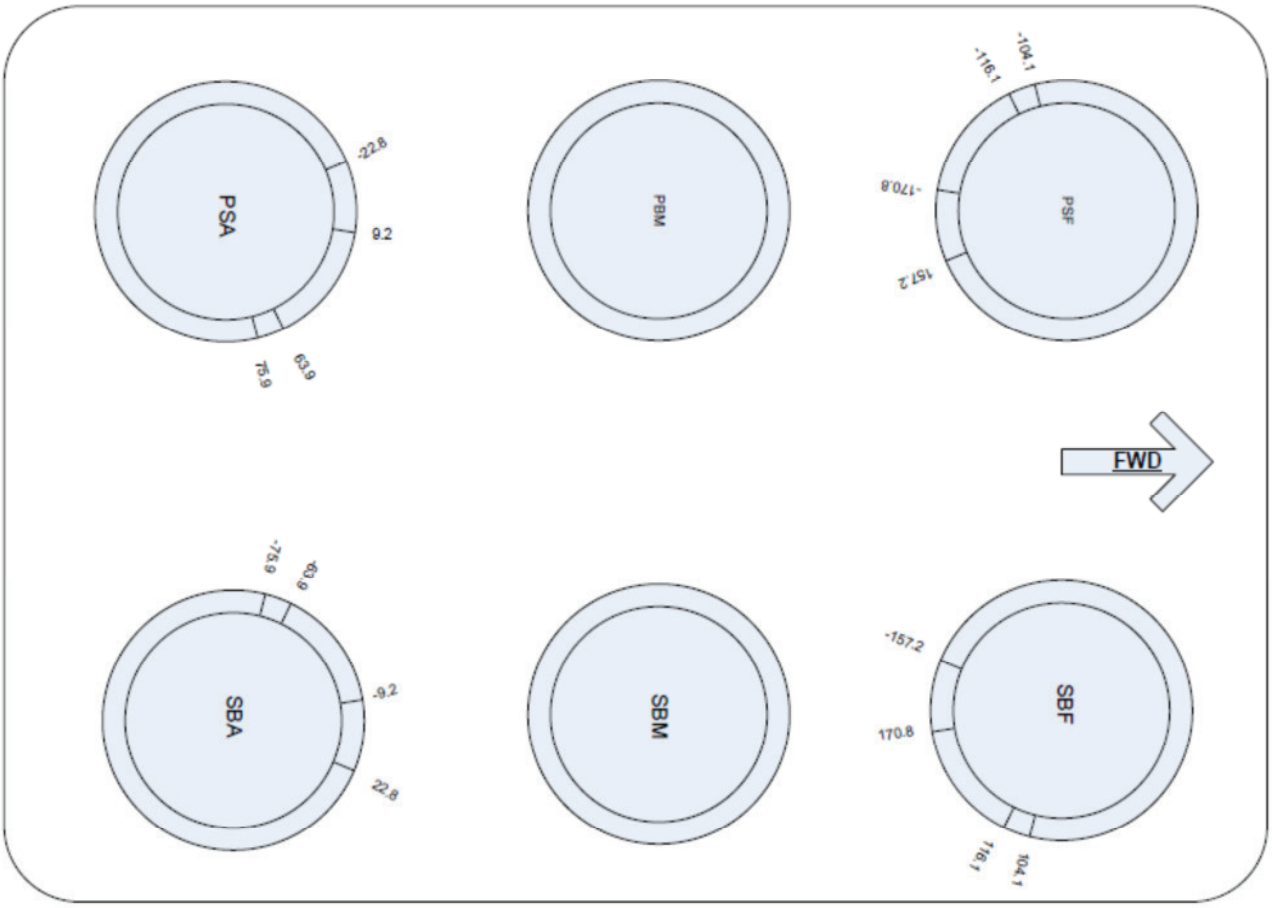


Figure 9-2 9 2 Thrusters-Leg forbidden Zones

The recommended thrusters configuration during track pilot (Auto heading) Mode is shown in the graph below, FWD and Middle thrusters to be fixed Inbound and outbound simultaneously while AFT thrusters shall be freely rotatable and controlled by the ATOW. In Manual mode it is recommended to adjust the thrusters in a similar fashion as seen on the figure below.

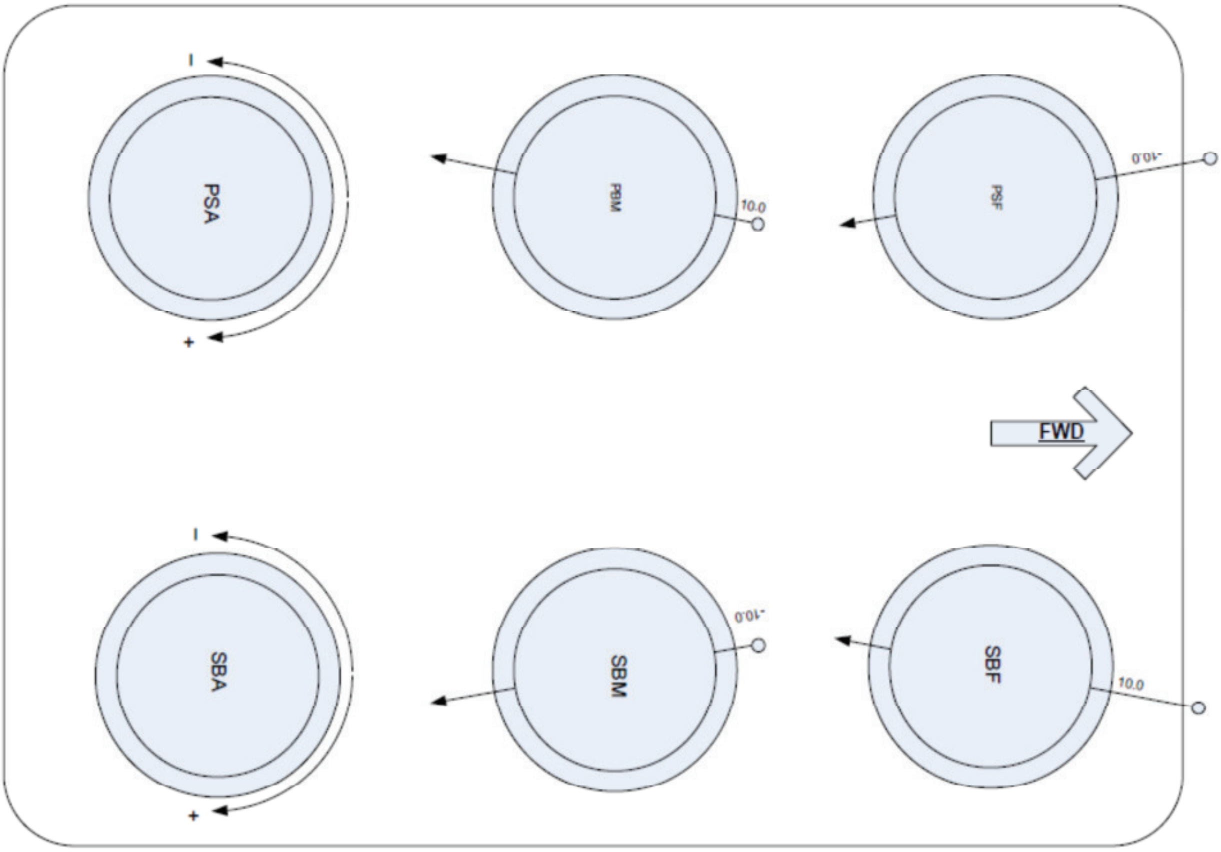


Figure 9-3 Recommended Thrusters Configurations In Auto Mode

9.5.3 Thruster Retraction Procedure

Lifting / lowering system works by the means of electric controlled hydraulic system. The main functions are unit up-down and shaft line engaging / disengaging. Control positions are the local one at the Aqua Master (AQM) unit and remote control by Integrated Automation System (IAS).

The time for lifting and lowering is depending on following things

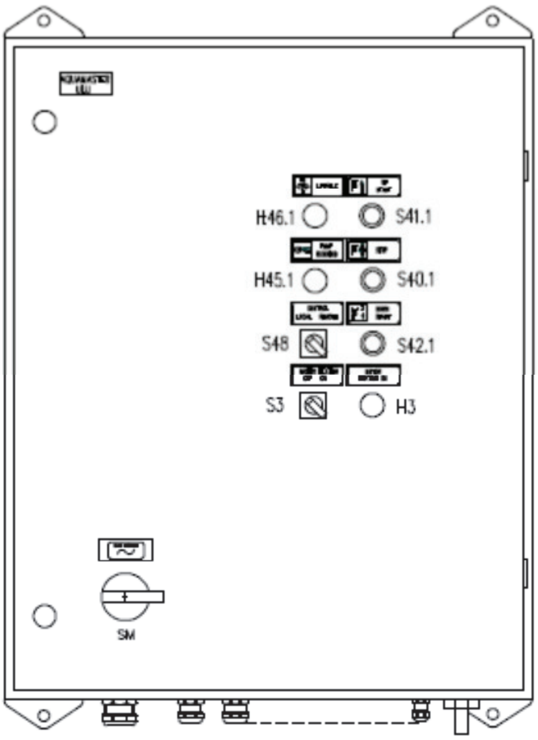
- External loads (ship on water or not)
- The oil temperature (viscosity)

The average time for thruster retraction is 4 minutes.

9.5.3.1 Starting of the Lifting / Lowering Operation by Local Control

- Stop the prime mover (The safety system does not allow lift / low operation if the prime mover is running).
- Turn Aqua Master to a certain lifting direction. Indicators on the local starter and on the remote panel indicate when unit is in liftable direction.
- Stop the hydraulic and lubrication pumps.

Lifting / Lowering Pump Starter



Local Control

Switch on power supply by SM

Lifting the Unit

- Select LOCAL control by switch S48. If H46.1 indicates, the unit is in liftable direction. Push the button S41.1 to start the lifting
- Operation.
- Now the lifting pump is started up and the detachable shaft will be disengaged. The unit goes automatically to the uppermost store position and the lifting pump stops.
- If there is any reason to stop the move, it can be made by the STOP-button S40.1.

Lowering the Unit

- Make sure that the unit is in liftable direction.
- Start the lowering by the button S42.1. The lifting pump starts and the unit goes down to the lowermost position. Thereafter the detachable shaft engages automatically. The lifting pump stops and the Aqua master is now ready for maneuvering use.

9.5.3.2 Remote control by Integrated Automation System (IAS)

Integrated automation system gets needed Aquamaster UL unit's position information from UL lifting / lowering control unit (ULU). Thereby IAS can operate UL unit properly, all safety interlocks are working also under IAS control.

Interface between IAS and Aquamaster

Integrated automation system to Aquamaster

- Start Lifting
- Start Lowering
- Stop Lifting / Lowering

Aquamaster to Integrated automation system to

- Lifting Pump Running
- Unit Lifted and Locked Up
- Unit Down
- Unit Down and Shaft Engaged
- Unit In Liftable Direction
- Remote Lifting / Lowering Control Prevented

9.6 Other Equipment

9.6.1 Anchor Winches

REF DWG: Arrangement of Anchor Handling DA431D001 Rev 1

REF DOC: HATLAPA Windlass Operation Manual

Total number of windlass/vessel	2
Anchor Operation	
Category	K3
Thickness of chain link	68 mm
Nominal chain pull	220 kN (22.43 t)
Maximum chain pull	330 kN (33.64 t)
Hauling nominal speed of chain cable	10 m/min
Slow speed of chain cable	3.3 m/min
Holding load of cable lifter brake	1,654 kN (168.6 t)
Warping End Operations	
Max. pull at warping end	125 kN (12.74 t)
Nominal speed at warping end	19 m/min
Light line speed at warping end	37 m/min
Driving Motor	14.6/44/44 kW, 690 V, 60 Hz

9.7 HVAC System

9.7.1 Design Temperatures

Ambient Air (summer) + 35 deg. C @ 70% Relative Humidity

Min Sea Water Temperature - 20 deg. C @ 50% Relative Humidity

9.7.2 Ventilation for AFT Machinery Space

REV DWG: Ventilation Diagram in AFT Machinery Space DA574M002-02

The following fans are provided:

Fan Name	Volume (m^3/hr)	Description
Packaged Unit for Engine Workshop and Store	9,500	Cooling and heating
Packaged Unit for Switch Cabinet Room	3,500	Cooling and heating
Packaged Unit for ECR and Elec Workshop & Store	4,500	Cooling and heating
Packaged Unit for Hydraulic Power Pack Room	15,000	Cooling and heating
Thruster Room 1 Supply Fan	10,000	Axial
Thruster Room 2 Supply Fan	10,000	Axial
Thruster Room 3 Supply Fan	33,300	Axial
Thruster Room 4 Supply Fan	33,300	Axial
Engine Room Supply Fan No. 1	2,00000	Axial
Engine Room Supply Fan No. 2	2,00000	Axial
Emergency Generator Supply Fan	24,000	Axial
Flame Cutting Area Exhaust Fan	600	Axial

9.7.3 Ventilation for Accommodation

REF DWG: Schematic Design of HVAC System for Accommodation DA571A301 Rev 3

The following fans are provided:

Fan Name	Volume (m^3/hr)	Description
Sanitary Exhaust Fan	4,250	Centrifugal
Galley Supply Fan	1,890	Axial
Galley Exhaust Fan	5,040 / 3,390	Axial
Ambulance Exhaust Fan	693	Duct Fan
Machine Room Supply Fan	3,590	Axial
Welding Exhaust Fan	366	Duct Fan
Battery Room Exhaust Fan	300	Axial
Rope Store Supply Fan		
Paint Store Exhaust Fan		
Garbage exhaust Fan		
Electrical equipment room exhaust Fan		
Mid Void Supply Fan 1		

9.7.4 Air Conditioning for Accommodation

REF DWG: Schematic Design of HVAC System for Accommodation DA571A301 -03

The following units are provided:

Fan Name	Volume (m^3/hr)	Description
Packaged Unit for Galley	1,890	Cooling and heating
Accommodation AHU 1		
Wheel House AHU 2		
Absorbtion Chiller Water Unit 1		
Conventional Chiller Water Unit 2		

9.8 Compressed Air Systems

REF DWG: Compressed Air System DA700M001-9

REF DWG: QCV & RCV Control System DA700M001-10

The service/ control compressed air system for the Vessel supplies control air for the generators, control air services and other auxiliary equipment in the service air system. It is equipped with two service/control air compressors, a service /control air dryer and two service/control air reservoirs.

The Compressed Air System is comprised of two service/ control air reservoirs with a volume of 2.0 m^3 and a working pressure of 8 bars each. The reservoirs are supplied from two electrically driven service/control air compressors, which operate in a lead lag configuration. No.1 and No.2 Service/Control air compressors are fed from MD-DBH02 and MD-MCC06 respectively. No.1 and No.2 service air compressors are controlled through field processing device 9 and 10 respectively. Compressed air from the compressors is passed through either T-A or T-B Service /Control Air Dryers before it is stored in the service air reservoirs. No.1 & 2 Service air dryers are monitored on the IMCSS by field processing device 9.

The consumers supplied from the service/control air reservoirs from a common manifold include:-

- The quick closing air reservoir
- Control air for DG No.1 pneumatic quick closing valve (OE017)
- Control air for D/G No.2 pneumatic quick closing valve (OE012)
- Control air for D/G No.3 pneumatic quick closing valve (OE006)
- Control air for D/G No.4 pneumatic quick closing valve (OE041)
- Control air for D/G No.5 pneumatic quick closing valve (OE036)
- Instrument air for the forward thrusters (Gravity tanks and thrusters motor breaks)
- No.5 Thruster Control Panel for Gravity Tank
- No.5 Control Panel for Shaft Breaker
- No. 6 Control Panel for Gravity Tank
- No.6 Control Panel for Shaft Breaker
- No.2 Main SW Cooling Pump for No.1 D/G Group priming pump

The provision of a vessel wide integrated air supply system serving both open ended deck air consumers and operationally critical control consumers requires sufficient supply capacity and comprehensive monitoring to ensure continuity of supply during periods of maximum air consumption and of system loss of capacity. Consideration should be given to providing the compressed air system with an additional air compressor. That is why compressed air from the air receiver has the pressure retaining valve to prevent pressure reduction below 6.00 bar when using the service air.

9.9 Bilge System

REF DWG: Bilge System P&ID DA800D101

9.9.1 Bilge System Description

The bilge system pumps water from the sumps located in various watertight compartments on the machinery area. The system has two (2) main bilge pumps that are installed at the Aux. Machinery Space. The system also has two (2) bilge transfer pumps.

he components of this system are the following:

Equipment	Description
No.1 Main Bilge Pump (Centrifugal)	130 m^3/hr x 25 m
No.2 Main Bilge Pump (Centrifugal)	130 m^3/hr x 25 m
No.1 Bilge Transfer Pump (Piston type)	4 m^3/hr x 2 bar
No.2 Bilge Transfer Pump (Piston type)	4 m^3/hr x 2 bar
Emergency Fire & Bilge Pump for Dual Purpose(Fire Water Supply/Bilge Suction)	166/110 m^3/hr x 25/100 MTH
Oily Bilge Water Tank	18.9 m^3
Oily Water Separator (MAHLE NFV)	2.5 m^3/hr x 5 ppm
Dirty Oil Tank	9.5 m^3

The following compartments are connected to the bilge manifolds:

- Hydraulic power pack space B.W. (AFT and FWD)
- No.5 and No.6 Thruster room Bilge HAT
- Cofferdam for hydraulic power pack space
- Cofferdam for auxiliary machinery space
- Auxiliary machinery B.W. (AFT and FWD)
- No.1 and No.2 D/G Space B.W. (FWD)
- Cofferdam for D/G Space

Bilge water from the compartments mentioned above is discharged to the Oily Bilge Water Tank through the Bilge Transfer Pump. Each compartment has sumps that are connected to the bilge water system. Drainage from the sumps is activated by manually opening the individual stop check globe valve.

The bilge water holding tank is emptied automatically or manually by the oily water separator (via oil water separator pump) which monitors the oil content. Separated oil is pumped to the Dirty Oil Tank and clean water (<5 ppm oil content) is discharged over board.

9.9.2 Bilge System Operations

9.9.2.1 General Information

- Keep all valves closed, except when pumping a tank or compartment.
- Check all bilge sumps periodically to prevent overflows.

9.9.2.2 Normal Operations

- Close all isolation valves along the main line.
- Open valves to the bilge holding tank.
- Open the sump valve for the compartment to be pumped.
- Activate the pump.

9.9.2.3 Operation if One Pump Fails

- If one pump fails, close the suction valve to the failed pump and open the suction valve to the other bilge pump and proceed with normal operations.

9.10 Seawater Cooling System

REF DWG: Sea Water Cooling System P&ID

REF DWG: Sea Water Cooling System Schematic Diagram

REF DWG: Sea Water Cooling System Control Logic

9.10.1 General

The seawater system consists of single supply manifold which is common to the diesel generators and auxiliary consumers. The seawater supply to the diesel generators is divided between diesel generator group No.1 and diesel generator group No.2. Diesel generator group No.1 consists of diesel engines No.1 through No.3 and Diesel engine group No.2 consists of diesel engines No.4 and No.5. Diesel generator No.6 is radiator cooled. The three thruster freshwater heat exchangers like the diesel generator groups are each equipped with their own allocated seawater circulating pumps.

9.10.2 System Description

9.10.2.1 Sea Water Supply

The seawater system for the various marine auxiliaries is supplied from a common supply manifold. These in turn are supplied from a high and low sea chest. A hydraulically actuated remote controlled valve (CW101 and CW102) controls the seawater supply from each sea chest. These remote control valves fail as set on loss of hydraulic pressure and control power. These are assumed to be allocated to signal processing unit, which can allow for remote operation.

The sea chests are assumed to be protected by an anti-bio fouling system. Each sea chest has a strainer that is assumed to be regularly cleaned and maintained according to a planned maintenance system. The sea chests strainers are equipped with a pressure differential transducer, which monitors the condition of the sea strainers on the IMCSS.

9.10.2.2 Sea Water Cooling Pumps

The cooling seawater pumps for No.1 .D/G Group have a flow rate of 490.00 m^3/hr and operate on a standby start configuration. No.2 main cooling seawater pump is equipped with self-priming equipment that is driven by the service air system. The start-up of the standby pump is assumed to be indicated as an alarm on the IMCS.

The cooling seawater pumps for No.2 D/G Group have a flow rate of 340.00 m^3/hr and operate on a standby start configuration. The start-up of the standby pump is assumed to be indicated as an alarm on the IMCS.

The main seawater manifold is essentially a common means of seawater supply for diesel generators and thrusters. The seawater manifold can be split into two sections by the maintenance crossover valve (CW005), however in normal operations this valve is normally kept open. The seawater cooling system consists of various sub groups supplied from the common seawater manifold, these are described in more detail below.

9.10.2.3 Change Over from Sea Chest to Heeling Tank Supply

Permissive condition

- All sea water cooling (except thruster cooling) systems connected to sea chests is open
- No level transmitter (remote sounding system) failure.
- No level control loop failure.
- Selection of the overboard valve for the level control of the heeling tank.
- No black-out condition.
- No failure of remote operated valves set to be controlled automatically.
- Heeling tank outlet valves (CW082 & CW094) installed for sea water supply to the cooling system is closed.
- CSW pump for thruster to be stop.
- S.W supply pump for R.O unit to be stopped (In general condition)
- No vessels draft gauge failure.

Procedure

- Close the valves after stopping the CSW pump for thruster except the overboard valves CW109, CW110 (provided for air condition and provisional plant cooling system) & CW105 or CW106 (Heeling tank level control).Remote operated valves CW107, CW108 should be in closed position.
- Check open condition of all valves except CW081 and CW093, which are provided for re-circulating the cooling sea water to the heeling tank. Manually open in remote the valves CW079 & CW090 (DG cooling system).
- Check the open condition of the interconnection valve 'CW074' that is placed in the DG cooler SW discharge common main line.
- Select the overboard valve (CW105 or CW 106) that shall be used for the heeling tank level control and close the overboard valve that is not selected for the heeling tank level control. The overboard valve selected for the heeling tank level control is to be opened/closed automatically when the heeling tank level control function is activated.
- Set the control mode of the re-circulating valve (CW081) on automatic in order to make the valve to be controlled by the heeling tank level control function.
- Run "Pump for S.W supply to heeling tank" and Open the heeling tank outlet valve. (CW082)
- Open CW093 valve which is provided for re-circulating the cooling sea water to the heeling tank.
- Close the overboard valves (CW109 &CW110) provided for the air cond.sytem & prov plant cooling system.
- Close main sea suction valves (CW101 &CW102).

The sea water cooling system is now connected to the heeling tanks

Heeling Tank Level Control Logic

Operating Condition	No.1 DG Group Overboard Valve Selected for Level Control of the Heeling Tank		No. 2 DG Group Overboard Valve Selected for Level Control of the Heeling Tank	
	DG Group No.1	**DG Group No.2**	**DG Group No.1**	**DG Group No.2**
DG Group No.1	Open/Throttling/Close	Close	Close	Open/Throttling/Close
DG Group No.1	Open/Throttling/Close	Close	Close	Open/Throttling/Close
DG Group No.1 & 2	Open/Throttling/Close	Close	Close	Open/Throttling/Close

Control logic of level control valve (CW105 or CW106): Closed valve to be opened and open valve should keep its open position in case the heeling tank level control function is not activated.

Vessel's draft is greater than 0m: Valve which is selected for the level control to be closed in case of the heeling tank level below 2.4 m. Valve which is selected for the level control to be opened in case of the heeling tank level above 2.9 m.

Vessel's draft is less than or equal to 0m: Valve which is selected for the level control to be closed in case of the heeling tank level below 2.4 m. Valve which is selected for the level control to be throttle opened in case of the heeling tank level above 2.9 m(Preset open position).

- Valve fully open, in case the vessel's draft gauge is broken down.
- Valve full close in case the heeling tank level gauging system or heeling tank level control valve(CW105 or CW106) is broken down after heeling tank level control function is operated (With the condition of main sea suction valves(CW101 102) is closed)
- (S.W could be discharged by the heeling tank air vent line in this emergency condition)

9.10.2.4 No.1 D/G Group Seawater Cooling System

The No.1 D/G Group is supplied with coolant by one of two main cooling seawater pumps that operate on a standby start configuration. The pumps supply the three fresh water coolers that are allocated to diesel generators No.1 through No.3. The manual inlet and remote discharge valves(refer section 9.10.2.6 for cooling sea water shut off valve for DG control logic) for these coolers are assumed to remain open in normal operations to cater to automatic starting of generators as required. These valves are closed when isolating the heat exchanger for maintenance. A maintenance cross over valve (CW074) on the discharge manifold splits the manifold into two sections with this valve in the normally opened position.

The isolating valves at the port and starboard overboard discharges on the manifold are hydraulic actuated remote controlled valves (CW105 and CW106 respectively). These are assumed to be allocated to a signal processing unit to allow for remote operation. The RCVs are double acting valves which fail as set on loss of hydraulic pressure or control signal. The opening and closing of these valves is dependent on the activation of a level controller in the port heeling tank. The valves form part of a series of hydraulic actuated remote control valves for the heeling tanks.

9.10.2.5 No.2 D/G Group Seawater Cooling System

The No.2 D/G Group is supplied with coolant by one of the two main cooling seawater pumps that operate on a standby start configuration. The pumps supply the two fresh water coolers allocated to diesel generator No.4 and No.5. The manual inlet and remote discharge valves for these coolers are assumed to remain open in normal operations to cater to automatic starting of generators as required (refer section 9.10.2.6 for cooling sea water shut off valve for DG control logic) . Remote discharge valves open/close function depending on running signal DG. These valves are closed when isolating the heat exchanger for maintenance.

9.10.2.6 Cooling Sea Water Shut off Valve for DG Control Logic

FW Cooler for	Control Valve No.	Engine 'ON'	Engine 'OFF'
No.1 DG	CW047	Open	Close (10s time interval)
No.2 DG	CW049	Open	Close (10s time interval)
No.3 DG	CW063	Open	Close (10s time interval)
No.4 DG	CW051	Open	Close (10s time interval)
No.5 DG	CW053	Open	Close (10s time interval)

- The type of DG cooler CSW outlet shut-off valves is single acting type (Air fail to open.)

Solenoid valve de-energized (Engine 'ON') --> air exhaust from actuator -->Valve open.

Solenoid valve energized (Engine 'OFF') --> air supply to actuator --> Valve close.

- In case of only one engine operation condition, one of the other DG cooler CSW outlet shut-off valve which is located at the same DG group to be opened.
- In case the engine stopped, DG cooler CSW outlet shut-off valve should be closed with the time delay of 10 second for cooling the hot medium in the cooler.
- No 1 DG Group, only No 1/2/3 DG running and No. 3/2/1 shutoff valve open
- No 2 DG Group, only No 4/5 DG running and No. 5/4 shutoff valve open

- During the time delay for the closing of DG cooler CSW outlet shut-off valve(s), concerned F.W cooling pump(s) to be also operated. After that, F.W pump(s) to be stopped.
- In case all engine(s) is(are) stopped in DG group, relative CSW pump is also to be stopped with the time delay of 9 ~10 second (But, CSW pump to be previously stopped before closing the DG cooler CSW outlet shut-off valve(s).)

9.10.2.7 Seawater Cooling System for the Thrusters

The thruster seawater cooling system is supplied with coolant from one of two main cooling seawater pumps that operate on a standby start configuration. The pumps supply No.1, No.2 and No.3 thruster fresh water coolers, these are allocated to thrusters No.1 & No.6, thrusters No.2 & No.5 and thrusters No.3 & No.4 respectively. The manual inlet and discharge valves for these coolers are assumed to remain all open in DP operations and are closed at the normal sea going operation. (No.1&2 or No. 2&3 or No.1&3 coolers to be used based on the operated F.W cooling pumps number for thruster.)

Wastewater from the three thruster fresh water heat exchangers is directed to a separate discharge manifold from No.1 and No.2 D/G Groups. There are no maintenance crossovers on the discharge manifold and coolant is discharged overboard through the port and starboard overboard discharge valves. The port and starboard overboard discharge valves (CW107 and CW109 respectively) on the manifold are hydraulic actuated remote controlled valves that can be controlled from the IMCS. The remote control valves fail as set on loss of hydraulic pressure and control signal. These are assumed to be allocated to signal a processing unit which can allow for remote operation.

NOTE!

Stand-by CSW pumps for DG group function has to be checked when CSW pumps operation groups are changed during periodical maintenance checking.

In case the No.1 & 2 CSW pumps are all tripped, following alarm activations can be expected:

1) **LT cooling system temperature alarm high around 1 min. passed, (Alarm set point 38 deg.C)**
2) **Engine charging air cooler temperature alarm high around 5 min. 40 sec. pas sed, (Alarm set point 75 deg.C)**

In case of failure of FPD-5, the duty-standby function will not work for main sea water cooling pump of both DG group 1 & 2.

Also AMCS will not show the actual status of Main sea water cooling pump 1 of both DG group 1 & 2.

Hence it is operator's responsibility to monitor the outlet pressure and start the other pump from MCC or locally (not from AMCS), in case the outlet pressure drops.

In case of failure of FPD-8, the duty-standby function will not work for Main sea water cooling pump of both DG group 1 & 2.

Also AMCS will not show the actual status of Main sea water cooling pump 2 of both DG group 1 & 2.

Hence it is operator's responsibility to monitor the outlet pressure and start the other pump from MCC or locally (not from AMCS), incase the outlet pressure drops.

9.11 Fresh Water Cooling Systems

REF DWG: Fresh water cooling system P&ID

REF DOC: Automation system in machinery

9.11.1 Thruster Cooling

The fresh water cooling system for the thrusters is split into three different groups, with each group supplying coolant to two thrusters. The arrangement introduces some commonality between the three groups of thrusters as all the fresh water coolers form part of the main seawater cooling system. Although, the three groups operate independently there is a maintenance cross over between the three groups that also introduces commonality if these valves are left open. For this description these cross over valves (LC 342, LC 343, LC 344, LC, 345, LC 346, LC 347) are assumed to be closed.

In case of normal sea going condition, this cross valves to be opened.

(Two sets of coolers and pumps to be operated. The other one set of cooler and pump is for the stand-by purpose.)

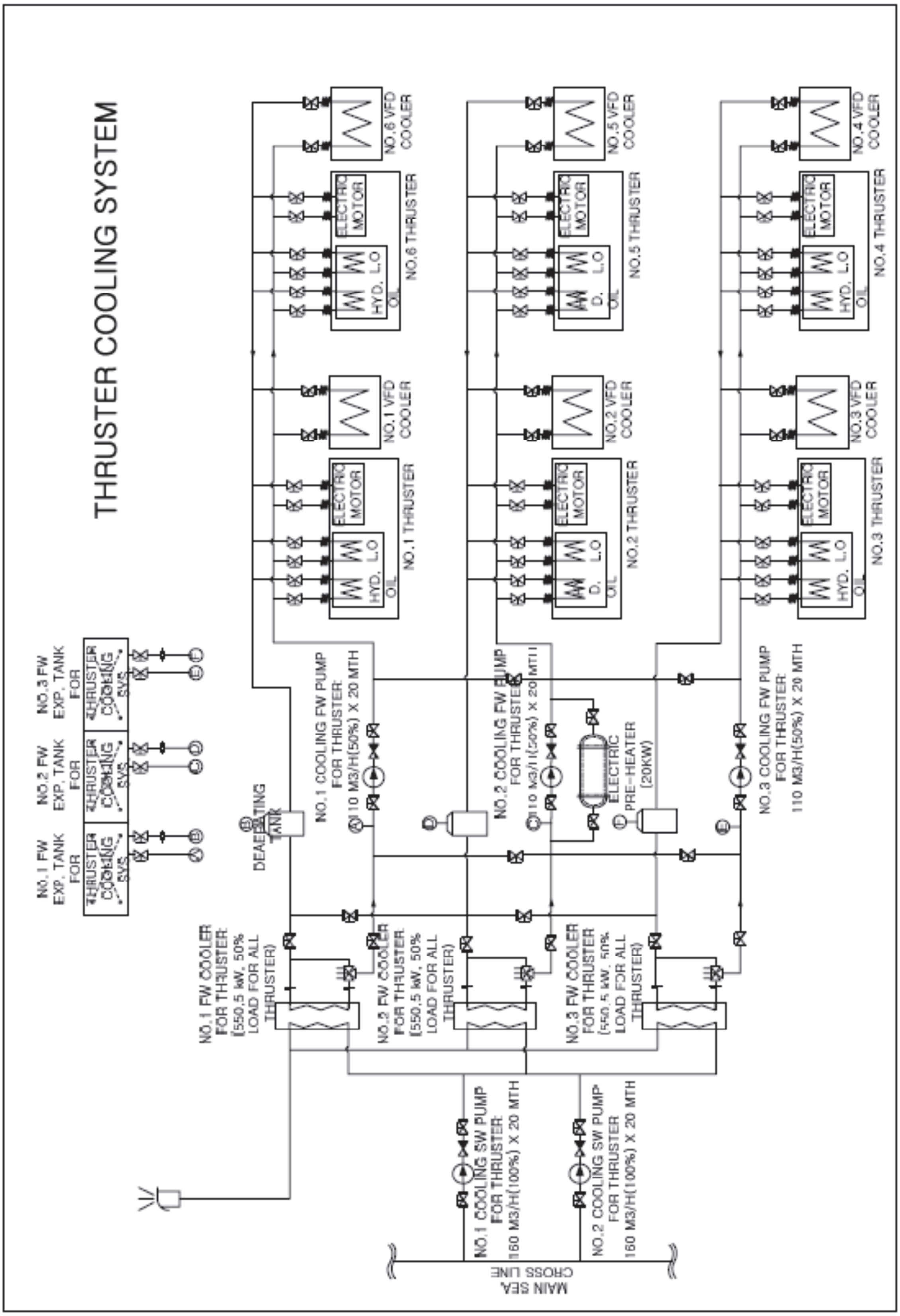


Figure 9-4 Thruster Cooling System Schematic

9.11.1.1 No.1 Fresh Water Cooler for Thrusters

The No.1 Fresh Water Cooler for Thrusters No.1 and No.6 has only one cooling fresh water pump. No.1 Thruster Cooling Fresh Water Pump has a flow rate of 110 m^3/hr and is fed from MD-MCC03. It is controlled through field processing device FPD 6A. No.1 Fresh Water Cooler for Thrusters supplies:-

- No.1 Thruster electrical motor air/water heat exchanger
- No.1 Thruster VFD cooler
- No.1 Thruster Hydraulic Power Pack Unit
- No.1 Thruster Lube Oil Unit
- No.6 Thruster electrical motor air/water heat exchanger
- No.6 Thruster VFD cooler
- No.6 Thruster Hydraulic Power Pack Unit
- No.6 Thruster Lube Oil Unit

The temperature of the fresh water cooling system is maintained at 36 ℃ by a 3-way wax type temperature control valve at the outlet of each fresh water cooler. The failure of a valve element would cause that element to fail to the closed position, however, it is assumed that as there are numerous elements within the valve, it should not affect the operation of the valve. The thruster fresh water-cooling loop for thruster No.1 and No.6 has an expansion tank with a volume of 0.5m^3, a low level alarm for the tank is provided on the IMCS.

9.11.1.2 No.2 Fresh Water Cooler for Thrusters

The No.2 Fresh Water Cooler for Thrusters has only one cooling fresh water pump. No.1 Thruster Cooling Fresh Water Pump has a flow rate of 110 m^3/hr and is fed from MD-MCC04. It is controlled through field processing device FPD 7B. No.2 Fresh Water Cooler for Thrusters supplies:-

- No.2 Thruster electrical motor air/water heat exchanger
- No.2 Thruster VFD cooler
- No.2 Thruster Hydraulic Power Pack Unit
- No.2 Thruster Lube Oil Unit
- No.5 Thruster electrical motor air/water heat exchanger
- No.5 Thruster VFD cooler
- No.5 Thruster Hydraulic Power Pack Unit
- No.5 Thruster Lube Oil Unit

9.11.1.3 No.3 Fresh Water Cooler for Thrusters

The No.3 Fresh Water Cooler for Thrusters has only one cooling fresh water pump. No.3 Thruster Cooling Fresh Water Pump has a flow rate of 110 m^3/hr and is fed from MD-MCC05. It is controlled through field processing device FPD 5. No.3 Fresh Water Cooler for Thrusters supplies:

- No.3 Thruster electrical motor air/water heat exchanger
- No.3 Thruster VFD cooler

- No.3 Thruster Hydraulic Power Pack Unit
- No.3 Thruster Lube Oil Unit
- No.4 Thruster electrical motor air/water heat exchanger
- No.4 Thruster VFD cooler
- No.4 Thruster Hydraulic Power Pack Unit
- No.4 Thruster Lube Oil Unit

9.11.2 Engine Cooling

The generator fresh water cooling systems are divided into two separate groups namely No.1 D/G Group and No.2 D/G Group. No.1 D/G Group consists of engines No.1 through No.3 and No.2 D/G Group consists of engines No.4 and No.5. The fresh water and seawater cooling system for the generators do not follow the same division of generators as the fuel oil system.

Although the generators in each group operate independently, there are maintenance cross over valves between the generators that also introduces commonality if these valves are left open. For the analysis of No.1 D/G Group, these cross over valves (LC 171, LC 172, LC 173, LC 174, LC 346, LC 347 and pre-heater cross over valves) are assumed to be closed.

Each engine has a separate LTFW and HTFW cooling system with independent cooling circuits. Each engine is fitted with an engine driven HTFW and motor driven LTFW pump. All the engines are equipped with allocated plate type heat exchangers. The inlet and discharge valves for these coolers are manual valves. During normal operations, all three coolers would be placed online to facilitate the auto starting of the generators as required.

The engine LTFW system is equipped with an expansion tank a LT CFW Pump, 3-way motor driven temperature control valve and combi cooler. Coolant from the generator fresh water cooler is directed to a motor driven 3-way temperature control valve, where the outgoing temperature to the engine is regulated to (TBD) or re-circulated back to the cooler. The LT CFW Pump circulates coolant from the heat exchanger through the combi cooler and alternator heat exchanger. The LT CFW pump is configured to automatically start and stop with the operation of the diesel generator when in auto mode.

Each engine high temperature system is equipped with an engine driven jacket water pump, a thermostat, an expansion and a pre-heating circuit. Heat exchange between the LTFW system, returning fuel and the HTFW system takes place at the combi-cooler. More details of the operation of the engine HTFW system is described in the appropriate sections.

The preheating circuit includes a jacket circulating fresh water pump and an electrical jacket water pre-heater. Coolant from the outlet of the thermostat is drawn by the circulating pump passed through the preheater and discharged to both rows of jacket and cylinders through a non-return isolating valve. In normal operations, the inlet and discharge valves in the pre-heating circuit are left in the open position as the system is primarily used for standby engines.

Heat exchange between the engine HTFW system and Accommodation Heating and Hot water calorifier fresh water system takes place in the heat recovery cooler.

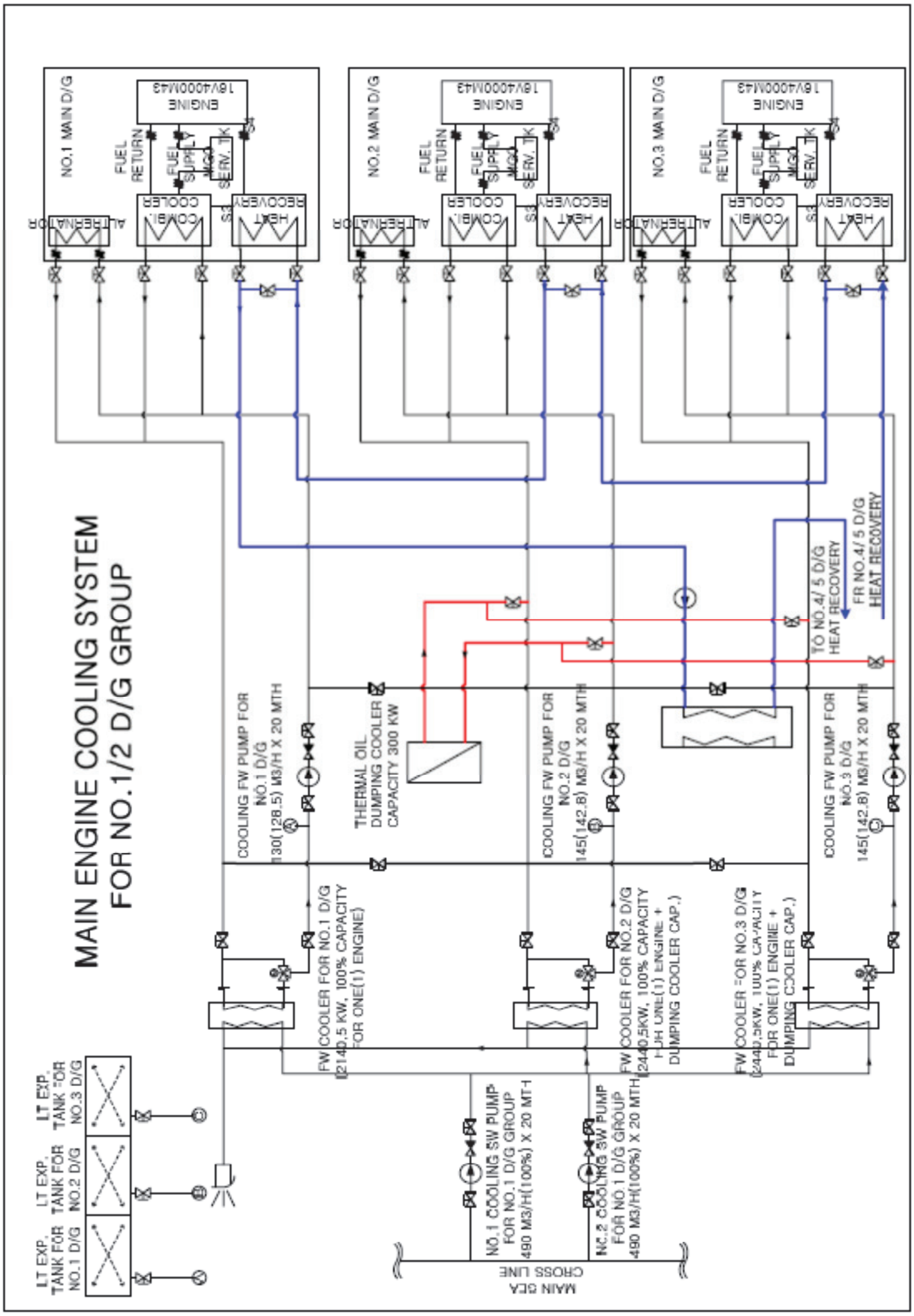


Figure 9-5 Engine Cooling System Schematic

9.12 Waste Management System

9.12.1 Sewage System

REF DOC: V/D of sewage treatment plant with vacuum unit DV582A002 Rev 0

Supplier / Maker	Jonghap Machinery Co., Ltd.
Purification Process	Activated Sludge (Extended Aeration)
Inflow Liquid	Black water + Grey Water
Treatment Capacity	9,625 L/day
	60 persons/day
Black + Grey water Volume	160 L/man/day (SBG = 135L/man/day)
Organic Load (g/person/day)	1,925 gm/day (32.08 gm/person/day)
Effluent Quality	BOD: Below 25 ppm & COD: Below 125 ppm Suspended Solid: Below 35 ppm Coliform: Below 100/100 ml PH: 6 ~ 8.5, AC 440, 60 Hz x 3ph

The key components are:

Discharge Pump	2 sets
Motor Output	2.64 kW
Motor	IP54 / 3437 rpm
Rated Current	5 A
Capacity	0.25 m^3/min
Type	Centrifugal / Non Clog
Air Blower	2 Sets
Motor Output	1.8 kW
Motor	IP54 / 3400 rpm
Rated Current	4.20A
Normal Work	96 m^3/hr x 150 mbar
Type	Rotary Vane
Ozone System	1 Set
Output	1.25 kW, IP23
Rated Current, Voltage	5 A, 220 V x 60 Hz
Pump Motor Output	0.35 kW
Pump Motor	IPx4 (over 44) / 3,400 rpm
Rated Current	1.9 A

Pump Capacity	32 L/min x 22 m

9.12.2 Garbage Treatment & Storage Equipment

REF DOC: Company IMS Garbage Management Plan

REF DWG: Galley and Laundry Equipment (Marine Type) DA551A001

Vessel is equipped with cooled on board garbage storage room.

The following equipments have been provided in garbage treatment system of the vessel

Item	Waste Compactor	Glass Crusher	Shredder
Model	UBP-30S USON	UBP-80S USON	UBP-2530S USON
Rating	2.2 kW	3.6 kW	3.6 kW
Voltage	3P/450.00V/60.00 Hz		
Capacity	Press Power 5 t	80 L	0.09 m^3
Location	Garbage Room		

9.13 Crew Service Installations

REF DOC: Sauna Unit HD-SU-DW

REF DWG: Sauna Unit DV583A002

REF DWG: Galley and Laundry Equipment (Marine Type) DA551A001

REF DWG: Galley and Laundry Equipment (Domestic Type) DA551A005

REF DWG: Drinking Water Fountain & Hot Water Boiler DV551A002

REF DWG: Gymnasium Equipment DV541A001 Rev 0

REF DWG: Personal Elevator DV561A001

REF DOC: Personnel Elevator Working Manual 11893 – 11894

REF DWG: Vendor Drawing of Computer Network System DV915E008 Rev A

9.13.1 TV Room

TV Room available on the tweendeck equipped with Multimedia equipment..

9.13.2 Mess Room

Mess Room is located on the tweendeck Available for 30 persons, the mess room also includes a TV screen for presentations.

9.13.3 Pantry

Pantry room available on the 5th floor, pantry is equipped with a fridge, coffee machine, water boiler etc...

9.13.4 Change Room

Two change rooms available at the main deck one for 12 persons while the other is for 34 persons.

9.13.5 Public Toilets

Public toilets (Male and female) are available at the following locations

- Main deck
- Tween Deck
- 5th upper deck

9.13.6 Sauna

Sauna provided with facilities on tween deck of the vessel

Material	Wood
Size	1.85 mm x 2,360 mm x 2,100 mm
Heater	8 kW
Control Panel	Steel
Control Panel Protection	IP44

Control Panel Painting	7.5 BG 7/2
Lighting fixture	Aluminum with Glass, IP55
Lighting power supply	220 VAC, 60 W

9.13.6.1 Sauna Controls

Local Control (inside Sauna)	Emergency Push Button
	Thermostat
Main Control Panel	Power ON/OFF with display
	Heater ON/OFF
	Alarm Buzzer connected to the Vessel's AMCS (Alarm, Monitoring and Control System)
	Heater Timer

9.13.6.2 Sauna Accessories

- Heater Guard (wooden)
- Bucket and Ladle (wooden, bucket capacity at 4 liters)
- Stone
- Thermo-hygro meter (20 -140°C and 0-100% Hygro Range)
- Sand Watch (15min + 15min)
- Warning Sign (wooden, 300x200x18t)
- Galley and Laundry Equipment.

9.13.7 Galley Equipment

The below mentioned table gives different galley items with description.

Description	Capacity	Model No.	Elect (VxPxHz)	Qty
Electric Range	22.7 kW	FUTURA RP6/220	440/3/60	1
Microwave Oven	3.2 kW	NE3280	220/1/60	1
Deep Fat Fryer	22 kW	V2200T	440/3/60	1
Bratt Pan	12 kW	PMD 85	440/3/60	1
Tilting Kettle	10.5 kW	VIKING 60E SW	440/3/60	1
Potato Peeler	0.66 kW	ME-10	440/3/60	1
Refrigerator	700 L	MBC-700R	220/1/60	2
Freezer	700 L	MBF-700R	220/1/60	1
Combi Steamer	10 kW	MSCC 61	440/3/60	1
Mixer	30 L	BEAR AR30	440/3/60	1
Vegetable Slicer	54 kg/min	RG-100	220/1/60	1
Dishwasher	10.5 kW	HOOD 130-EL	440/3/60	1
Meat Slicer	0.22 kW	PRIMA 300	220/1/60	1
Prewash Shower	-	6546 Table mount	220/1/60	1
Prewash Table	-	-	220/1/60	1
Discharge Table	-	-	220/1/60	1
Rack Stand	-	-	220/1/60	1
Bain Marie	3.5 kW	BM-1200-TDRL-TDRL-TDRR	220/1/60	1
Cold Bottle Basin	0.5 kW	BT-1200-DSL-MPL-DSR	220/1/60	1

9.13.8 Laundry Equipment

The below mentioned table gives different laundry items with description

Description	Capacity	Model No.	Elect (VxPxHz)	Qty
Washer Extractor	6 kW	W 6022	220/1/60	10
Drying Tumbler	6 kW	T 702	220/1/60	10
Hand Iron	2.10 kW	FV 3320E0	220/1/60	1

9.13.9 Other Equipment

The below mentioned table gives different pantry, wheel house, garbage, ECR & conference room equipments with description

Description	Capacity	Model No.	Elect (VxPxHz)	Qty	Location
Cooking Plate	1.8 kW	-	220/1/60	1	Pantry
Microwave oven	1.5 kW	TMW-1100E	220/1/60	2	Pantry, ECR
Toaster	2.3 kW	ROWLETT 4	220/1/60	1	Pantry
Coffee Machine	20 L/hr	M-100	220/1/60	5	Wheelhouse, ECR,TV, Pantry, Conf.
Hot Water Spot	30 L	CWP-303	220/1/60	3	Wheelhouse, TV, Conference room
Waste Compactor	2.2 kW	UBP-30S	440/3/60	1	Garbage
Glass Crusher	3.6 kW	U-80	440/3/60	1	Garbage
Shredder	3 kW	UMS-2530	440/3/60	1	Garbage
Refrigerator (45L)	45 L	FR-062R	220/1/60	29	Ambulance, Cabins
D.W. Fountain	2.5 L	T-118AB	220/1/60	10	Gym, Mess, ECR, Accomm., Wheelhouse
Refrigerator (122L)	122 L	FR-143R	220/1/60	1	Wheelhouse

9.13.10 Gymnasium

The following gym equipments are facilitated on the tween deck of the vessel.

No.	Machine	Qty	Description
1	Weight Lifting Machine	1	110 kg
2	Cycling Machine	2	
3	Rowing Machine	2	130 kg
4	Multipurpose Trainer	1	70.3 kg
5	Table Tennis	1	
6	Table Football	1	

9.13.11 Elevator

One personnel transfer elevator in the deckhouse, Fr 169-175, Port Side is provided to connect the double bottom (lowest level) with the 5th upper deck (highest level), with stops on every level. It has an emergency escape ladder and trunk located at wheel house of the vessel. The elevator is also facilitated with a emergency phone for communication in case of emergency. The emergency call will be received at the wheel house and the Pipe duct beside the Elevator at the 5th floor. The elevator can operate safely up to 10 deg.(max.) rolling and pitching of vessel.

NOTE: During transit/floating condition the lower water tight sub-section of the main deck door should be kept closed.

Capacity	1,500 kg
No. of person	16
Travel	20.25 m
Entrance	9
Stops	8
Speed	0.8 m/s VVVF
Counter weight	1,700 kg
Voltage	690 V- 60 Hz
Light voltage	230 V – 60 Hz
Regulation	GL EN-81-1

9.13.12 Network System

All computer workstations connected to the platforms LAN. One central rack including an office server, a firewall, a switching hub and VSAT units is provided in the conference room. The cabling is suitable for Gigabit Ethernet. There is one access point close to every computer but following access points are installed:

- Conference room: 5 connections
- Control cabin :4 connections
- Equipment room :4 connections
- Single cabins: 1 connections
- Single cabins (1+1): 2 connections & Double cabins (2+2): 4 connections
- Offices: 2 connections
- ECR1: 2 connection & ECR2: 2 connection
- Network printer / Photocopy machine: 1 connection
- Ambulance: 1 connection

One server for office purpose is installed. The server provides e-mail, file and printing service for the Office PC's. The Server has the following minimum configuration:

Software: e-mail server, backup management software, file and printer service for office workstations. One raid disc including mounting frame supplied as spare part. Office equipped with sufficient mounting facilities for personnel computer. VSAT system with two aerials for satellite reception are provided and connected to the vessel LAN.

9.14 Technical Gases

These includes different gases used in the fire fighting systems, refrigerants and coolants used in chiller units and A/C systems and cutting or welding gases used in different workshops of the vessel.

No.	Kind of Gas	Usage	Working Capacity
1	NOVEC1230	ER Fire Extinguishing System	180 L X 21 Sets 25 bar @ 20° C
2	NOVEC1230	Switchboard Room Fire Extinguishing System	147 L X 2 Sets 25 bar @ 20° C
3	CO_2	Emergency Gen Room Fire Extinguishing System	45 kg X 2 Sets 58 bar @ 20° C
4	CO_2	Paint Store Fire Extinguishing System	45 kg X 1 Set 58 bar @ 20° C
5	Oxygen	Flame Cutter	40 L X 2sets 147 bar @ 15° C
6	Acetylene	Flame Cutter	40 L X 2sets 15 bar @ 15° C
7	Argon	Universal Welder	50 L X 1 Set 200 bar @ 15° C
8	Argon + CO_2	Universal Welder	50 L X 1 Set 200 bar @ 15° C
9	CO_2	CO_2 System For Galley Duct	13.4 L X 1 Set 58 bar @ 20° C
10	R-407C	Conventional Chiller Unit	25 kg X 1 Set 24.1 bar
11	R-407C	Provision Refrigerant Plant	18 kg X 1 Set 24.1 bar
12	R-407C	Package Type A/C For ECR	3.5 kg X 1set 26 bar
13	R-407C	Package Type A/C For switch board	3 kg X 2set 26 bar
14	R-407C	Package Type A/C for Hydraulic Room	3 kg X 2set 26 bar
15	R-407C	Package Type A/C for Engine Workshop	3.5 kg X 1set 26 bar
16	R-407C	Package Type A/C for Galley	5.6 kg X 1set 26 bar

No.	Kind of Gas	Usage	Working Capacity
17	Nitrogen	Sliding block	5L x 32 set 65 to 220 bar
18	Nitrogen	Leg Lashing	51.7L X 8 set 140 bar,

VOLUME V – DRAWINGS

Table of Contents

10 KEY REFERENCE DOCUMENTS & DRAWINGS

REF REG: MODU-CODE 14.1.2.19

Sl No.	Drawing Name	Drawing No.
1	General Arrangement Plans	DA101Z029
2	Fire Control And Safety Plan(Including Escape Route & Life Saving Appliances Plan)	DA500D001
3	Leg Structural Drawing	10-B4040_41-001
4	Spudcan Structural Drawing	DA330H001
5	MUNS Operation Manual for Jack Up System	DA101D030
6	Overall Hydraulic Jacking Schematic	090610-100
7	Main Crane (Liebherr) Load Charts	170 564 – 565 – 100
8	Approved – Final Trim & Stability Booklet	DA101Z035
9	Load Line Certificate	
10	Calibration Table (Water Ballast Tanks)	DA101Z061
12	Calibration Table (MGO,LO & Misc Tanks)	DA101Z022
13	Damage Control Booklet	DA101Z066
14	Damage Control Plan	DA101Z055
15	Deck Load Plan	DA300H005
16	L-3 DP Operation manual	DV943E00
17	DP Capability Plots	
18	Bilge System	DA700M001
19	P/D of Ballast/Anti Heeling/ Jetting/ Sea Water Suction Mast System	DA800D101
20	Fuel Oil Filling, Transfer and Overflow System	DA700M001
21	Main One-Line Diagram of Electrical Distribution System	DA880E021

VOLUME VI – MAINTENANCE

Table of Contents

11 MAINTENANCE & REPAIR

REF DOC: Machinery Vendor Maintenance and Repair Manuals

REF DOC: Company IMS guidelines for maintenance and repair.

REF DOC: Code of Safe working practices

All vessel deck and engine machinery must be maintained in good conditions and working order at all times. All maintenance of machinery should be carried out as per planned maintenance system which should be developed as per maintenance and repair guidelines given in vendor manuals.

Company IMS guidelines and procedures should be followed to carry out maintenance which should only be carried out by qualified personnel.

Spare parts for planned maintenance should be ordered in good time. Critical spares as per company guideline should be re-ordered as soon as they are consumed and should be maintained on board at all times.

Safety precautions as per vendor manuals, company guidelines and safety guidelines as per code of safe working practices should be followed while carrying out maintenance and repair works.

Detailed procedure of maintenance of each equipments and machinery is described in the respective vendor manuals. The vendor’s maintenance manuals provide all procedure in detail including frequency of maintenance works and helps to keep machineries in good working conditions.

VOLUME VII – TRAINING

Table of Contents

12 TRAINING

REF DOC: Company IMS Guidelines for Training

REF DOC: Company IMS Training Manual

12.1 Training Manual

REF REG: MODU-CODE 14.10

The purpose of the training manual is to exercise thoroughly and train the crews in the proper use of the various emergency, safety and security systems and equipments of the vessel. Therefore all personnel must be trained to proceed without delay to their assigned stations in the event of an emergency.

For the details of training refer company's training manual.

12.2 Training and Drill Schedule

REF REG: MODU-CODE 14.11

The safety training and drills schedule conducted and supervised by the Master or designated staff personnel in accordance with the Company IMS Manual in a regular interval of time according to company's policy.

For the details of training and drill refer to company's training manual.

13 Annex 1

This annex consolidates temporary modifications done on the vessel related to national regulations, construction site and/ or specific requirements.