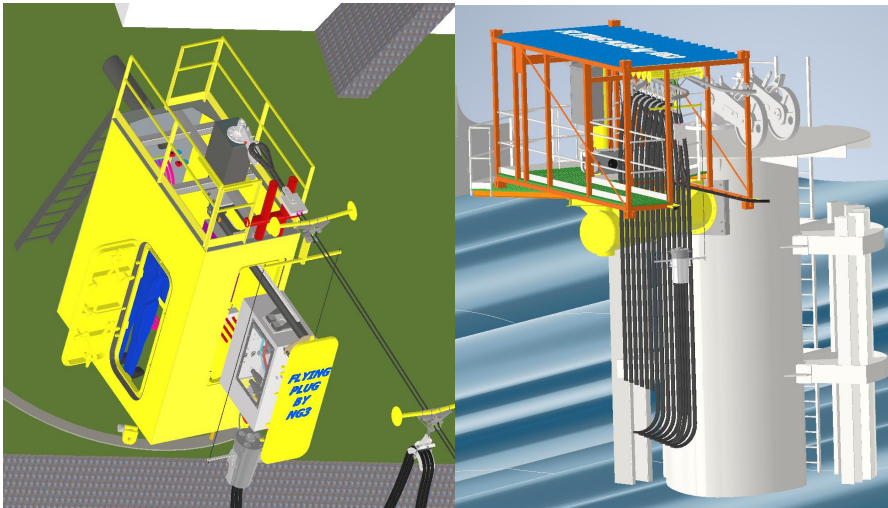
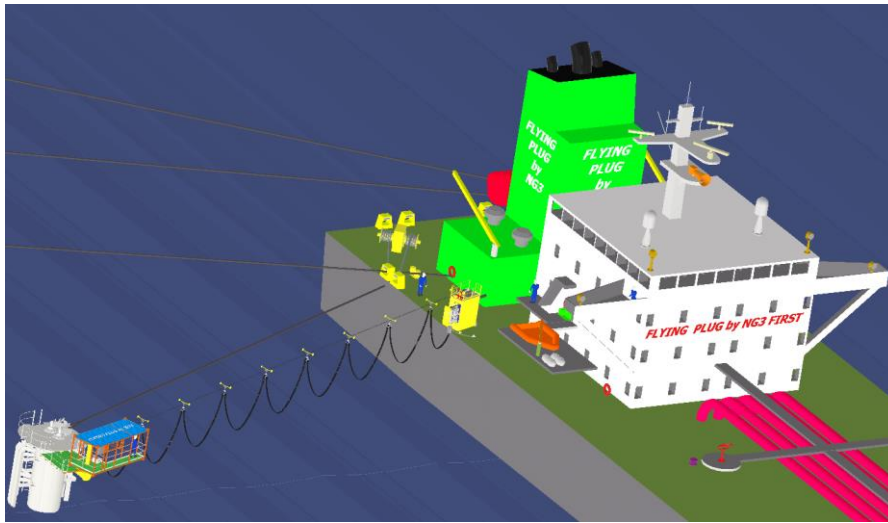




FLYING PLUG Shore Power Cable Management System for Tankers

Compliance analysis with OCIMF On Shore Power Systems recommendations for tankers and terminals, 2025 edition



Contact point for further information:

- NG3:

Damien Féger

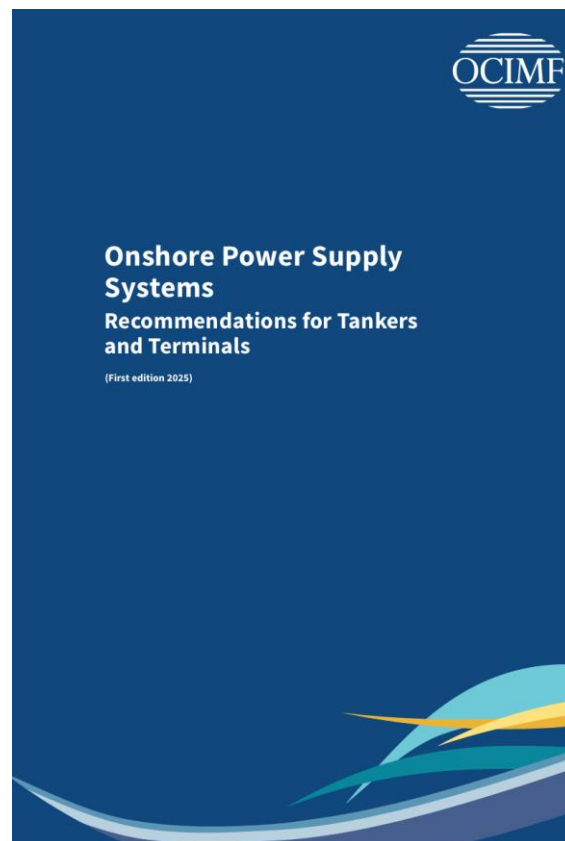
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Introduction

Tanker shipowner companies are considering as part of the requirement to optimize the environmental performances of these vessels, to equip these vessels with a shore power connexion, so that they can perform their loading /unloading operations with reduced emissions.

For this purpose, OCIMF has set up a working group to issue recommendations for OPS implementation on tankers and terminals, which published a set of recommendation mid 2025.

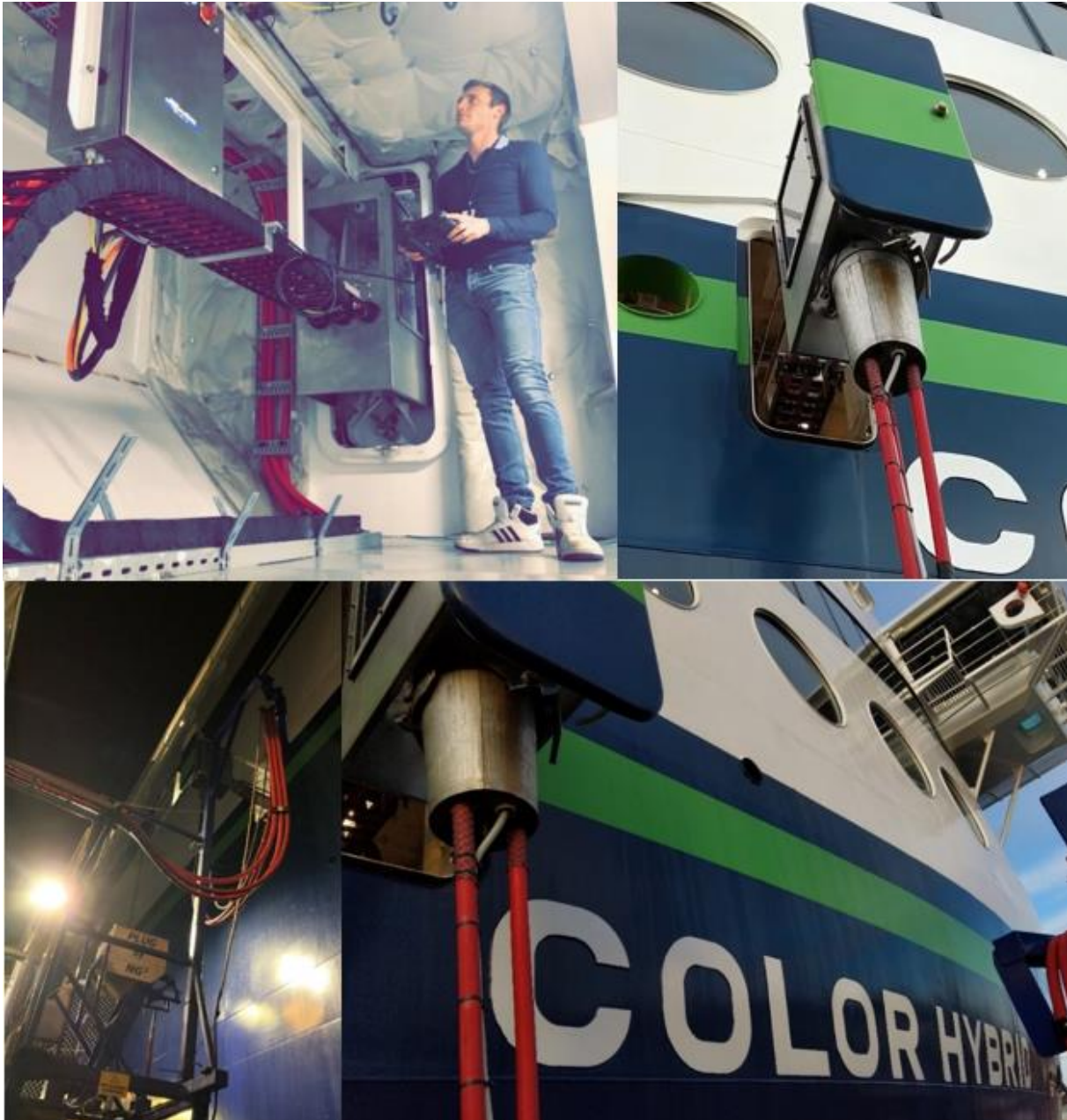


Main features of this publication is to be based on IEC 800005 shore power standards, in particular the use of IEC manual connectors.

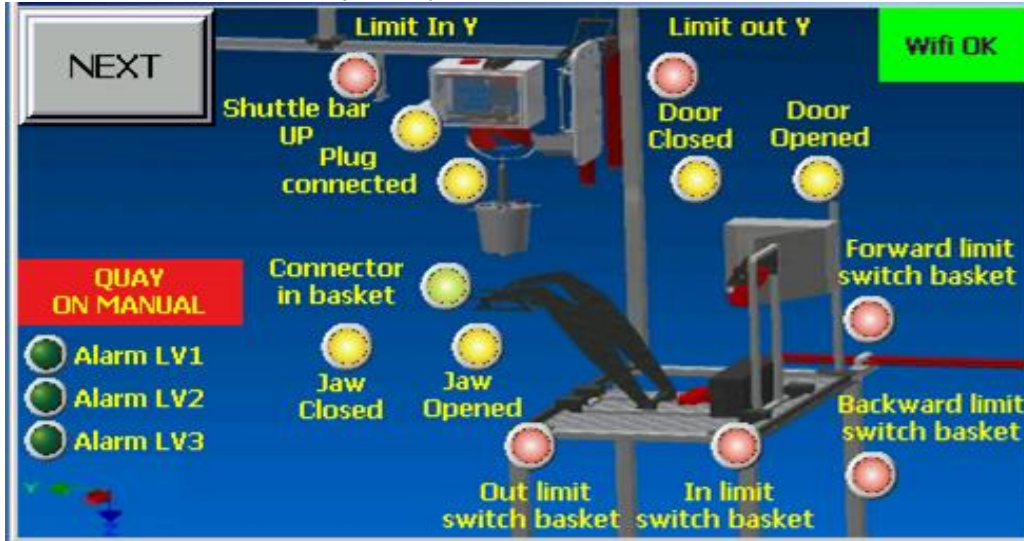
As the relevant manual handling of shore power connectors and cables brings significant safety and operational challenges, , NG3 has investigated, based on inputs provided by Port of Rotterdam, an alternative “hands off” “FLYING PLUG” solution based on our “PLUG” self-mating/de mating connector technology in operations for more than a decade, on numerous RoPax vessels.

To see PLUG in action see:

www.youtube.com/watch?v=pebvK7FjcSo&t=667s



View of Color Hybrid 700 A, 11kV PLUG connexion



View of Color Hybrid crew interface display



PLUG is light weight and avoids any significant harbour engineering when vessels are docking alongside the quay



This document is therefore split in three parts:

- A technical description of the FLYING PLUG solution;
- A compliance matrix between FLYING PLUG and OCIMF OPS recommendations
- A identification of FLYING PLUG solution benefits for the industry

1. FLYING PLUG technical description

Main design driver for FLYING PLUG is to locate the shore power operations away from cargo hazardous areas, in particular, in the case of tankers, the cargo manifold area.

The key requirement is therefore to implement the interface at the aft of the vessel, although, in most cases, this part of the vessel is located away from the terminal bank.

As vessel's length vary greatly depending on their sizes, this interface has to offer, in addition, a wide flexibility in terms of distance of the ship side interface w.r.t the vessel's midship cargo manifold which is the usual mooring reference point.

To reduce risks, speed up operations and providing an optimized mechanical solution to connect the two interfaces, FLYING PLUG is based on our well proven (since 2011!) PLUG self mating /demating connector solution.

The FLYING PLUG solution is therefore based on a ropeway solution, with the PLUG connector basket hanging from a dolly suspended on a rope, its power cables hanging in festoons suspended to a set of following dollies.

This approach offers numerous benefits, as, by design, the solution is compatible with large variation of the position of the aft of the vessel w.r.t its cargo manifold, but, as well, tide and vessel draft variations...

FLYING PLUG main components are the following:

On the vessel side:

- A dedicated FLYING PLUG room installed at the aft of the vessel. This room is rotating along a vertical axis, in order to, due to the rope way pulling force, align itself with the terminal side interface;
- A hook, located, on the roof of this room is used to attach the ropeway coming from the terminal to the vessel;
- As in RoPax PLUG solution, the ship side socket and the hoisting system is attached to a sliding beam supporting as well a watertight door.

On the terminal side:

- a rotating support gantry is to be installed on the existing first aft mooring dolphin, in order to deploy, retrieve and park, the connector and the cables festoons;
- the PLUG connector is in basket hanging from the first dolly, so that when within reach, it can be hoisted towards the ship side socket, like for other RoPax PLUG solutions.

Operations to establish the connexion are the following:

- Initially the ship side watertight door is closed and the terminal side gantry is rotated out of the way, to avoid any interference with the mooring line operations;

Compliance analysis with OCIMF –FLYING PLUG –30/07/2025

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- Once they have established aft mooring lines, line men handle to the crew aft mooring team the end of the ropeway so they can attach it to the hook located above the FLYING PLUG room;
- The terminal operator can then use the terminal side interface winches to fully establish the rope way and pull the dollies supporting the connector basket and the cable festoons towards the vessel; due to the tension on the rope the two interfaces self-align so the connector gets within reach of the ship side hoisting system;
- the crew can open the ship side interface door, slide out as needed the hoisting system, so as to “fish” the connector out of its basket and hoist it up towards the ship side socket, until the connexion is established;
- The system is then ready for power exchange...

So total estimated time to connect the vessel to shore power is 15 minutes after mooring.

Once the linemen have brought the rope way end to the crew, all operations can be performed by a single crew member and single terminal operator.

No direct handling of connector and cables is required.

PLUG Operations do not interfere with cargo handling ones. And are out of any gas hazardous zone.

Disconnection is performed by the same actions, in reverse.

Depending on the power exchange requirement, sizing of the cables can be optimized, on both sides, as well as the voltage. Our PLUG contacts have been qualified for 11 kV and up to 700 A.

The following 3D views show a typical implementation of FLYING PLUG taking into account the characteristics of a typical VLCC tanker vessels and oil terminal mooring plans provided by port of Rotterdam.

- First of all, safety as nobody needs to directly handle cables and connectors;
- Second, high power exchange capability as the weight of the connector and the following cables is not a concern, as the operations are fully mechanized (allowing for some smaller vessels to feed the vessel at its main bus voltage, avoiding the requirement of a on board step-down transformer!);
- Third, it offers an emergency /remote release capability, if for example the vessel’s drifts away from the quay;
- Fourth it offers speedy operations, allowing to establish the power exchange from “the first to the last minute” of the call...

Single conductor power cables are used as these offers the best heat dissipation (hence power carrying capability) per kg of copper, and in addition, the lowest manufacturing cost and procurement lead time...

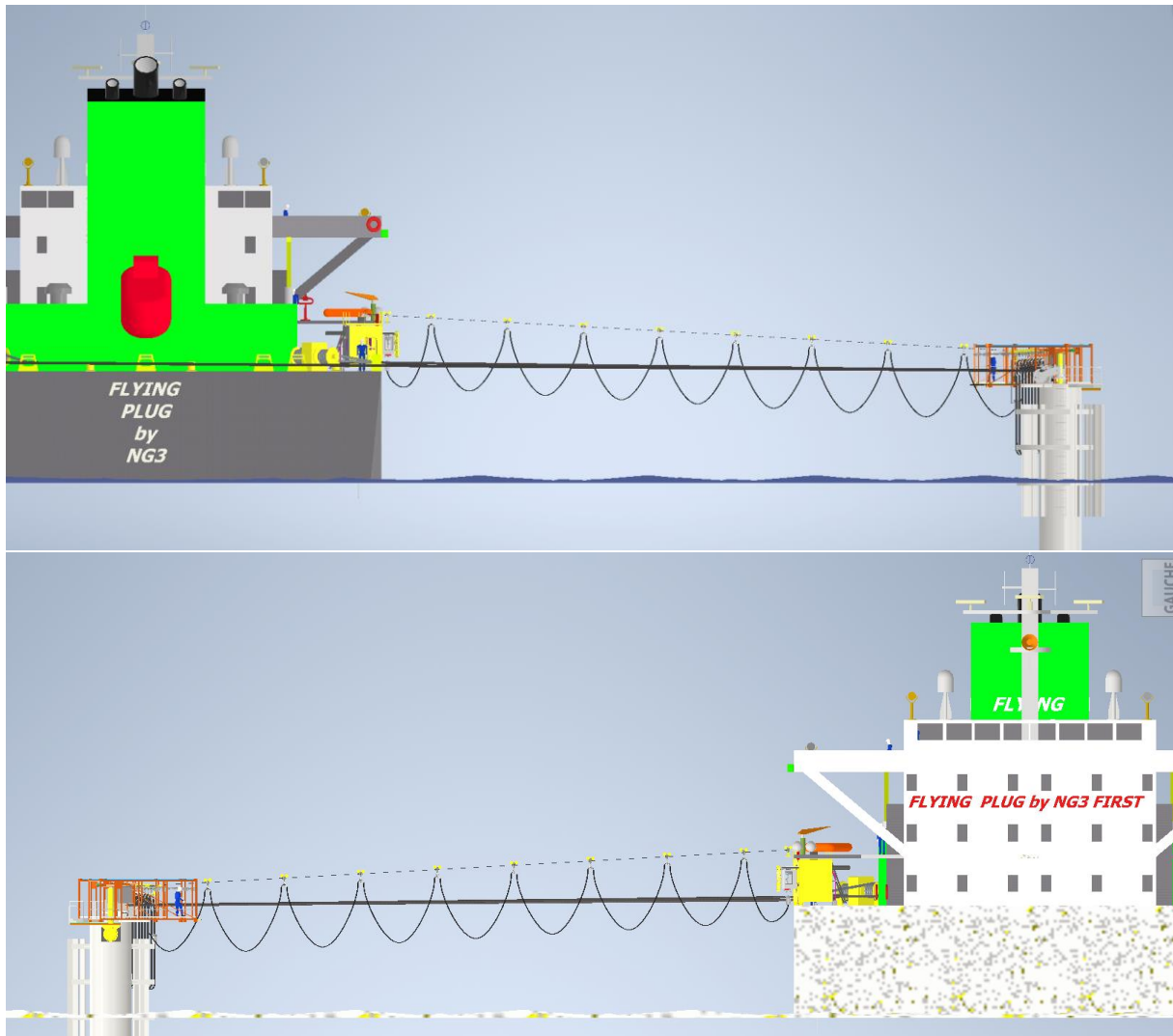
The hull side watertight door is attached at the end of the ship side sliding beam supporting the connector hoisting system, combining the beam sliding and door closing functions...

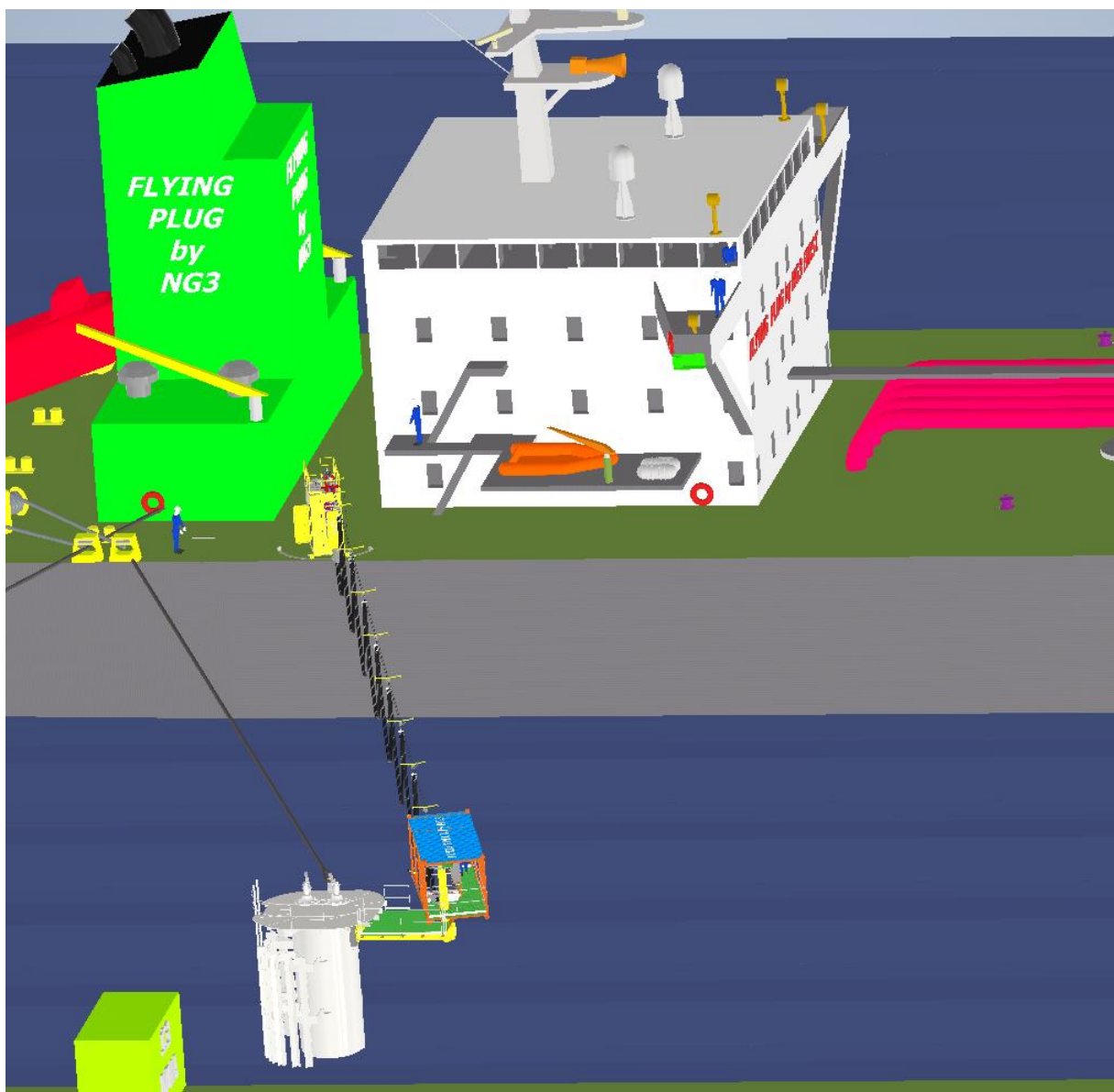
In terms of ease of operations, user friendliness is achieved with a crew interface displaying in details the whole system status for easy check and a quay side internet link allows easy remote support and troubleshooting...

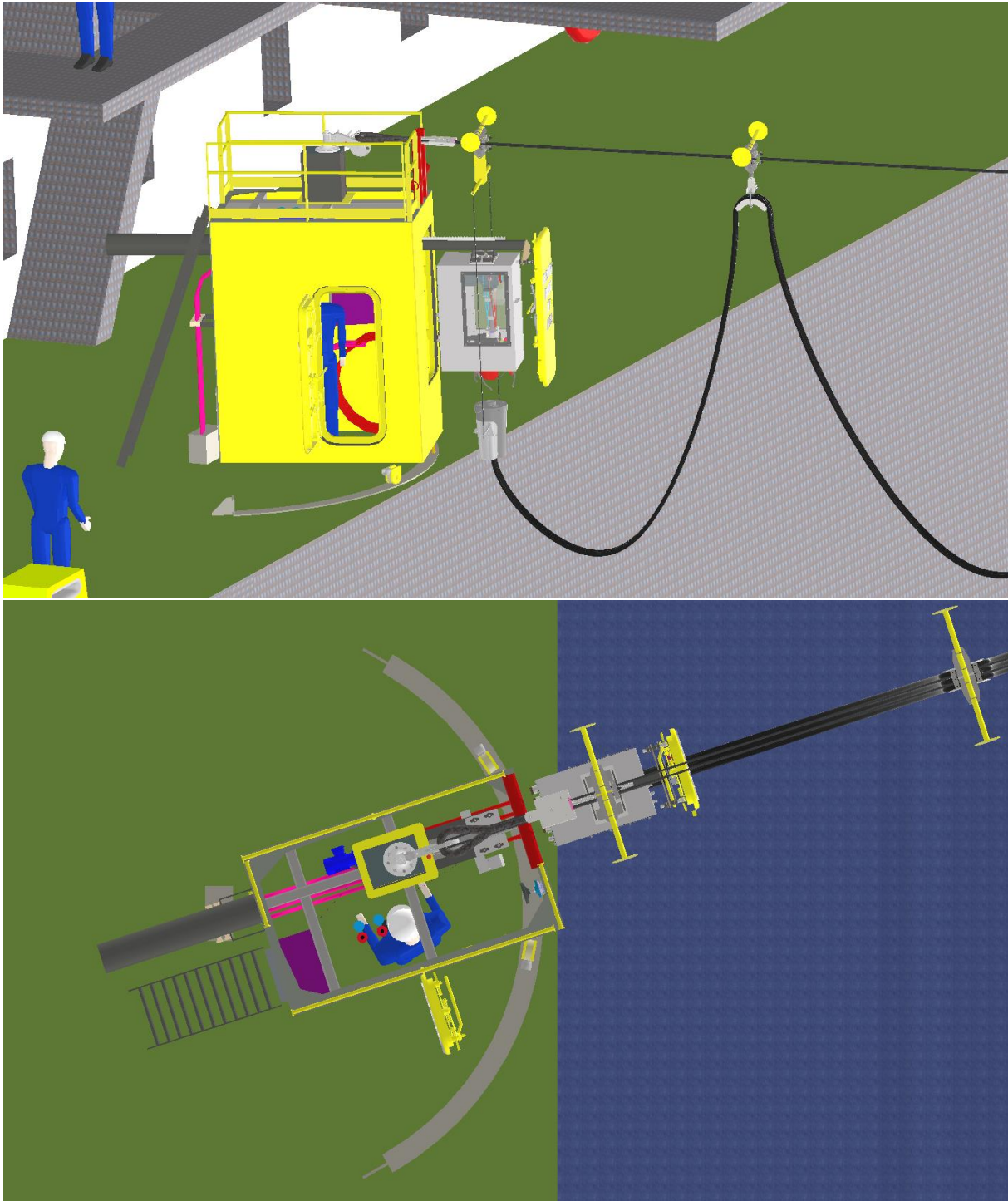


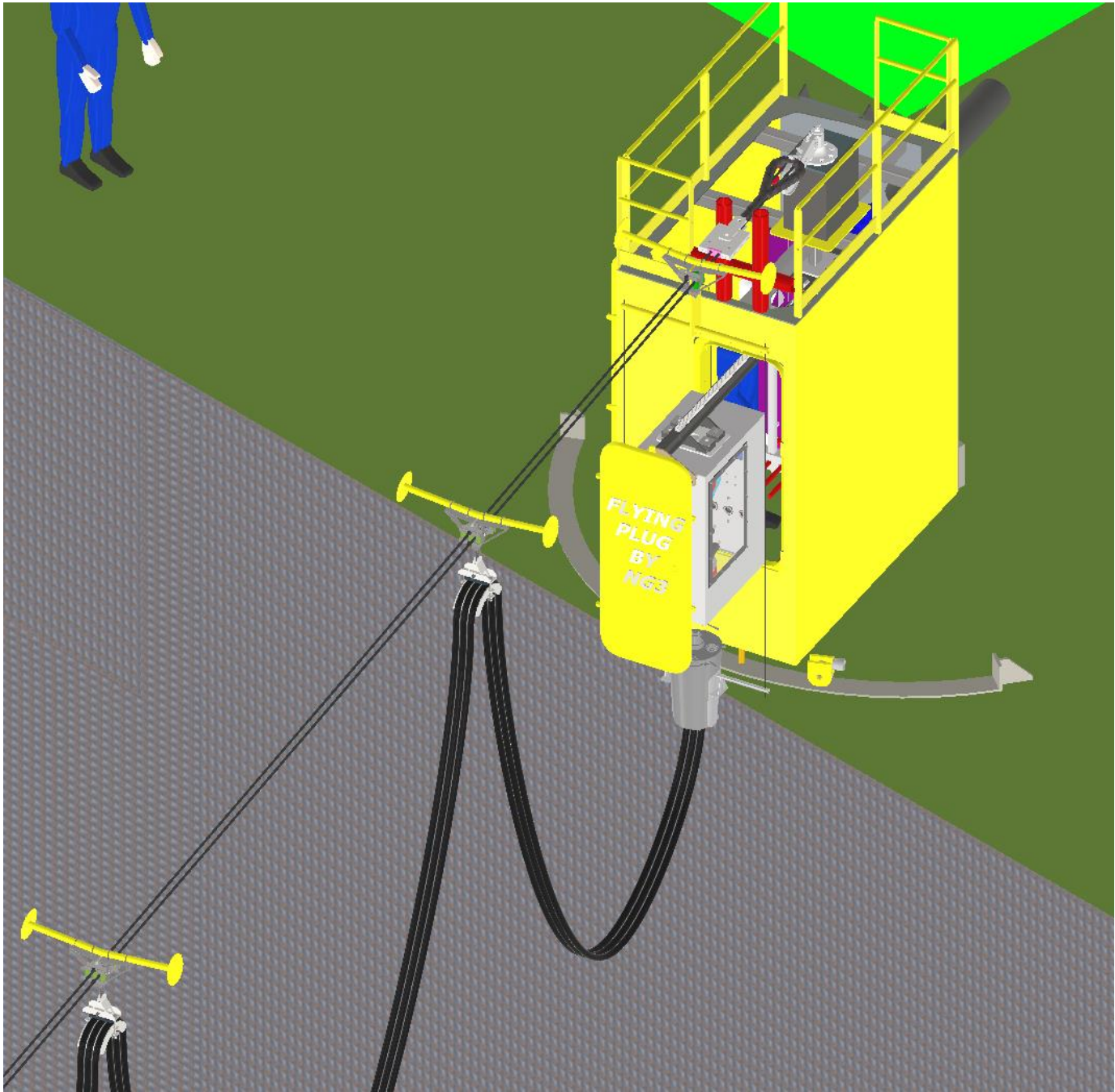
In terms of security, the ship and quay side interfaces are linked with a dedicated Wi-Fi link, while interfaces with the ship side and quay side power management systems are performed exclusively by a set of 24 Volt dry contacts, suppressing any risk of hacking...

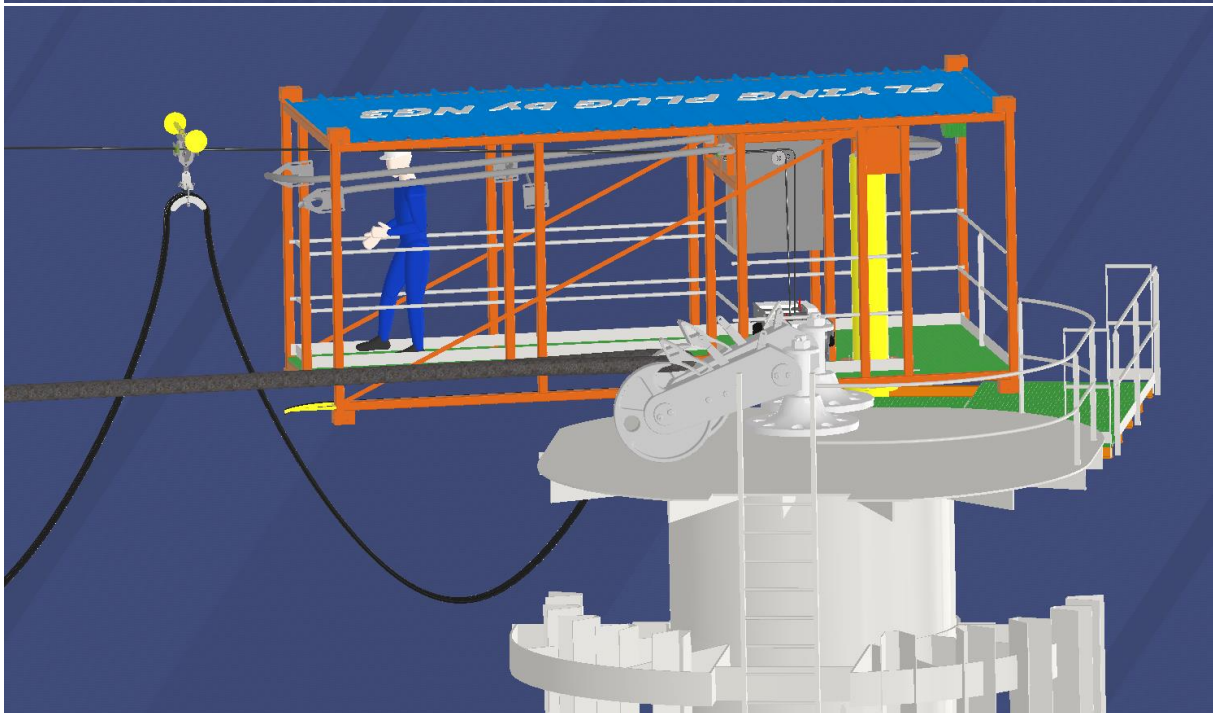
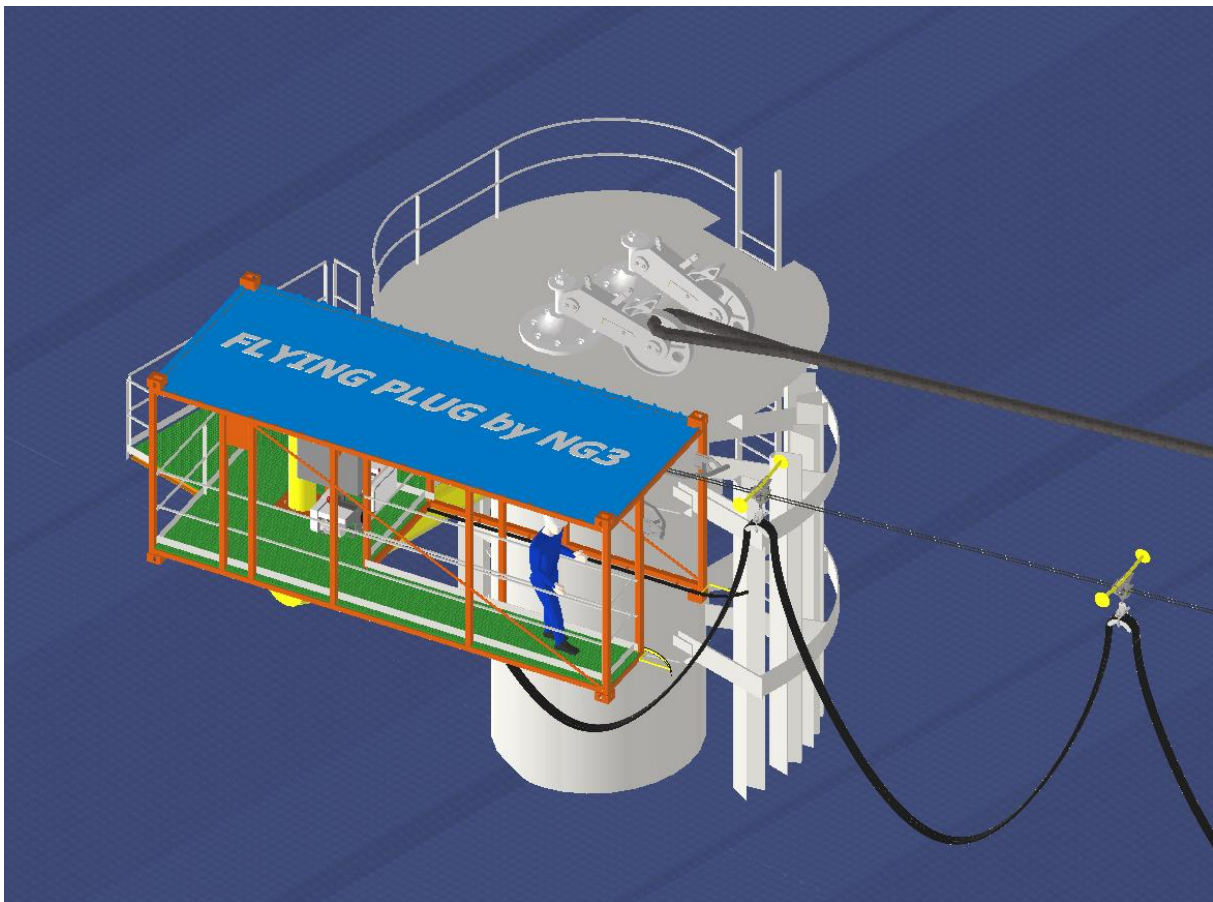
The proposed implementation is expected to be versatile enough to be acceptable for most tankers and terminals, but, evidently, FLYING PLUG may be adapted to specific requirements and constraints.

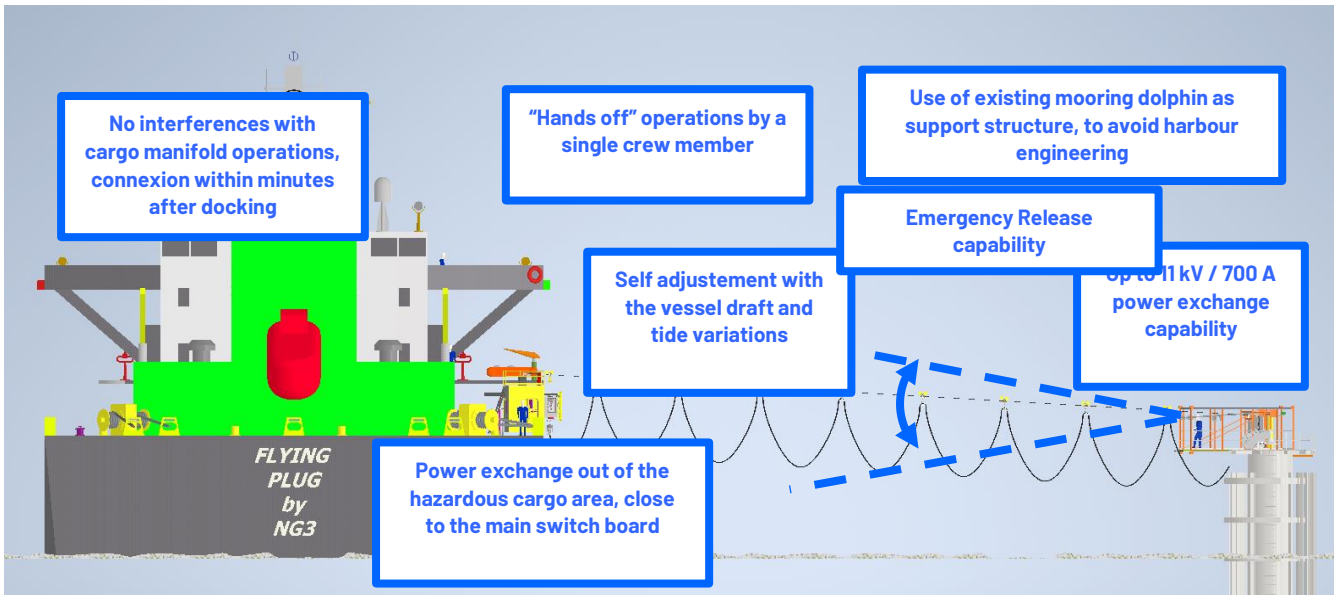
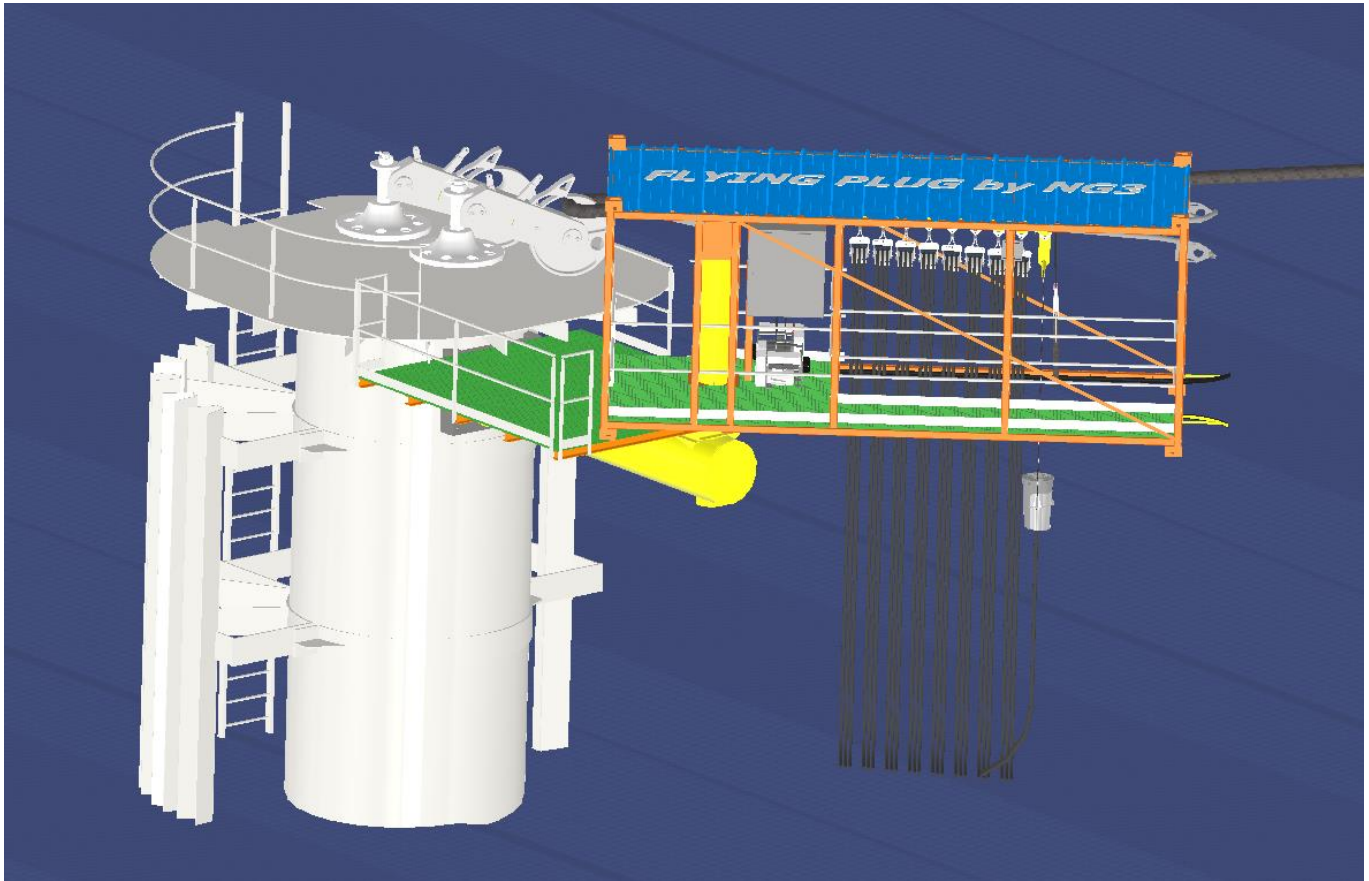










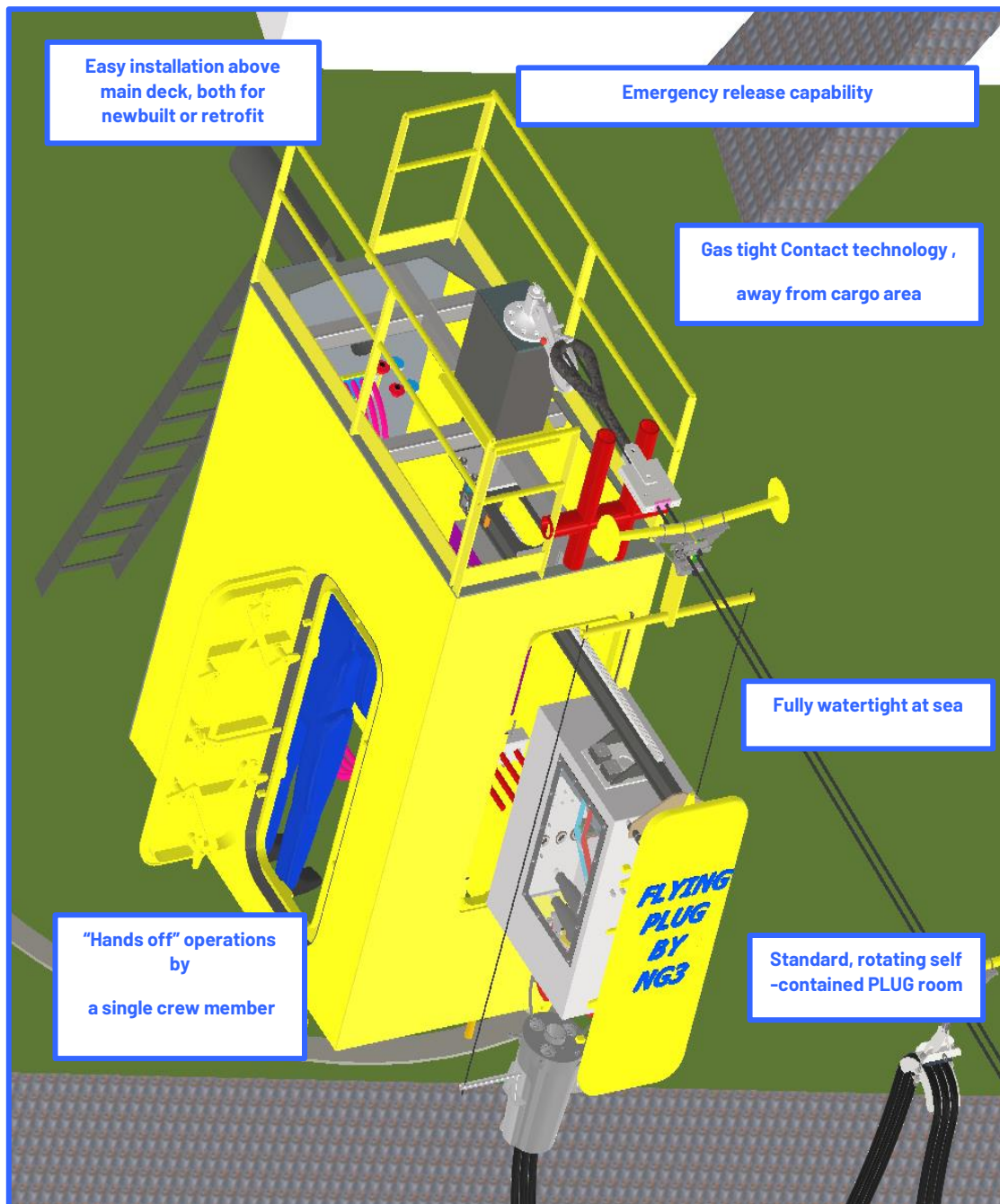


1.1. Ship side

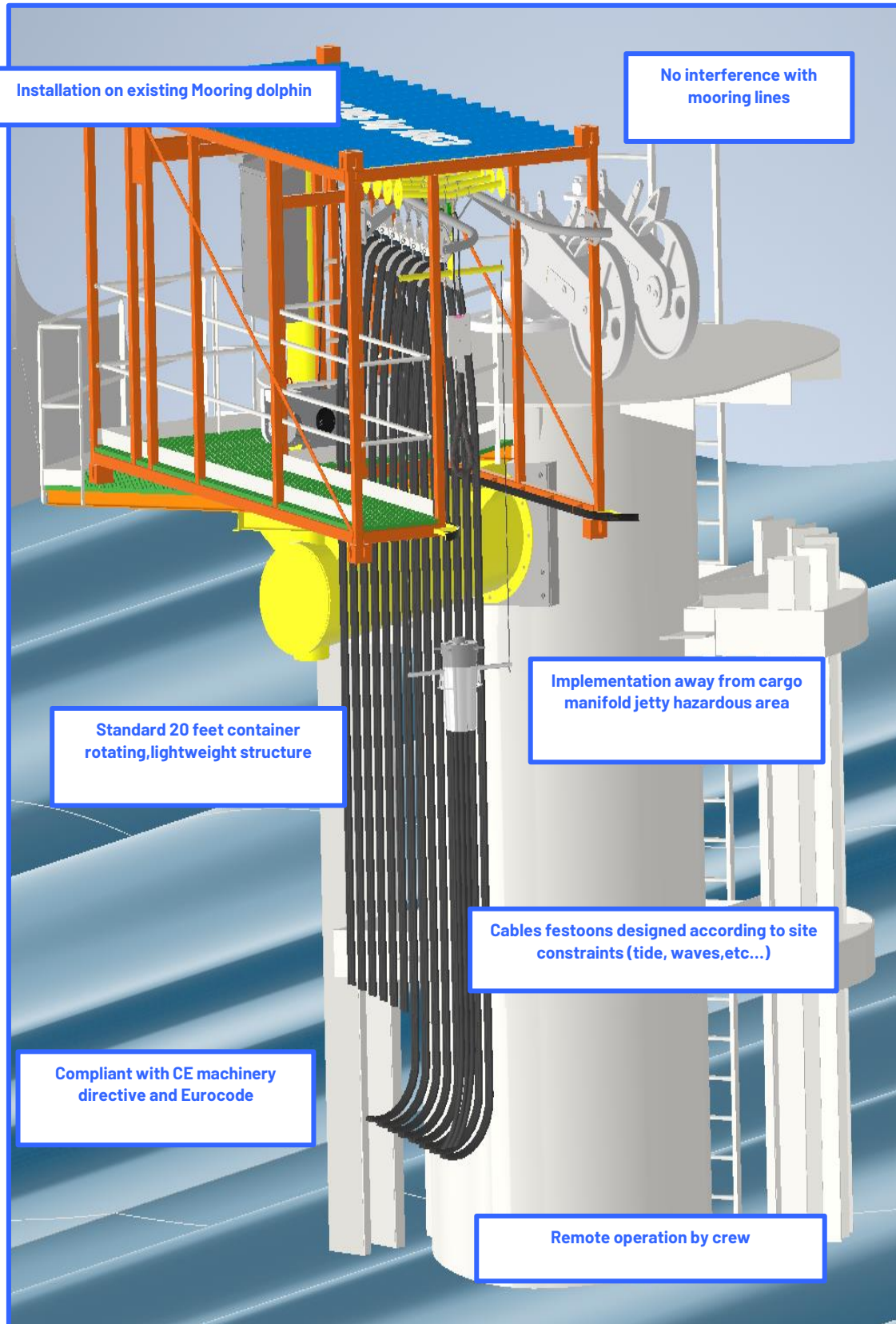
Main component on the ship side is a rotating PLUG room typically installed on the vessel's main deck.

This weather proof PLUG room contains:

- a motorized sliding beam which protrudes rain proof "fish tank" hosting the connector hoisting mechanism and a 11k V / 700A socket, attached to a motorized sliding beam which supports, as well, a watertight door. This sliding beam will rotate to align it in the same vertical plane as the terminal side interface



Main components on ship side



Main components on terminal side



Compliance with OCIMF guidance note

Paragraph	Title	Comments
1	Introduction	Regrettably we did not have the opportunity to introduce FLYING PLUG to OCIMF OPS working group
1.1	Purpose & scope	
2	Tanker general	Beyond the OCIMF guidance note limitation to oil, product and chemical tankers, FLYING PLUG is compliant, as well, with gas tankers and terminals anticipated OPS future requirements.
2.1	OPS system overview	Due to its FLYING PLUG “hands off” design is not limited, compared to solution based on manual connectors, by the weight of cables and connectors so if appropriate, high amperage, low voltage shore power exchange can be considered to feed the vessel with its main switchboard tension, suppressing the need for a on board step down transformer...
2.2	Codes and standard	FLYING PLUG is compliant or exceeds IEC 80 005 functional and safety requirements, but excludes the use of IEC standard manual connectors, considered inadequate. FLYING PLUG shall be compliant with class and national authorities’ requirements.
3	Ship layout and design	Beyond the mentioned design drivers, FLYING PLUG includes as design drivers, simplicity, CaPex and OpEx...
3.1	Hazardous areas	By design, FLYING PLUG is outside and far away from the vessel’s cargo hazardous and terminal loading manifold areas.
3.2	Structural design	Due to its implementation on the vessel aft main deck, FLYING PLUG structural design is straightforward, limited to a simple bolted interface.
3.3	Location of OPS inlet	As recommended by OCIMF, FLYING PLUG ship side interface is located at the aft of the vessel, in a non-hazardous area. Different vessels size and terminal configuration are taken into account by the fact that both the ship and terminal side FLYING PLUG interfaces are rotating to self-align with each other. By design FLYING PLUG interface is closed to the vessel’s main switchboard and avoids routing of cables within hazardous areas. If required, the FLYING PLUG connexion can be flushed with inert gas.
3.4	Cable lifting	By design, FLYING PLUG avoids use of ship side cranes. The whole cables and connector lifting operation is performed by the combination of the hook located on top of the FLYING PLUG room and the rope way support provided by the terminal.



		By design, FLYING PLUG rope way solution, once established, passively adapts itself to the vessel's movements without active monitoring and adaptation.
3.5	Interaction of cabling with mooring system	Due to its location forward of all the aft mooring lines, FLYING PLUG does not interfere with them and is out of the way of the hazardous mooring lines snap back areas.
3.6	Interaction with gangway and cargo transfer equipment	Due to its location FLYING PLUG avoids any such interactions
3.7	Accommodating varying ship orientation at berth	FLYING PLUG ship side rotating interfaces aft location on each side of the vessel's aft are compatible with various ship orientation at berth.
3.8	Accommodation for ship movement	By design, FLYING PLUG avoids wear and stress on the power cables due to ship movement
3.9	Access restriction at the OPS ship inlet point	By design the FLYING PLUG ship side interface provide a restricted access to the connexion
3.10	Cable routing and protection	By design FLYING PLUG avoids mechanical damage on the power cables due to falling objects or other causes. By design FLYING PLUG provides optimum cooling of power cables By design FLYING PLUG avoids routing of cables through cargo hazardous areas High voltage warning notice are displayed on both ship and terminal side interfaces
3.11	Human-centred design	By offering a "hands off" design solution, FLYING PLUG satisfies this requirement in a simple and effective way. The ship and terminal FLYING PLUG interfaces will be directly connected to the ship and terminal power management systems controlling the breakers. Both interfaces are equipped with local emergency stop buttons outside of the arc flash range and cameras to be connected to the ship and terminal CCTV system.
4	Ship electrical design	FLYING PLUG design is compliant with, on the ship side , class and flag requirement's and on the terminal side with local ones, such as EUROCODE and European Machinery Directive
4.1	Power requirement's, voltage, frequency and couplers	The PLUG contacts technology used for FLYING PLUG is qualified for 700A under 11 kV, and could be uprated if required. This allows to use: a single PLUG under 6.6 kV to cover, with up to 8MVA capability, the need for most vessels covered by the OCIMF survey. The 10.4 MVA power needs for the most demanding vessels could be either covered by a Twin 6.6 kV FLYING PLUG configuration, either by a single 11 kV FLYING PLUG solution. In any case due to its much higher power exchange capability, both in terms of amperage and voltage, compared to IEC manual



		connectors, FLYING PLUG allows to reduce drastically the complexity and the part numbers of the shore power connexion (such as breakers/pilots lines, etc...). By design PLUG connector technology provides interlocks and avoid access to potential contact with live parts.
4.2	Further consideration on the voltage and frequency	FLYING PLUG is compliant with the present IEC 6.6 kV recommendation. Nevertheless, without any change it is compatible with 11 kV providing a significant potential for growth without modification, to cover for example battery charging of future hybrid /full electric vessels...
4.3	System voltage dip and subsequent faults caused by inrush current during operations	If appropriate, the ship side shore power breaker can be implemented within the FLYING PLUG shore power room.
4.4	Safety system design , emergency stop, auto ejection, quick release and ESD permissive	<p>FLYING PLUG is compliant with the requirements but offers as well an emergency release capability, for which we propose the following levels of alarms /</p> <ul style="list-style-type: none"> - Level 1 : alarm which warns the crew of a potential shore power black out to initiate the starting and synchronisation of the on board gensets to avoid such black out; - Level 2 : opening of the ship and terminal side breakers and grounding of the power cables - Level 3 : release of the ship side PLUG hoisting chain down to the last link to disconnect and release the connector to its basket.retraction of the shore power cables festoons towards its terminal side parking position. - Level 4 : opening the supporting cable emergency hook to free the vessel from the rope way. <p>This would allow to perform and complete remote emergency release of the vessel from the CMS within minutes, without any risk and direct handling. For this purpose, ship side interface shall be provided with uninterrupted power supply so that the hoisting down of the chain and the cable way hook release can be performed even if a ship side black out occurs after the level 2 opening of the breakers.</p> <p>Note that SIGTTO requires Emergency Release capability.</p>
4.5	Physical protection of the coupling point	FLYING PLUG is compliant with these requirements. While at sea the ship side connexion is protected behind a watertight door.
4.6	Connection design	FLYING PLUG is fully compatible with these functional requirements and provide built in safety caps functions.



4.7	Frequency conversion	No impact on FLYING OLUG design
4.8	Step down transformer design	No impact on FLYING OLUG design
4.9	Shore connection switchboard location and design	If appropriate, the ship side shore power breaker could be implemented within the ship side FLYING PLUG shore power room
4.10	Earthing of electrical equipment	FLYING PLUG is compliant with these requirement's, with pilot contact opening prior power and earthing contacts.
4.11	Protection of ship equipment due to surge/dip power factor, voltage regulation and surge protection	FLYING PLUG cable's location away from personnel area during operation avoids any risk linked to cable jumping in case short circuit surge.
4.12	Coupling space and compartment	If required FLYING PLUG room and contact can be pressurized with inert/gas free supply.
4.13	On board PMS	FLYING PLUG is compliant with these requirement's
5.1	Stand by on board power	FLYING PLUG is compliant with these requirements, provided the interface is on UPS, see 4.4
5.2	Additional safety devices and equipment	No impact on FLYING PLUG
5.3	Cable movement and prevention	By design, FLYING PLUG avoids any stress on the power cables due to movements.
5.4	Maintaining cargo system integrity in case of a sudden loss of power	No impact on FLYING PLUG
5.5	Additional gas detection considerations	Although it is located out of the hazardous cargo area, FLYING PLUG ship side interface can be equipped with Gas detection system and oxygen level sensor if inerted.
5.6	Fire protection	FLYING PLUG ship side interface can be equipped with fire detection systems
5.7	Independent supply in different locations	FLYING PLUG is compatible with different locations, although the preferred aft port and starboard implementation should be versatile enough to cover most of ship and terminals needs.
5.8	Consideration for cargo pumping systems	Due to its higher amperage and voltage capability, FLYING PLUG offers extra power exchange capabilities for such needs.
5.9	Consideration for tank cargo inert gas	Due to its higher amperage and voltage capability, FLYING PLUG offers extra power exchange capabilities for such needs.
6.1	Vetting and berth/ship compatibility checks	Due to its versatility, FLYING PLUG solution is expected to not required any significant ship or terminal side adaptation simplifying drastically the vetting process



	with electrical connection	
6.2	Pre arrival communication	As FLYING PLUG operations are not expected to be different from one ship or terminal to the other, qualification of personnel should be simplified.
6.3	Managing access restriction around electrical installation	On the ship side access to the FLYING PLUG shore power can be easily restricted to the ship side electrician. On the terminal side access to the FLYING PLUG interface can be easily restricted to the terminal side PIC. By design, FLYING PLUG ensures that non authorized personnel have access to the CMS and are kept away from any CMS generated risks.
6.4	Electrical connexion procedure	By providing a “hand off”, “self-mating” connexion, provides a simpler and safer connexion procedure compared to IEC manual connectors.
6.5	Operating shore power system procedures	By design, FLYING PLUG simplifies power system procedures
6.6	Managing interaction between mooring operations and electrical equipment	By design, FLYING PLUG self-adapts to mooring conditions changes without requiring specific attention. No risk of cable damages due to ship ‘s movement
6.7	SIMPOS impact on electrical installation and hazardous areas	By avoiding the manifold area and allowing CMS operations to be performed exclusively by the ship and terminal personnel in charge of the aft mooring lines, FLYING PLUG avoids any interferences with other tasks such as the one in charge of the cargo connexion in the manifold area or the establishment of the forward mooring lines.
6.8	Ship readiness to evacuate and decoupling	By design, compared to IEC manual connector solution, FLYING PLUG offers a remote emergency decoupling capability within a few minutes
6.9	Physical protection of the electrical installation while alongside	By design, FLYING PLUG avoids the need for such protection
6.10	Ship shore pre-operation conference to cover operating limits	By design, FLYING PLUG can cope with ship movement due to passing vessels.
6.11	Firefighting procedures	By design and by implementation at the aft of the vessel, with a connexion outside of the vessel envelope and including no flammable materials ship side FLYING PLUG interface offers limited fire risk. Ship side PLUG room can be equipped with appropriate fire extinguishing devices. The same applies for the terminal side interface which is located away from cargo fire hazards sources.



6.12	Independent verification , class for ISM and vetting	Due to its versatility, FLYING PLUG is not expected to require significant specific vetting procedures, simplifying verification procedures by class and authorities
6.13	Protection of socket when not in use	By design, once retracted inside the PLUG room the ship side FLYING PLUG socket is fully weather protected
6.14	Procedures in case of system failure	As it is remotely operated, away from cargo and other operations FLYING PLUG reduces any risks in case of system failure. Each interface can be equipped with required sensors and alarms, as well as with cameras connected to the vessel and terminal control rooms for remote visual check of their status
7.1	Periodic structured rounds of equipment for integrity by operations	Due to its simplicity, FLYING PLUG offers a straightforward visual check of its status by both ship and terminal personnel.
7.2	Minimum inspection recommendation of equipment by maintenance technician, pre use, monthly and annually	FLYING PLUG user's manual will include inspection maintenance requirements
7.3	Inspection and maintenance recommendation of OPS equipment	FLYING PLUG user's manual will include inspection maintenance requirements
8.1	Competency recommendations of electrical coupling /decoupling team	FLYING PLUG user's manual will include training and certification requirements
8.2	Verification of competency of electrical coupling/decoupling team	FLYING PLUG user's manual will include competency verification procedure and periodicity.
8.3	Competency and training of maintenance team	FLYING PLUG user's manual will include inputs for the ship and terminal maintenance plans.
8.4	Training and drill recommendations to handle abnormal conditions and emergencies	FLYING PLUG user's manual will include recommendations for training and drill for these conditions



9.1	Location of shore coupling and alternative considerations	Proposed FLYING PLUG implementation at the aft of the vessel out of the cargo area is the one recommended by OCIMF
9.2	Effective Cable Management System	FLYING PLUG offers significant operational and safety benefits compared to the solutions listed in this paragraph.
9.3	Civil marine structural design requirements	The FLYING PLUG terminal side interface additional forces towards the mooring dolphin structure is expected to be negligible compared to the ones generated by the mooring lines and is not expected to require any re enforcement. The terminal side 20 feet container structure may be rotated sideways after use, increasing clearance with regard to the vessel movement when berthing/unberthing. If applicable, the terminal side interface structural design will be according to EUROCODE or other regulation (such as seismic for example).
9.4	Interaction of cabling with mooring design and operations	Proposed location of the terminal FLYING PLUG interface just forward of the first aft mooring Dolphin will avoid interference with the mooring lines and will place the shore power cables out of the snap back area if one of the aft mooring line breaks. We propose to Include the rope way connexion and dis connexion in the aft mooring crew and line men task will ensure that these operations will be performed after/before the mooring lines are established/ released reducing the reducing risk of interference between these operations;
9.5	Interference with gangway and cargo transfer equipment	Implemented at the aft of the vessel, FLYING PLUG avoids such interference by design.
9.6	Accommodating varying ship sizes and orientation	As checked with inputs provided by Port of Rotterdam a single FLYING PLUG terminal interface located on the first aft mooring dolphin , combined with either a port or starboard ship side interface located at the aft of the vessel, can connect to all size of vessels.
9.7	Accommodation for ship movements, surge, sway and heave	As demonstrated by the feasibility 3D modelling based on port of Rotterdam inputs FLYING PLUG is, by design, compatible with such movements.
10.1	Variation in power demand	Due to its higher amperage and voltage capacity FLYING PLUG offers larger margins w.r.t such demands. In addition, using single core, open air power cables, FLYING PLUG design provides higher margins with regard to cable overheating, especially w.r.t multicore cables mounted on cable reels
10.2	Connection design	IEC 80005 annex F which describe manual connectors is irrelevant to FLYING PLUG, although FLYING PLUG complies and, in most cases, exceeds this standard



		functional requirement, allowing to reduce, among other things, drastically the number of connexion required.
10.3	Frequency conversion	No impact on FLYING PLUG
10.4	Shore transformer design	No impact on FLYING PLUG
10.5	Shore switchboard location and design	If appropriate the shore power switch board breakers can be implemented respectively within the FLYING PLUG ship or terminal interface.
10.6	Voltage consideration	11 kV capable by design, FLYING PLUG complies, with margins, with this requirement
10.7	Cable design including consideration for ship movement-freewheel	FLYING PLUG, by design, compensate ship movements
10.8	Reel design	By design FLYING PLUG avoids use of cable reel , subject to overheating, and associated medium voltage slip ring rotating contacts, subject to added maintenance, simplifying the solution.
10.9	Lifting equipment including consideration for ship movements	FLYING PLUG design is self supporting and does not need any additional lifting equipment
10.10	Earthing of electrical equipment	FLYING PLUG will include the required pilot lines to check earthing and equipotential functions
10.11	Safety system design -emergency stop, auto ejection quick release and EDS permissive	FLYING PLUG offers hard wired safety loop between ship and terminal
10.12	Protection of ship equipment due to power surge/dip-power factor, voltage regulation and surge protection	Due to its amperage and voltage capability, FLYING PLUG component are expected to have higher margins than required.
10.13	Protection of shore utility, reverse power and impact to cogeneration operations	No impact on FLYING PLUG
10.14	Additional gas detection considerations	Both ship and terminal side FLYING PLUG interfaces can implement the required sensors and alarms
10.15	Additional fire protection for electrical	Such additional equipment can be implemented on FLYING PLUG

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	equipment-foam suppression	
10.16	Back up/redundant supply-shore protection relays and UPS	On the ship side, UPS shall be provided to the FLYING PLUG interface to perform Emergency Release function. Manual / battery operated hand drill can be used to store the hoisting chain and slide in the beam. Watertight door can be locked manually. On the quay side, back-up power supply to store the cables and the rope way could be provided by a generator on board the line men boat.
11.1	Pressurized building design	Pressurisation and inerting is not expected to be required for FLYING PLUG due to its location away from the cargo hazardous area.
11.2	Shore power generation	No impact on FLYING PLUG
11.3	Ship/shore electrical isolation	FLYING PLUG provide equipotential bonding
11.4	Fluid surge	Not applicable to FLYING PLUG
11.5	Environmental considerations	Ship side FLYING PLUG interface control cabinet will be provided with a heater to protect it from low temperatures. The same will apply for the terminal side, with heating or cooling provisions, as needed according to local conditions. Local temperature extremes at the Terminal side will be taken into account for shore power cables limitations.
11.6	Berts with ERS and auto mooring systems	FLYING PLUG built in emergency release capability is compatible with such systems
11.7	Arc flash consideration	FLYING PLUG “hands out” operations avoid arc flash risk for personnel
11.8	shore physical barriers around electrical equipment	FLYING PLUG provides such barriers
11.9	Human factor design	Not Applicable to FLYING PLUG as substations are not in the scope of supplies
11.10	Corrosion protection	By design FLYING PLUG components are compatible with marine environment. Terminal side anti - corrosion strategy may be adapted to local conditions if needed.
12.1	Operational responsibility	Due to the limited number of people involved in FLYING PLUG operations, typically ship and terminal f electrician and line men, responsibility and task allocation are straightforward.
12.2	Pressurisation system failure	Due to its location away from hazardous zone,FLYING PLUG is not expected to require pressurisation.
12.3	Cable reel handling between ship and shore	FLYING PLUG is compliant as the cable supporting rope way is provided by the terminal

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12.4	Cabel retrieval	FLYING PLUG rope way solution is compliant with these requirements
12.5	Berth pre-connection checks and tests	FLYING PLUG by design allows such test and inspection
12.6	Electrical connection procedure	FLYING PLUG offers the possibility to have a standard procedure for all vessels and terminals
12.7	Shore power supply interruption	No impact on FLYING PLUG
12.8	Electrical disconnection procedure	FLYING PLUG offers the possibility to have a standard procedure for all vessels and terminals
12.9	Physical protection of the electrical cabling while alongside	By design FLYING PLUG provides such protection
12.10	Managing interaction between mooring operations and electrical equipment	FLYING PLUG use a dedicated rope way system to support the cable, independent and away from the mooring lines
12.11	SIMOPS impact on electrical installation and hazardous areas	Due to speed of its operations, compared to cargo manifold connexion/dis connexion, FLYING PLUG connection /disconnection is expected to be performed well before/after cargo transfer is started/resumed
12.12	Emergency departure	By design, FLYING PLUG provides a remote emergency release capability within minutes
12.13	Managing access restriction around electrical installations, safety and security	By design, FLYING PLUG, provide effective access restriction against un authorized personnel. Signage will be implemented as needed.
12.14	Cybersecurity protection	Risk of hacking is limited as FLYING PLUG control command interfaces with the ship and terminal side power management systems are limited to dry contacts
13.1	Codes and standards	FLYING PLUG is compatible with such standards
13.2	Equipment integrity	By design, FLYING PLUG provides safe storage of power cables and connector when not in use

Compliance analysis with OCIMF –FLYING PLUG –30/07/2025

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13.3	Inspection recommendation of equipment by mechanical technician	FLYING PLUG user manual describes the recommended inspection
13.4	Inspection and maintenance of equipment by competent person	FLYING PLUG user manual describes the recommended inspection and maintenance
14.1	Competency and qualification recommendation of coupling/decoupling team	FLYING PLUG user manual describes the recommended competency and qualification
14.2	Recommended training frame work for coupling/decoupling team	FLYING PLUG user manual describes the recommended training
14.3	On going verification of competency of coupling/decoupling team	FLYING PLUG user manual describes the recommended verification
14.4	Competency and training of maintenance team	FLYING PLUG user manual describes the recommended competency and training
14.5	Competency and training of terminal operators	FLYING PLUG user manual describes the recommended competency and training
14.6	Training and drills recommendations to handle abnormal conditions and emergencies	FLYING PLUG user manual describes the recommended training and drills
15.1	OPS design interface philosophy	FLYING PLUG will be upgraded as needed to follow the industry best practice
15.2	Hazardous area classification	Local hazardous area classification will be taken into account during terminal side FLYING PLUG implementation analysis
15.3	Hazardous areas	Due to its design and location FLYING PLUG is expected to be out of hazardous areas
15.4	Compatibility design characteristics and evaluation between ship and berth	By design, BFLYING PLUG is directly compatible with various ship and terminal characteristics



15.5	Electrical protection coordination confirmation between ship and berth	No impact on FLYING PLUG
15.6	Design guidance to prove electrical isolation between ship and shore	FLYING PLUG connector provide equipotential bonding
15.7	Startup /commissioning	FLYING PLUG is compatible with this startup / commissioning procedure
16.1	Ship screening and berth /ship compatibility	Due to its design FLYING PLUG will simplifies this analysis
16.2	Pre-arrival communication between ship and shore	Due to its design FLYING PLUG will simplifies this communication
16.3	Roles and responsibilities for coupling /decoupling teams	Due to the limited and well-defined role of the ship and terminal side involved in its operations, FLYING PLUG insure clear responsibility and role of all participants
16.4	Managing hazardous areas	By design, FLYING PLUG avoids access to the personnel in the vicinity of the connexion
16.5	Minimum PPE for coupling/decoupling teams	No impact on FLYING PLUG
16.6	Cable handling between ship and shore, including safe manual handling practices	By design, FLYING PLUG avoids any cable handling
16.7	Sequencing of OPS coupling and decoupling	No impact on FLYING PLUG
16.8	Emergency OPS decoupling procedure	By design, FLYING PLUG provides a remote emergency release capability within minutes
16.9	Minimum staffing and competency considerations for coupling/decoupling	Due to its "hands off" design, FLYING PLUG minimizes drastically staffing requirements. Only one ship and terminal side personnel will be required to operate the system, once the rope way is installed;
16.10	Safety check list	FLYING PLUG user manual describes the recommended safety check list



Identification of FLYING PLUG benefits for the industry

Safety benefits

For crew and terminal personnel, FLYING PLUG avoids all the risk linked to manual handling and proximity with high voltage cables and connectors.

By its implementation away from the cargo hazardous area, FLYING PLUG avoids the fire/explosion risks related with electrical installation in operations in potentially explosive atmosphere.

As its operations can be performed by the aft mooring team, FLYING PLUG avoids potential interferences with the midship cargo transfer operations, and the relevant SIMPOS hazards.

By offering a very standardized solution for all types of vessels and terminal conditions, FLYING PLUG “one fits for all” capability reduces risk of misunderstanding between crew and terminal personnel.

By involving directly the aft mooring line team, FLYING PLUG reduce risk of interferences with mooring operations, such a connecting prior final mooring or releasing mooring before disconnecting....

By its implementation forward of all the aft mooring lines, FLYING PLUG avoids interferences with the power cables, even in case of mooring line backlash.

By offering a remote emergency release capability, FLYING PLUG allows departure of the vessel on immediate request.

Due to its implementation away from the manifold piers installation of the quay side interface on the first aft mooring dolphin avoids hot work in potentially hazardous area.

Due to its location in a non-explosive area FLYING PLUG avoids the need for inerting and the relevant risk of anoxia.

Environmental benefits

As FLYING PLUG operations will be performed by the aft mooring team within minutes after/ before docking / un docking, FLYING PLUG will maximize the use of shore power during the call, reducing accordingly the relevant emissions.

Due to its amperage/voltage power exchange capacity, FLYING PLUG allows to reduce drastically the parts count of the whole infrastructure, such as breakers.

Due to its location at the aft of the vessel, close to the main switch board, FLYING PLUG reduces the required length of cable, reducing use of copper.



Due to its use of single core power cables, which offer better cooling capabilities, FLYING PLUG allow to further optimize their copper cross section.

By using the terminal existing mooring dolphin as supporting structure on the terminal side and the vessel main deck on the ship side, FLYING PLUG reduces or avoids the required steel and concrete.

Due to its higher power exchange capability FLYING PLUG offers margins for additional electrical loads covered by the shore power supply, such as battery charging for hybrid propulsion vessels, inert gas generator, cargo heating...in addition it offers the possibility of having STS shore power transfer form one vessel to the other...

FLEET benefits

On the sip side the FLYING PLUG room will be a “one fits all “ solution, directly bolted to the main deck. Apart from the savings during installation this allows shipowners to optimize the implementation and possibly, at the beginning when only limited number of ports are equipped, to have their whole fleet “FLYING PLUG ready “, but to equip, on demand, only with FLYING PLUG rooms the vessels which are chartered towards these ports, in the same way container carrier vessels shipowners first implemented AMP shore power interface within relocatable AMP containers.

New build and retrofit vessels benefits

Due to the simplicity of their installation FLYING PLUG room can be installed on new or retrofitted vessels in a few days. No engineering and steel works are needed to route cables though the cargo area. No hazardous areas specific requirements are needed. And length of routing and cable trays towards the main switch board. Due to extra power exchange capability , FLYING PLUG allows to reduce the number of breakers required.

New build and retrofit terminals benefits

By its implementation on the already existing / or already planned aft mooring dolphin, FLYING PLUG reduce engineering effort , steel work and harbour engineering and being away from the terminal hazardous areas, ease hot work permit process to install is support.

Insurance coverage benefits

Generating less risk, both for personnel and hardware, FLYING PLUG will reduces the insurance coverage of both ship owners and terminal operators.

Mower legal risks

FLYING PLUG reduce legal risk linked to non compliance with local regulation relevant to mananul handling of loads , such as the ones driven by the 89/991 EC directive w.r;t avoidance of back injuries risk for workers

Wear and tear benefits

Due to its design, FLYING PLUG reduce wear and tear of the power cables are they will not be subject to the wear and tear of manual handling / dragging

Maintenance benefits

Relying on simple , straight forward mechanical principles, FLYING PLUG can be easily maintained by crew and terminal personnel while due to its higher power exchange capability, the electrical architecture is simplified with a reduced number of components such as breakers...



Reduced logistics costs

Designed within a 20 feet standard container structure, the quay side interface can be easily shipped and stored at minimum cost.

Reduced manpower cost

FLYING PLUG operations are expected to be just an added task for the crew and terminal personnel in charge of the aft mooring, so this will reduce man power costs. Due to the simplicity of operations, training will be limited as well as vetting procedures.



FLYING PLUG avoids waste of time, use of on board cranes, and intense labour compared to IEC solution



Tanker class	DWT	Survey population	Total apparent power demand (MVA)	No. of standard couplers at 6.6kV, 350A	Couplers capacity at 6.6kV, 350A (MVA)	Number of 6.6 kV FLYING PLUG couplers	Number of 11 kV FLYING PLUG couplers
Product/ Chemical	3k – 60k	70%	Average: 3.2	1	4.0	1	1
			Maximum: 6.4	2	8.0		
Panamax	60k – 80k	6%	Average: 3.5	1	4.0	1	1
			Maximum: 4.0	1	4.0		
Aframax	80k – 120k	16%	Average: 5.4	2	8.0	1	1
			Maximum: 5.8	2	8.0		
Suezmax	120k – 200k	3%	Average: 6.9	2	8.0	1 2	1
			Maximum: 10.4	3	12.0		
VLCC	200k – 320k	5%	Average: 8.2	3	12.0	2	1
			Maximum: 10.4	3	12.0		

Table 4.1: Total apparent power for cargo discharge from tanker survey and associated cables and couplers

Due to its higher Amperage and Voltage capacity FLYING PLUG simplifies the number of connexions required

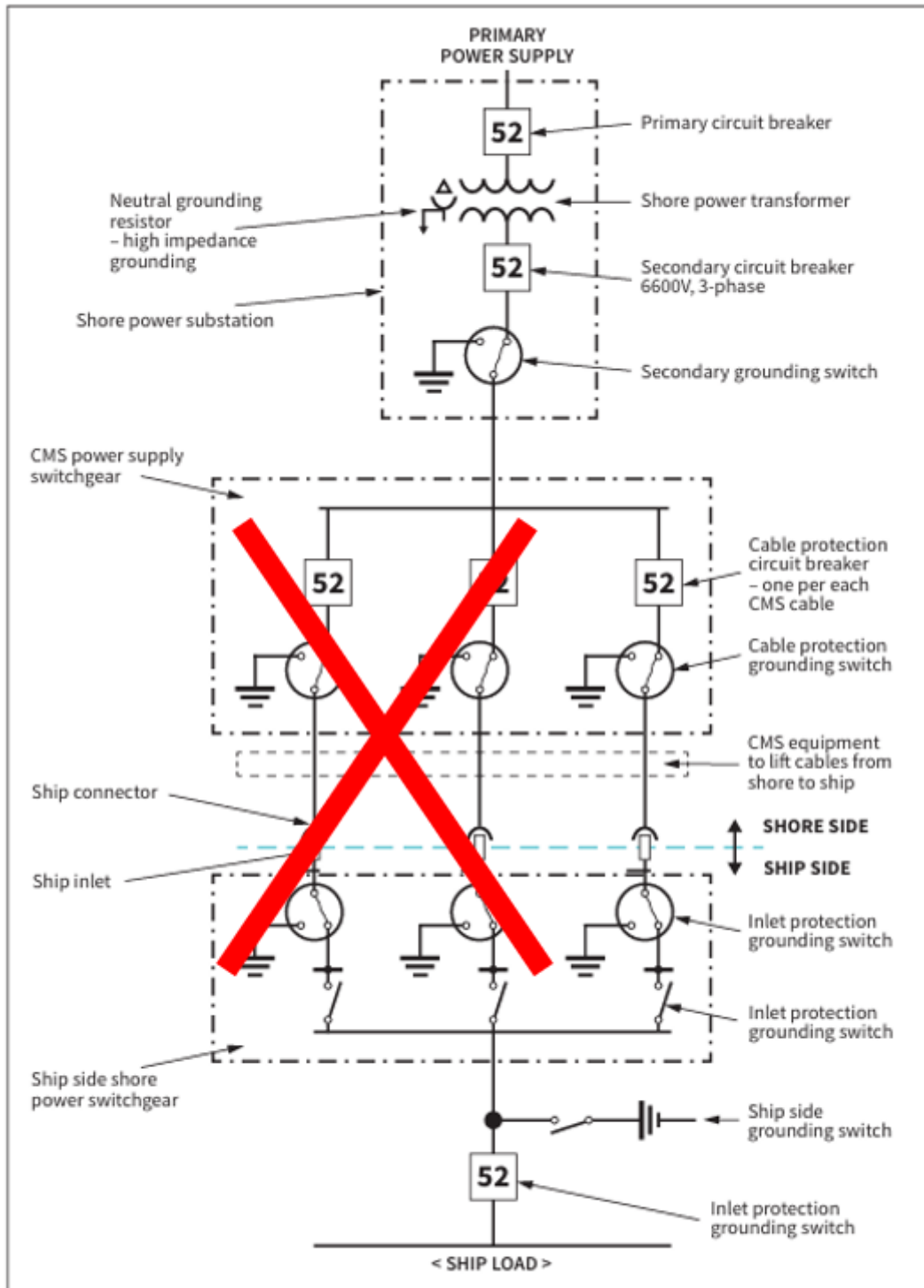
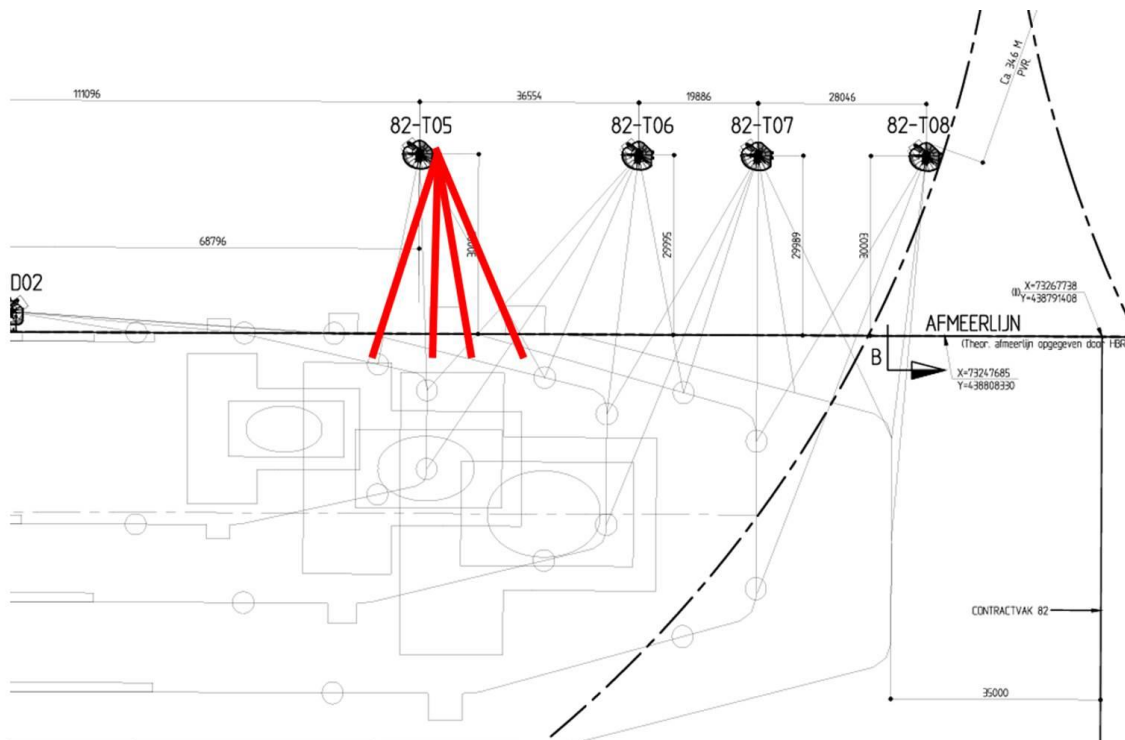


Figure 10.5: Typical Single Line Diagram for 1-2-3 Selective Shore Power System
(Source: Moffatt & Nichol)

A single 6.6 kV FLYING PLUG cover shore power requirements up to most vessels up to Aframax size instead of two for manual ones...under 11 kV a it covers all vessels needs



As show during the PREFED study based on Port of Rotterdam inputs a single FLYING PLUG interface installed on the forward mooring dolphin may connect all sizes of vessels

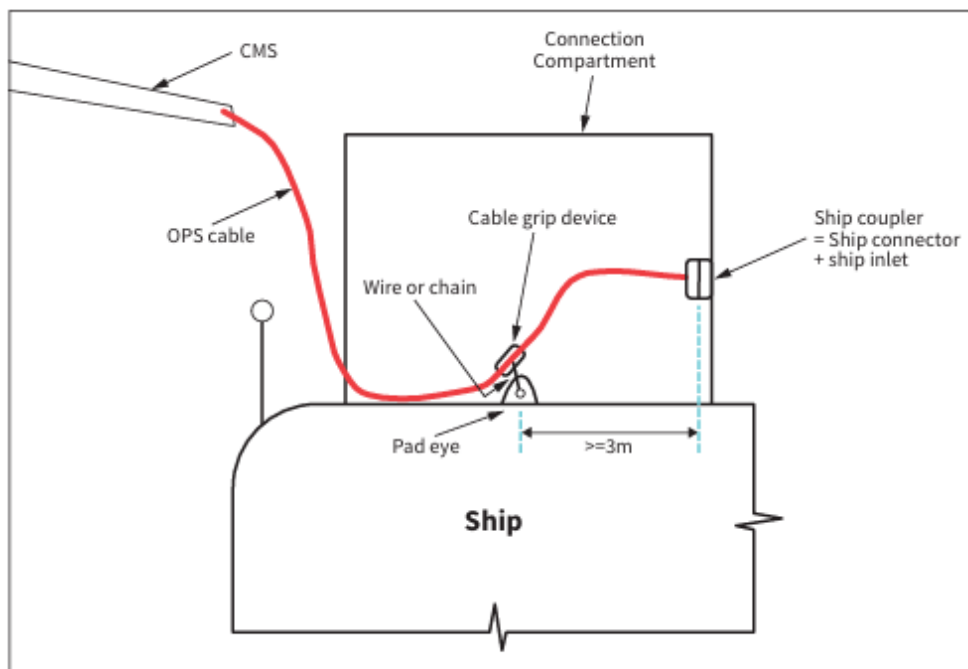


Figure 5.1: Example of cable anchoring points arrangement

FLYING PLUG avoids “make do” solutions required by manual connexions