



ISClass

**GUIDELINES FOR IMPLEMENTATION OF
THE REQUIREMENTS FOR CONSTRUCTION AND
EQUIPMENT OF TANKERS OF OIL INDUSTRY
ORGANIZATIONS**

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Chapter 1 General

1.1 Purpose and application

1.1.1 Major oil industry organizations worldwide require an inspection of their chartered tankers (including oil tankers, chemical tankers and gas carriers, hereinafter referred to as “tankers”), tankers calling at their wharfs, or tankers carrying their cargoes (or to which they have an interest in) in accordance with Vessel Inspection Questionnaire (VIQ). The Guidelines for Implementation of the Requirements for Construction and Equipment of Tankers of Oil Industry Organizations have been developed for the compliance of tankers classed with ISC and engaged on international voyages with the requirements of oil industry organizations and the satisfactory completion of the inspection.

1.1.2 The special requirements for tankers of major oil industry organizations worldwide are summarized and listed in the Guidelines.

1.1.3 Only the special requirements for the construction and arrangement of equipment in relation to tankers of oil industry organizations are given in the Guidelines, excluding those already covered by international conventions and ISC classification rules. The relevant requirements of the Guidelines are in general more specific or clear than those of international conventions and classification rules, not covering the operating policies of the ship management company or ship operator, e.g. manning, crew qualifications, maintenance of ship and equipment, crew management, etc.

1.1.4 The Guidelines apply to tankers engaged on international voyages and classed with ISC. The survey services of the Guidelines are those relating to notarial matters other than classification survey and statutory survey services.

1.1.5 At the request of the client, ISC may carry out plan approval and survey of new tankers in accordance with the Guidelines, in order to determine compliance of ships with the requirements of the Guidelines.

1.2 Introduction to oil industry organizations

1.2.1 Oil industry organizations mean tanker industry organizations, including:

- (1) Oil Companies International Marine Forum (OCIMF);
- (2) International Association of Independent Tanker Owner (INTERTANKO);
- (3) Chemical Distribution Institute (CDI); and
- (4) Society of International Gas Tanker and Terminal Operators (SIGTTO), etc.

1.2.2 The inspection of tankers carried out by oil industry organizations is intended to prevent personnel injuries, property damages and pollution of marine environment due to unsafe factors during the ship operation and carriage of cargoes.

1.2.3 The scope of vetting of tankers by oil industry organizations not only covers ship construction and equipment, crew qualifications, ship management and maintenance, but also includes the management of ship company, ship design and construction standards, classification and statutory certificates and notarial certificates or documents required by oil industry organizations (those certificates or documents are in general issued by classification societies as approved by oil industry organizations).

1.2.4 The inspection of tankers by oil industry organizations is in general carried out in accordance with the following steps:

(1) The ship owner or operator submits the application to the inspection department of a member of oil industry organizations.

(2) The Vessel Particular Questionnaire (VPQ) is completed in accordance with provisions of oil industry organizations.

(3) Ship management and operation personnel make preparations for inspection in accordance with the items of Vessel Particular Questionnaire (VPQ) and the standards given in Vessel Inspection Questionnaire (VIQ).

(4) In accordance with the agreement with the ship owner or operator, the member of oil industry organizations assigns the inspectors to carry out inspection at the vetting location and time proposed by the ship owner or operator. Members of oil industry organizations generally require the inspection to be carried out at cargo discharge port.

(5) The responsible department personnel on board accompany inspectors of oil industry organizations for the inspection of relevant items in accordance with the standards given in Vessel Inspection Questionnaire (VIQ). The responsible personnel are to answer the questions raised on site by inspectors.

(6) After completing the on-site inspection, inspectors of oil industry organizations carry out discussion with the master with regard to observations and deficiencies found during the on-site inspection. During the discussion, the master gives interpretation or explanation of observations and deficiencies raised by inspectors, i.e. giving his/her own opinions and comments based on ship size, construction time, and adopted standards.

(7) After confirmation of the observations and deficiencies by the master, inspectors complete the uniform inspection report of OCIMF. The master signs on the letter of comments.

(8) The ship owner or operator carries out rectification in accordance with the letter of comments and reports the results to inspectors of oil industry organizations.

(9) The member of oil industry organizations examines the rectification report of the ship owner or operator, issues the acceptance report where it is satisfied and informs the the ship owner or operator directly.

1.3 Main standards used as basis

1.3.1 The following standards of oil industry organizations worldwide are mainly used as the basis for the Guidelines:

- (1) Mooring Equipment Guidelines MEG 3;
- (2) Effective Mooring;
- (3) Recommendations for Oil Tanker Manifolds and Associated Equipment;
- (4) Guidelines for the Control of Drugs and Alcohol on Board Ships;
- (5) Tank Vessel Management and Self Assessment (TVMSA);
- (6) Recommendations for Equipment Employed in the Mooring of Ships at Single Point Moorings;
- (7) Bridge Procedures Guide;
- (8) Guide to Helicopter /Ship Operations;
- (9) Tanker Safety Guide (Chemicals);
- (10) Tanker Safety Guide (Liquefied Gas);
- (11) Clean Seas Guide for Oil Tanker;
- (12) Prevention of Oil Spillages through Cargo Pump Room Sea Valves;
- (13) Ship to Ship Transfer Guide (Petroleum);
- (14) International Safety Guide for Oil Tankers and Terminals (ISGOTT);
- (15) Peril at Sea and Salvage;
- (16) Ship to Ship Transfer Guide (Liquefied Gas);
- (17) A Guide to the Vetting Process;
- (18) Tanker Officer Training Standards (TOTS), including references and implementation plan;
- (19) Marine Environmental, Safety and Quality Assurance Criteria (MES & QAC);
- (20) Guidelines Manual for Tanker Structures;
- (21) Liquefied Gas Handling Principles on Ship and Terminals;
- (22) An Introduction to the Design and Maintenance of Cargo System Pressure Relief Valves on board Gas Tankers;
- (23) Regulations for Tankers, USCG CFR 33 Part 1~199 & USCG CFR 46 Part 1~40.

1.4 Liability of each party

1.4.1 At the request of the ship owner or operator, the plan approval and survey carried out and various certificates and documents issued by IS Class (ISC) in accordance with the Guidelines only demonstrate the compliance of ship construction, equipment and arrangement with relevant provisions of the Guidelines. They do not guarantee that all the items and criteria of ship can be accepted by all the members of oil industry organizations.

1.4.2 Where the classification certificate or statutory certificate of ship ceases to be valid, it will directly affect the validity of any document of compliance and assessment report issued in accordance with the Guidelines.

1.4.3 The ship owner or operator is responsible for informing ISC of any incident occurred or information obtained during the ship's mooring, cargo operations, navigation and maintenance, so as to take appropriate measures.

1.4.4 When applying the Guidelines, the ship owner or operator and relevant parties are to pay close attention to the latest edition of relevant documentation and information of oil industry organizations referenced by the Guidelines as well as any corresponding update and change.

1.5 Application

1.5.1 Applicants requesting services from ISC are to submit a written application to ISC or one of its local branches or the units designated by it, and/or sign a contract/agreement with ISC.

1.5.2 The responsibilities of both parties, etc. are to be clearly specified in the application or contract/agreement.

1.5.3 Applicants are to submit plans and technical documents necessary for the requested services.

1.5.4 Applicants are to provide safe and appropriate inspection conditions for the Surveyors of ISC, including the convenience for access to locations, workshops, manufactories and ships for carrying out timely and efficient inspections.

1.6 Fees

1.6.1 Applicants are to pay relevant fees, traffic fees and other necessary expenses in accordance with the contract/agreement.

1.6.2 For any service provided beyond the contract/agreement or any service provided anew due to the reasons on the part of the party receiving such service, ISC has the right to charge additional fees from the applicant.

1.7 Submission and examination of plans and documents

1.7.1 For tankers constructed in accordance with the Guidelines, the applicant is to submit the plans and documents in triplicate specified by 1.7.2 to 1.7.5 of this Chapter to a plan approval unit designated by ISC for examination. The plans and documents are in addition to those related to classification and statutory survey requirements. Where relevant contents have already been covered in the plans and documents in respect to classification and statutory requirements submitted for approval, re-submission may not be necessary.

1.7.2 Plans and technical documents of cargo systems:

- (1) detailed standards on the structure of cargo pipeline systems;
- (2) arrangement of cargo tanks, pump rooms and cargo pump-rooms;
- (3) cargo pumps and stripping systems;
- (4) cargo heating systems;
- (5) arrangement of cargo pumps, including driving units and seals of driving shafts passing through bulkheads;
- (6) arrangement of ventilation of cargo pump-rooms;
- (7) ventilation of pipe tunnels and duct keels;
- (8) detection systems of flammable gas and toxic gas of pump rooms (cargo pump-rooms and pump rooms), pipe tunnels and duct keels;
- (9) detection systems of flammable gas and toxic gas of spaces adjacent to cargo tanks, e.g. ballast tanks, void spaces and cofferdams;
- (10) bilge pump drainage systems of cargo pump-rooms and cofferdams;
- (11) segregated ballast or ballast systems;
- (12) venting and gas-freeing of cargo tanks, including details of pressure/vacuum valves;
- (13) inert gas systems, including inert gas generating plants, control and monitoring arrangements, and inert gas distribution piping;
- (14) cargo vapour emission control systems;
- (15) crude oil washing systems and operating manuals;
- (16) oil discharge monitoring equipment and operating manuals;
- (17) fixed deck foam fire-extinguishing systems;
- (18) fixed fire-extinguishing systems of cargo pump-rooms;
- (19) information on hazardous areas and electrical equipment;
- (20) hatches and hatch closing arrangements;
- (21) operating manuals;
- (22) details of doors, windows and frames.

1.7.3 Plans and technical documents of pollution prevention:

- (1) prevention and control of pollution by cargoes in cargo tanks;
- (2) prevention and control of pollution by cargo pipelines on decks;
- (3) prevention and control of pollution by ballast water;
- (4) prevention and control of pollution between cargo and ballast water;
- (5) prevention and control of pollution by bilge water of machinery spaces;
- (6) prevention and control of pollution by bilge water of other spaces;
- (7) prevention and control of pollution by other materials.

1.7.4 Plans and technical documents of anchoring and mooring equipment:

- (1) provision and arrangement of anchoring equipment;
- (2) provision and arrangement of emergency towing arrangements;
- (3) provision and arrangement of emergency towing-off equipment;
- (4) provision and arrangement of mooring equipment;
- (5) provision and arrangement of equipment at bow of single point mooring;
- (6) provision and arrangement of equipment at stern of single point mooring.

1.7.5 For the supervision of safety of waterways, terminals and operations, the ship owner or operator, as required by the port authorities, terminals and operating personnel, is to at least submit the following characteristic parameters of ship:

- (1) *L*, Max. Length or Length Overall, in m;
- (2) *B*, Max. Beam or extreme Beam, in m;
- (3) *D*, Max. / Min. Draft Permitted, in m;
- (4) *A*, Air Draft, in m;
- (5) Max. Trim, in m;
- (6) Max. Windage Area, in m²;
- (7) Max./Min. Displacement, in t;
- (8) Arrival Displacement, in t;

- (9) F , Max./Min. Height of Manifold to W.L, in m;
- (10) Max./Min. Height of Hatch Coaming to W.L, in m;
- (11) Max. Trim for Berthing and Unberthing, in m;
- (12) Min. Draft for Berthing and Unberthing, in m;
- (13) G , Distance Bow to Centre of Manifold, in m;
- (14) H , Distance Stern to Centre of Manifold, in m;
- (15) Distance Ship Side Rail to Manifold, in m;
- (16) J , Parallel Body Length of Hull, in m;
- (17) Min. Parallel Body Length in Ballast Condition, in m;
- (18) E , Distance Fwd. Parallel Body Length to Manifold, in m;
- (19) I , Distance Aft. Parallel Body Length to Manifold, in m;
- (20) C , Under Keel Clearance, in m;
- (21) Min. SWL of Crane/Derrick for hose, in t.

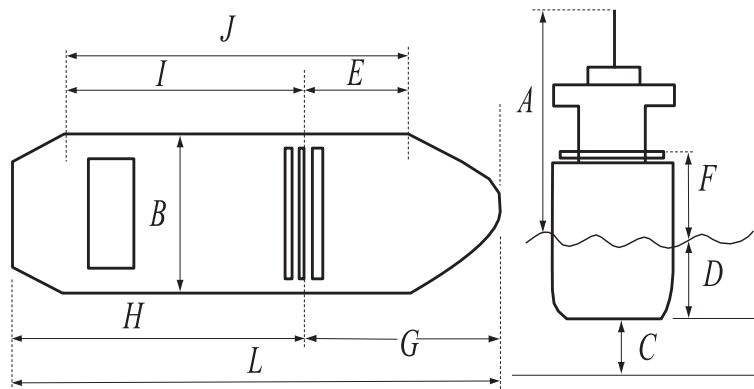


Figure 1.7.5 Characteristic parameters of ship

1.7.6 The documentation and information checked by oil companies are to be available both in Chinese and English.

1.7.7 The term “approval” means that the plans or documentation have been examined and found in compliance with the Guidelines. The approval of plans and documents by ISC covers only the items as required by the Guidelines, excluding any items not required by the Guidelines. Where ISC undertakes classification and statutory services at the same time, the “approval” by ISC is to cover the items related to the requirements of classification rules or relevant international conventions.

1.7.8 The plans and documents as deemed to comply with the Guidelines upon examination are to be stamped with APPROVED seal. The approval conditions and restrictions may be written on the plans and documents, or stated in the plan approval letters with appropriate notes being added on the plans and documents.

1.7.9 The approved plans are valid only for construction in the designated shipyard, the construction project number or the number of ships to be constructed as specified in the application or contract/agreement for plan approval. The approved plans will be invalid automatically in one of the following cases:

- (1) the construction of the ship(s) for the project number or the number of ships as specified in the contract has been completed;
- (2) the ship is not constructed in the existing shipyard;
- (3) the ship is not constructed under the supervision of ISC;
- (4) the Guidelines have been revised in accordance with the new standards issued by oil industry organizations.

1.8 Issuance of document of compliance and assessment report

1.8.1 A document of compliance indicates only that the ship, as verified during plan approval and survey, is in compliance with the Guidelines.

1.8.2 Where the plan approval is carried out in accordance with the Guidelines and the survey during construction is satisfactory, ISC may issue the document of compliance with period of validity not exceeding 1 year. After DOC is due, at the request of the ship owner for survey after construction, the document of compliance may be renewed with period of validity not exceeding 1 year where the survey is satisfactory.

1.8.3 Where the plan approval is not carried out and the ship is not constructed in accordance with the Guidelines, ISC may issue an assessment report with period of validity not exceeding 1 year after completing survey after construction in accordance with the Guidelines upon request. The assessment report is to truthfully reflect the survey results.

Chapter 2 Surveys

2.1 Surveys during construction

2.1.1 The purpose of surveys during construction is to confirm that ship structure and the arrangement of equipment comply with the approved plans and documents, and that the installation techniques meet the requirements of the Guidelines.

2.1.2 The shipyard is to provide product certificates of relevant equipment in accordance with the requirements of the Guidelines.

2.1.3 The survey items during construction are given in Table 2.1.3.

Survey items during construction **Table 2.1.3**

No.	Item	Survey mode	Survey contents
1	Mooring equipment		
1.1	Mooring lines	Installation survey	1. Checking certificates or documents and ID. 2. Confirming the correct stowage
1.2	Bollards	Installation survey	1. Checking certificates or documents and ID. 2. Carrying out patrol inspection. 3. Carrying out visual inspection of installation quality and welding quality
1.3	Fairleads	Installation survey	1. Checking certificates or documents and ID. 2. Carrying out patrol inspection. 3. Carrying out visual inspection of installation quality
1.4	Winches	Installation survey	1. Checking certificates or documents and ID. 2. Carrying out patrol inspection. 3. Carrying out visual inspection of winch foundation and installation quality. 4. Checking the arrangement of fairleads, bollards (bits) and winches. 5. Carrying out on-site witness of the test of setting of winch brake capacity and recording the setting of brake capacity. 6. Issuing certificates or documents of setting of mooring winch brake capacity
1.5	Single point mooring equipment	Installation survey	1. Checking certificates or documents and ID. 2. Confirming the SWL of equipment. 3. Carrying out patrol inspection. 4. Carrying out visual inspection of installation quality and welding quality. 5. Checking the arrangement of fairleads, chain stoppers and winches. 6. Carrying out inspection of the arrangements at stern for tug escort and pull-back
1.6	Emergency towing-off pennants	Installation survey	1. Checking certificates or documents and ID. 2. Confirming the correct arrangement of bollards. 3. Confirming the stowage of towing-off pennants

No.	Item	Survey mode	Survey contents
2	Anchoring equipment		
2.1	Chain stoppers	Installation survey	<ol style="list-style-type: none"> 1. Checking certificates or documents and ID. 2. Confirming the SWL mark. 3. Carrying out patrol inspection. 4. Carrying out visual inspection of installation quality and welding quality. 5. Checking the arrangement of fairleads, chain stoppers and winches. 6. Checking the foundations and welding strength of fairleads, chain stoppers and winches
.2	Windlasses	Installation survey	<ol style="list-style-type: none"> 1. Checking certificates or documents and ID. 2. Confirming the SWL mark. 3. Carrying out patrol inspection. 4. Carrying out visual inspection of installation quality and welding quality. 5. Checking the arrangement and installation of hawse pipes and chain lockers. 6. Checking the arrangement of chain stoppers, windlasses and their foundations
3	Pollution prevention equipment		
3.1	Continuous deck edge fishplate enclosing	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of the height, continuity and arrangement of the deck edge fishplate enclosing. 2. Carrying out inspection of the drainage arrangements of coaming of the deck edge fishplate enclosing. 3. Carrying out visual inspection of installation quality and welding quality
3.2	Aft end of cargo tank and transverse fishplate	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of the arrangement of the aft end of the deck edge fishplate enclosing and transverse fishplate. 2. Carrying out visual inspection of installation quality and welding quality
3.3	Deck dump valves and scupper plugs or equivalent means	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of the arrangement of deck dump valves and scupper plugs of mechanical type or equivalent means. 2. Carrying out visual inspection of installation quality and welding quality
3.4	Spill containers under manifold flanges	Installation survey	<ol style="list-style-type: none"> 1. Confirming the arrangement. 2. Carrying out visual inspection of installation quality and welding quality. 3. Volume and fittings of spill containers. 4. Means for removing oil from the spill container and cleaning
3.5	Spill containers around deck opening of vent pipes (air pipes) of fuel oil tanks and lubricating oil tanks	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of the arrangement. 2. Carrying out visual inspection of installation quality and welding quality. 3. Volume and fittings of spill containers. 4. Means for removing oil from the spill container and cleaning
3.6	Spill containers of deck hydraulic machinery	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of the arrangement. 2. Carrying out visual inspection of installation quality and welding quality. 3. Means for removing oil from the spill container

No.	Item	Survey mode	Survey contents
3.7	Means for the discharge of oil of the spill containers to the slop tanks	Installation survey	1. Carrying out inspection of the arrangement. 2. Carrying out visual inspection of the arrangement of operating equipment. 3. Carrying out inspection of the installation quality
3.8	Sampling and observation arrangements of ballast tanks	Installation survey	1. Carrying out inspection of the arrangement. 2. Carrying out visual inspection of installation quality
3.9	Blanks of end openings of cargo manifolds, bunker manifolds and vapour return manifolds not in use	Confirmation inspection	1. Carrying out inspection of the arrangement. 2. Blanks and fittings. 3. Carrying out visual inspection
3.10	Pollution control equipment or means for removal of spilled oil	Confirmation inspection	1. Carrying out inspection of the arrangement. 2. Carrying out visual inspection of necessary equipment
3.11	Means for removal of spilled oil	Confirmation inspection	1. Carrying out visual inspection of necessary equipment. 2. Carrying out inspection of equipment stowage
3.12	Environmental protection policy	Confirmation inspection	1. Carrying out visual inspection of necessary equipment. 2. Examining necessary documentation
3.13	Test measures for preventing cargo from escaping through sea valves of cargo pump-rooms	Installation survey	1. Carrying out inspection of the arrangement of cargo systems and sea systems, especially sea valves. 2. Carrying out visual inspection of necessary equipment and its arrangement. 3. Carrying out operating test
4	Fire fighting		
4.1	Measures for preventing the accumulation of flammable gas		
4.1.1	Ventilation system	Installation survey	1. Carrying out inspection of the arrangement. 2. Carrying out operating test
4.1.2	Washing machines interlocked with the ventilation system	Installation survey	1. Carrying out inspection of the arrangement. 2. Carrying out function test
4.1.3	Flammable gas detection	Installation survey	1. Examining atmosphere test report of the manufacturer. 2. Carrying out inspection of the arrangement. 3. Carrying out function test
4.2	Means for controlling the oxygen content in the tank		
4.2.1	Inert gas systems	Installation survey	1. Carrying out inspection of product certificates or documents of blowers with power of greater than 100 kW. 2. Carrying out inspection of product certificates or documents of motors with power of greater than 100 kW. 3. Carrying out inspection of product certificates or documents of overboard valves of the system, e.g. overboard discharge valves of scrubbers and deck water seals. 4. Examining atmosphere test report submitted by the manufacturer with regard to temperature sensors, oxygen content indicators and analysers, and pressure sensors, etc. 5. Carrying out inspection of the arrangement and installation quality of the system. 6. Carrying out inspection of screw-down valves and locking arrangements between inert gas branch pipes and cargo tanks. 7. Carrying out tests as required by the ship owner or operator

No.	Item	Survey mode	Survey contents
4.3	Suppression of ignition source		
4.3.1	Electrical equipment in hazardous areas	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of product certificates or documents suitable for use in hazardous areas. 2. Carrying out visual inspection of the arrangement and installation quality of equipment. 3. Carrying out inspection that the enclosures of equipment have been earthed
4.3.2	Equipment in tanks	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of product certificates or documents suitable for use in hazardous areas. 2. Carrying out visual inspection of the arrangement of equipment. 3. Carrying out visual inspection of the installation quality and static electricity precautions of equipment in tanks
4.3.3	Static electricity precautions for equipment in hazardous areas	Installation survey	<ol style="list-style-type: none"> 1. Electrical earthing exists between all equipment and the hull. 2. Electrical bonding exists between equipment. 3. Electrical bonding of pipelines and fittings of cargo area
4.3.4	Equipment in accommodation spaces	Installation survey	<ol style="list-style-type: none"> 1. Confirming the arrangement of cabins and galleys. 2. Confirming that there are no galley stoves and cooking appliances that employ naked flames. 3. Confirming that there are no portable stoves and cooking appliances. 4. Confirming that there are no window type air conditioning units
4.3.5	Other ignition sources	Installation survey	<ol style="list-style-type: none"> 1. Confirming that there are no mechanical lighters and portable lighters with electrical ignition sources. 2. Confirming that there are fixed electric heaters
4.4	Fire extinguishing		
4.4.1	Fire-extinguishing appliances in cargo spaces	Installation survey	<ol style="list-style-type: none"> 1. Confirming the installation of fixed deck fire-extinguishing systems of cargo area. 2. Confirming that the type of fire-extinguishing medium is not more than one. 3. Confirming that the storage tank containing foam fire-extinguishing medium is full. 4. The fixed deck fire-extinguishing system is tested after the installation of system
4.4.2	Fire-extinguishing appliances in other spaces	Installation survey	<ol style="list-style-type: none"> 1. Confirming that galleys with external doors or similar openings are provided with flammable gas detectors. 2. Fire blankets of galleys. 3. Fire blankets of helicopter operating areas
4.4.3	Fire-extinguishing appliances and equivalent in other spaces	Installation survey	<ol style="list-style-type: none"> 1. Confirming that spaces not fitted with fire detectors are provided with portable fire extinguishers. 2. Confirming that portable fire extinguishers are arranged near the entrance to spaces
4.5	Fire detection and alarm		
4.5.1	Machinery spaces	Installation survey	<ol style="list-style-type: none"> 1. Confirming the correct installation of fire detection of machinery spaces. 2. Confirming that the fire detection of machinery spaces is independent from other spaces

No.	Item	Survey mode	Survey contents
4.5.2	Pump rooms	Installation survey	<ol style="list-style-type: none"> 1. Examining atmosphere test report of fire detectors. 2. Confirming that fire detectors are fitted at lower and upper parts of pump rooms. 3. Confirming that pump rooms are provided with emergency rescue arrangements
4.5.3	Other spaces adjacent to cargo tanks	Installation survey	<ol style="list-style-type: none"> 1. Examining atmosphere test report of fire detectors. 2. Confirming that the venting system is provided with flammable gas concentration detectors
5	Cargo operations and ballast operations system		
5.1	Cargo manifolds, bunker manifolds and vapour return manifolds	Installation survey	<ol style="list-style-type: none"> 1. Confirming the correct installation and arrangement of manifolds and fittings, as well as the equipment, arrangement and stowage of pipeline fittings. 2. Carrying out visual inspection of installation quality of equipment. 3. Carrying out inspection of the correct installation of manifold fittings, e.g. valves, expansion arrangements, pressure gauges, temperature gauges and flow gauges. 4. Carrying out pipeline hydraulic tests
5.2	Ullage gauge, sampling systems	Installation survey	<ol style="list-style-type: none"> 1. Confirming that vapour lock gauges are fitted where inert gas systems are not provided and cargoes having a flashpoint not exceeding 60° (140°) or heated cargoes having a flashpoint exceeding 60° (140°) and volatile toxic gas cargoes are carried. 2. Carrying out visual inspection of the installation quality of equipment. 3. Examining or approving vapour lock gauges
5.3	Venting systems	Installation survey	<ol style="list-style-type: none"> 1. Confirming the installation of main and auxiliary venting systems. 2. Carrying out inspection of the isolation arrangements of common venting systems. 3. Carrying out inspection of the installation of P/V valves. 4. Confirming venting system calculations. 5. Where auxiliary venting systems are replaced by pressure sensors, confirming the pressure setting. 6. Confirming that cargo control stations are provided with pressure indicators
5.4	Crude oil washing systems	Installation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of the system integrity and installation quality. 2. Carrying out system pressure tests. 3. Carrying out operating tests
5.5	Pump rooms		<ol style="list-style-type: none"> 1. Confirming the arrangement of pump rooms. 2. Gas detection systems. 3. Operating and control devices of fire dampers and flooding damper of ventilation systems. 4. Carrying out operating tests of ventilation systems after installation. 5. Confirming the correct arrangement of means for preventing cargo from escaping through sea valves. 6. Confirming the correct arrangement and installation of test means for preventing cargo from escaping through sea valves

No.	Item	Survey mode	Survey contents
5.6	Cargo hoses	Installation survey	1. Examining working environment and scope. 2. Confirming the pressure test report. 3. Confirming the arrangement of ventilation and fire-extinguishing equipment of storage locations on board
6	Safety equipment		
6.1	Static electricity precautions	Installation survey	1. Electrical earthing exists between all equipment and the hull. 2. Carrying out inspection of bonding between equipment and pipelines. 3. Static electricity precautions for equipment in tanks
6.2	Safety equipment	Installation survey	1. Carrying out inspection of the provision of safety equipment on board. 2. Confirming that sufficient spare equipment is provided for safety equipment. 3. Confirming that calibration equipment is provided for safety equipment
6.2	Personal protective equipment	Installation survey	1. Carrying out inspection of certificates or documents of personal protective equipment suitable for use in hazardous areas. 2. Carrying out inspection of the provision and stowage position of equipment
6.3	Electrical equipment used in hazardous areas	Installation survey	1. Carrying out inspection of product certificates or documents suitable for use in hazardous areas. 2. Carrying out inspection of the provision, arrangement and installation quality of equipment
6.4	Smoking rooms	Installation survey	1. Confirming the arrangement of smoking rooms. 2. Carrying out inspection of the provision of equipment of smoking rooms. 3. Carrying out inspection of all the openings and their closing devices of smoking rooms
6.5	Ship security	Confirmation survey	1. Confirming the provision and arrangement of security equipment. 2. Carrying out inspection of security information and documentation
6.6	Monitoring arrangements in flammable gas spaces or potentially flammable gas spaces	Confirmation survey	1. Examining space entry management documentation. 2. Carrying out inspection of the provision of equipment. 3. Measuring the upper, middle and lower parts of spaces by portable flammable gas detectors and comparison with fixed ones
6.7	Monitoring of hot work	Confirmation survey	1. Examining space entry management documentation. 2. Carrying out inspection of the provision of equipment. 3. Confirming that the work is approved
6.8	Life-saving appliance	Confirmation survey	1. Confirming the provision and arrangement of life-saving appliance. 2. Provision and arrangement for fast release of lifebuoys. 3. Confirming the provision and stowage positions of additional liferafts at the extreme end of the stem or stern of ship. 4. Confirming the lighting of stowage and embarkation positions. 5. Carrying out inspection of launching and embarkation arrangements. 6. Launching and embarkation arrangements of liferafts at the extreme end of the stem or stern of ship are provided with emergency lighting

No.	Item	Survey mode	Survey contents
6.9	Access	Confirmation survey	<ol style="list-style-type: none"> 1. Carrying out inspection of installation of means of embarkation of crew, including fixed and portable accommodation ladders. 2. Carrying out inspection of installation of means of embarkation of pilots, including fixed and portable accommodation ladders and bulwark ladders. 3. Carrying out inspection of means of access to the bow. 4. Carrying out inspection of all access handrails and non-slip surfaces
6.10	Helicopter landing or embarkation areas	Confirmation survey	<ol style="list-style-type: none"> 1. Confirming the identification of areas. 2. Confirming the provision and arrangement of equipment. 3. Confirming the provision of fire fighting equipment and auxiliary equipment
7	Lifting equipment	Confirmation survey	<ol style="list-style-type: none"> 1. Confirming that lifting equipment, including cranes or derricks, and capacity (span, lifting weight and height) comply with requirements for ship size. 2. Checking test reports of components. 3. Carrying out inspection of installation quality. 4. Carrying out function test to confirm the performance characteristics
8	Navigation in ice conditions	Confirmation survey	<ol style="list-style-type: none"> 1. Confirming the safety provision for navigation in ice conditions. 2. Satisfactory means have been provided to prevent the icing up of air pipes required for the operation of the main propulsion plant and essential auxiliaries. 3. The equipment is suitable for operating at sea temperatures of -2? and air temperatures of -25?. 4. Means for preventing the icing up of deck machinery and pipelines. 5. All personnel have been provided with thermal protective aids. 6. Means for preventing the icing up of cargo tank primary and secondary venting arrangements. 7. Means for preventing the icing up of water levels inside tanks above the waterline. 8. Means for preventing the navigation equipment from freezing. 9. Means for preventing the icing up and thermal protection in lifting equipment control cabin

2.2 Surveys after construction

2.2.1 At the request of the ship owner or operator, the surveys after construction may be carried out by ISC in accordance with the requirements of the Guidelines. For ships constructed in accordance with the Guidelines and furnished with the document of compliance, the DOC is issued upon completion of survey. For ships not constructed in accordance with the Guidelines, the assessment report is issued upon completion of survey.

2.2.2 Surveys after construction may be carried out in conjunction with statutory surveys and classification surveys, or carried out separately.

2.2.3 Prior to surveys, the crew members are to make preparations, at least including the survey and inspection of the following items:

(1) Checking the following certificates:

- ① classification information;
- ② Certificate of Registry (Certificate of Nationality);
- ③ SOLAS certificates;
- ④ LLC certificates;
- ⑤ IMO Certificate of Fitness;
- ⑥ MARPOL certificates;
- ⑦ Civil Liability Convention Certificate (CLC);
- ⑧ list of crew;
- ⑨ arrangement of cargo tanks;
- ⑩ safety management information of ship.

(2) Checking the following information:

- ① certificates of officers;
- ② documents of health;
- ③ Procedures and Arrangements (P&A) Manual;
- ④ approved crude oil washing manual;
- ⑤ approved ballast manual;
- ⑥ Cargo Record Book;
- ⑦ oil (fuel oil and cargo oil) transfer procedures;
- ⑧ Garbage Record Book complying with MARPOL Annex V;
- ⑨ test documents of cargo hoses and cargo pipelines;

- l maintenance documents of fixed and portable fire-extinguishing appliances;
- Н₂ maintenance documents of breathing devices by experts;
- Н₃ maintenance documents of liferafts;
- П documents of setting of P/V valves;
- п carriage information and manifolds;
- Н certificate of cargo stabilizer or inhibitor;
- h statements of inspection of bunkering;
- Н Material Safety Data Sheets;
- Н Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP);
- ДК inert gas manual;
- ДК upgrading and training policies of company personnel;
- ⓪ documents of cargo abandonment (if any);
- ⓪ Vessel Response Plan (for ships trading to USA);
- ⓪ safety management manual;
- ⓪ ship operating manual.

(3) Checking the following operating documentation and instruments:

- ① flammable gas detectors or fixed flammable gas detection system;
- ② oxygen analysers;
- ③ toxic gas detectors;
- Í oil discharge monitoring equipment (ODME);
- ⑤ cargo pump emergency shut down and overload alarms;
- Ⓜ high level alarms;
- ℓ high high level alarms;
- ℓ fuel main valves/quick closing arrangements (overflow control arrangements).

(4) Documentation of the following systems and alarms:

- ① alarms of inert gas systems;
- ② oil-water separating equipment;
- ⑤ fire-extinguishing systems;
- Í steering gears;
- ⑤ emergency generators;
- ® ventilation shut down of machinery spaces;
- Ł lifeboat engines.

(5) Checking the following items:

- ① firemen's outfits;
- ② international shore connections;
- ⑤ navigation equipment;
- Í nautical publications and charts and their latest revisions;
- ⑤ emergency position-indicating radio beacons, distress flares and hydrostatic release units;
- ® flame arresters of vent pipes of fuel oil tanks and ballast tanks;
- Ł fire-extinguishing systems of paint lockers;
- l' sewage treatment plants.

(6) Carrying out general inspection of the following important items:

- ① accommodation ladders: they are correctly deployed, provided with protective nets and with lifebuoys nearby;
- ② information: all warning signals are to be posted, e.g. visit prohibited, dangerous cargoes, safety notice;
- ⑤ crew: all the crew on deck are to be provided with rigid helmets and other personal protective equipment;
- Í watchkeeping: watchkeeping personnel in the area where they are on duty are to be provided with rigid helmets and emergency equipment, e.g. safety goggles, rubber boots, rubber gloves and spill cleaning equipment;

- ⑤ fire-extinguishing equipment in way of manifolds: the equipment is to be provided on site and correctly arranged;
- Ⓢ deck: the deck is to be clean, free of oil, water and unobstructed;
- ℓ scuppers: scuppers are to be plugged. Spill collection pumps are to be connected to the discharge pipelines;
- ℓ' cargo information: it is to be ensured that all personnel engaged in cargo operations, especially watchkeeping personnel on deck, are aware of cargoes to be carried, regardless of whether cargoes are being loaded/unloaded. The list of information on all cargoes intended to be carried is to be posted and easily read;
- Ⓢ emergency equipment: it is operational and effectively and clearly marked;
- ℓ₅ mooring: it is in a satisfactory condition and maintained by satisfactory watchkeeping;
- H₃ accommodation spaces: all the doors and openings are closed, clean and tidy. The ventilation is maintaining positive pressure.

2.2.4 The survey items after construction are given in Table 2.2.4.

Survey items after construction

Table 2.2.4

No.	Item	Survey mode	Survey contents
1	General information of ship		
1.1	Particulars of ship	Confirmation	1.The information is complete
1.2	Particulars of ship required by SOLAS	Confirmation	1.The information necessary for ship certificate is complete
1.3	Particulars of ship required by MARPOL	Confirmation	1.The information necessary for ship certificate is complete
1.4	Information on inspection by port authorities	Confirmation	1. The information is complete
1.5	Particulars of ship required by OCIMF	Confirmation	1.The information, especially VPQ, is complete
1.6	List of crew	Confirmation	1. The information is complete
1.7	Arrangement of cargo tanks and ballast tanks of ship	Confirmation	1. The information is complete
2	Certification and documentation		
2.1	Certificate of Registry (Certificate of Nationality)	Confirmation	1. The information is complete
2.2	Certificates and documents as specified by MSC/Circ.1151, including mandatory and non-mandatory certificates, documents and documentation	Confirmation	1.The validity of necessary certificates, documents and documentation

No.	Item	Survey mode	Survey contents
2.3	Management systems	Confirmation	<ol style="list-style-type: none"> 1. Documentation and information necessary for the management system, e.g. safety management and the operator's procedures manuals. 2. Emergency procedures, including a description of the master's and crew's responsibilities and shipboard operation plans. 3. A safety and environmental policy and personnel health document. 4. Maintenance, training and drills as well as close-out of systems
4	Classification certificates and survey reports	Confirmation	<ol style="list-style-type: none"> 1. Survey reports of classification society, date of equipment survey. 2. Reports on handling of conditions of class
2.5	Enhanced survey documentation	Confirmation	<ol style="list-style-type: none"> 1. Maintenance of the enhanced survey reports. 2. Plans and documents, repair report of ship
2.6	Condition assessment reports	Confirmation	<ol style="list-style-type: none"> 1. Condition assessment report of ship. 2. Condition Assessment Scheme (CAS), or 3. Condition Assessment Programme (CAP) of a classification society
2.7	Publications	Confirmation	<ol style="list-style-type: none"> 1. Necessary publications. 2. Updated procedures
3	Crew management		
3.1	Ship management	Confirmation	<ol style="list-style-type: none"> 1. The manning complies with or exceeds the STCW requirements. 2. The policy of minimizing fatigue of crew is ensured by the operator. 3. Documentation related to training of the master and crew, as well as training given to the crew by the master
3.2	Crew qualifications	Confirmation	<ol style="list-style-type: none"> 1. Qualification certificates of the master and officers. 2. Qualification certificates of the crew
3.3	Management of drug and alcohol	Confirmation	<ol style="list-style-type: none"> 1. Carrying out inspections of provisions related to alcohol regularly or not regularly. 2. Carrying out inspections of alcohol records regularly or not regularly
4	Safety of navigation		
4.1	Procedures and documentation	Confirmation	<ol style="list-style-type: none"> 1. Navigation instructions and procedures. 2. Provisions relating to the minimum under keel clearance for navigation. 3. Procedures are in place for arrival and departure information exchange. 4. Night orders are completed by the master
4.2	Nautical publications and charts	Confirmation	<ol style="list-style-type: none"> 1. Nautical publications and charts are on board. 2. A system is in place for updating nautical publications
4.3	Navigation equipment	Confirmation	<ol style="list-style-type: none"> 1. All navigation equipment is operational

No.	Item	Survey mode	Survey contents
5	Safety management		
5.1	Safety management	Confirmation	<ol style="list-style-type: none"> 1. Safety aspects related to the operation of fire fighting and life-saving appliance, the use of personal protective equipment, procedure management and close-out, ship/shore safety management, smoking regulations, management of doors and windows, and training documents of environmental management of accommodation spaces. 2. Management of loose gear
5.2	Drills and training	Confirmation	<ol style="list-style-type: none"> 1. Training involving all relevant personnel is carried out at regular intervals. 2. Drills for emergency procedures. 3. Fire drills are regularly held. 4. Records of life-saving drill (abandon ship drill) held regularly
5.3	Security management	Confirmation	<ol style="list-style-type: none"> 1. Records of the last port calls are maintained. 2. Security records. 3. Information required by ISPC furnished by the company. 4. The security officer has qualification certificate
5.4	Enclosed space entry management	Confirmation	<ol style="list-style-type: none"> 1. Enclosed space entry procedures. 2. Cargo pump-room entry procedures. 3. Ventilation systems of cargo pump-rooms. 4. Operational efficiency of fire and flooding dampers of ventilation systems of cargo pump-rooms. 5. Emergency alternative arrangements in case there is only one ventilation system in cargo pump-rooms
5.5	Management of spaces adjacent to cargo tanks	Confirmation	<ol style="list-style-type: none"> 1. Enclosed space adjacent to cargo tanks entry procedures. 2. The flammable gas detection system is fitted in the enclosed space adjacent to cargo tanks. 3. The flammable gas alarm system in the enclosed space adjacent to cargo tanks is in a satisfactory condition
5.6	Gas analysers	Confirmation	<ol style="list-style-type: none"> 1. The gas analyzing system is appropriate to the cargoes intended to be carried. 2. The number of gas analysers is sufficient, together with a sufficient set of spares and suitable means and equipment for the calibration of such instruments. 3. Ships equipped with inert gas analysers capable of measurement in an inert atmosphere
5.7	Hot work management	Confirmation	<ol style="list-style-type: none"> 1. Hot work procedures. 2. Electric and gas welding equipment. 3. Arrangement of gas welding equipment

No.	Item	Survey mode	Survey contents
5.8	Life-saving appliance management	Confirmation	<ol style="list-style-type: none"> 1. The arrangement and requirements with respect to life-saving appliance comply with SOLAS and life-saving appliance training manual. 2. The life-saving appliance is maintained in accordance with SOLAS
5.9	Fire fighting equipment	Confirmation	<ol style="list-style-type: none"> 1. Fire fighting equipment is provided and arranged in accordance with SOLAS. 2. The fire safety operational booklet is appropriate to the cargoes intended to be carried. 3. The fire fighting equipment is maintained in accordance with SOLAS. 4. Firemen's outfits are in a satisfactory condition. 5. Air quality documents of means for recharging air cylinders. 6. The ventilation equipment in accommodation spaces is provided with emergency stops. 7. Ventilation systems and fire flaps are clearly marked to indicate the spaces they serve. 8. Carrying out inspection that ventilation systems are clearly marked to indicate the spaces they serve
5.10	Stairways, accesses and walkways	Confirmation	<ol style="list-style-type: none"> 1. The arrangement of transfer equipment, including that of crew and pilot, complies with the requirements of SOLAS. 2. The safe access to the bow complies with the requirements of MSC.62(67), i.e., to the position operating anchor windlass on the port and starboard sides. 3. The arrangement of helicopter landing area and embarkation area complies with the Guide to Helicopter /Ship Operations. 4. Safety and protection means for stairways, accesses and walkways
6	Pollution prevention		
6.1	Oil record books	Confirmation	<ol style="list-style-type: none"> 1. Oil record books are correctly completed. 2. Oil record books are free of any pollution incidents by oil. In case of any pollution incident, confirming that the corrective actions have been taken. 3. The arrangement with regard to the discharge of engine room oily water to a slop tank in cargo area is to be approved by the classification society. 4. If the discharge of engine room oily water to a slop tank has taken place, the event has been recorded in both parts of oil record books

No.	Item	Survey mode	Survey contents
6.2	Shipboard Oil Pollution Emergency Plan	Confirmation	<ol style="list-style-type: none"> 1. Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP). 2. Vessel Response Plan (VRP). (Although VRP only applies to ships trading to USA, it is often required by charterer considering the flexibility and convenience of navigating waters.) 3. Qualified Individual (QI)
6.3	Deck area pollution prevention	Confirmation	<ol style="list-style-type: none"> 1. The condition of scupper plugs preventing deck pollution is satisfactory. 2. The main deck boundary coaming is in good condition. 3. Means for disposal of any oil spill on deck. 4. Free from any visible bulkhead, valve or pipeline leakage. 5. Sea valves connected to cargo system are closed and lashed. 6. Test is carried out regularly to sea valves connected to cargo system. 7. The drainage arrangements of oil spill containers under the deck cargo manifolds are satisfactory. 8. All openings of ends of pipelines not in use on deck have been blanked and fully bolted. 9. The drainage arrangements of oil spill containers fitted around all fuel, diesel and lubricating oil tank vents are satisfactory. 10. The oil spill containers and drainage arrangements fitted around deck machinery are satisfactory. 11. The arrangements for the disposal of oily water in forecastle and other spaces, especially spaces provided with hydraulic supply and machinery, are adequate and in good order. 12. Means for inspection and observation prior to deballasting
6.4	Engine and steering compartments	Confirmation	<ol style="list-style-type: none"> 1. Bilge high level alarms of machinery spaces and cargo pump-rooms are satisfactory, furnished with test records carried out regularly. 2. Emergency arrangements for disposal of cargo pump-room bilge accumulation are adequate. 3. Oil discharge monitoring equipment (ODME) is in good order. 4. The drainage arrangement by a small-diameter cargo pipeline is correct. 5. Emergency bilge pumping arrangement in machinery space is satisfactory. The discharge valve is clearly identified and provided with a warning notice. 6. Two pumps connected to the bilge pumping system of machinery space are in good order

No.	Item	Survey mode	Survey contents
6.5	Ballast water management	Confirmation	<ol style="list-style-type: none"> 1. Ballast water management plan. 2. Ballast tanks are free from evidence of oil contamination. 3. Means for checking and sampling of ballast tanks are convenient, reliable and in good order
6.6	Garbage management	Confirmation	<ol style="list-style-type: none"> 1. Garbage management plan. 2. Garbage Record Book is correctly completed
6.7	Management of other environmental pollutants	Confirmation	<ol style="list-style-type: none"> 1. Environmental protection management plans required by the Administration of the flag State and the state the ship arrives
7	Hull structure		
7.1	Hull	Confirmation	<ol style="list-style-type: none"> 1. The hull is free from substantial structural defects. 2. The coating of hull structure is in good condition. 3. Any cargo and ballast tanks sighted from the deck are in a satisfactory condition
7.2	Weather deck	Confirmation	<ol style="list-style-type: none"> 1. The weather deck is free from substantial structural defects. 2. The coating of weather deck is in good condition
7.3	Superstructure	Confirmation	<ol style="list-style-type: none"> 1. The superstructure is free from substantial structural defects. 2. The coating of superstructure is in good condition
8(P)P	Cargo and ballast (oil tanker)		
8(P).1	Documentation of safe cargo operations on board	Confirmation	<ol style="list-style-type: none"> 1. The ship owner or operator's procedures with regard to cargo operations. 2. Information on maximum loading/unloading rates and venting capacities. 3. Cargo pump performance curves, diagrams of cargo, ballast, inert gas and venting systems
8(P).2	Documentation of ship stability and cargo operation limitations	Confirmation	<ol style="list-style-type: none"> 1. Ship stability and cargo loading information. 2. The loading instrument is furnished with the approval certificate issued by the classification society. 3. The loading instrument is calibrated quarterly. 4. Items of attention for ship stability, e.g. the dangers due to free surface effects are indicated in the loading manual. Special measures are taken to ensure stability. 5. Cargo operation limitations, e.g. sloshing in cargo tanks and ballast tanks, cargo density, etc.

No.	Item	Survey mode	Survey contents
8(P).3	Cargo operations and safety management	Confirmation	<ol style="list-style-type: none"> 1. All officers are familiar with the cargo system. 2. All officers are familiar with the carriage requirements for the cargoes on board. 3. The cargo loading plan contains the cargoes allowed to be carried, cargo and ballast operations. 4. All operating officers understand the loading plan. 5. Cargo operations are entered into the log book. 6. Material Safety Data Sheets (MSDS) of each grade of cargo carried. 7. Officers and crew of cargo operations understand relevant emergency procedures
8(P).4	Cargo and ballast and monitoring equipment	Confirmation	<ol style="list-style-type: none"> 1. The cargo, ballast and stripping pumps, eductors and their associated instrumentation and monitoring equipment are in good order. 2. Test records of cargo and ballast pump bearing, casing and shaft gland temperature monitoring sensors. 3. Regular test records of the cargo lines, crude oil washing lines, vapour return lines and inert gas lines. 4. Cargo pump emergency shut down system. 5. Cargo system gauges. 6. Temperature and pressure sensors. 7. Cargo tank high level and overflow (high high level) alarms and overflow control arrangements. 8. The cargo temperature monitoring system is in good order
8(P).5	Ullaging, sampling and closed operations	Confirmation	<ol style="list-style-type: none"> 1. Vapour lock gauges, where fitted, are approved by a competent authority. 2. If fixed tank gauges are not fitted, sufficient portable tapes are provided on board ship. 3. Ships carrying volatile or toxic cargoes are provided with closed cargo operation systems. 4. Tank hatches of cargo tanks or other tanks are watertight or gastight
8(P).6	Venting systems	Confirmation	<ol style="list-style-type: none"> 1. The venting system is in a satisfactory condition. 2. The correct operation of venting system. 3. Where a common venting system is fitted, confirming the satisfactory condition of the isolation arrangements. 4. The pressure/vacuum arrangements including flame arresters are in a satisfactory condition, furnished with the maintenance record. 5. The flame screens of cargo tanks and ballasts tanks are in a satisfactory condition, furnished with the maintenance record

No.	Item	Survey mode	Survey contents
8(P).7	Inert gas systems	Confirmation	<ol style="list-style-type: none"> 1. The inert gas system is in a satisfactory condition. 2. Record of inert gas operations. 3. Record of maintenance of the inert gas system. 4. The ship owner or operator's policy is kept on board in case of failure of the inert gas system during cargo operations. 5. Record of equipment of inert gas system, including instrumentation, alarms, trips, temperature, pressure and oxygen records, etc. 6. The readings on recorders of each position are correctly displayed and consistent. 7. The liquid level in the deck seal is clearly visible. 8. The pressure/vacuum valves, including flame arresters, are in a satisfactory condition. 9. Means for protecting the supply of inert gas to double hull spaces are readily available
8(P).8	Crude oil washing	Confirmation	<ol style="list-style-type: none"> 1. Crude Oil Washing Operations and Equipment Manual approved by the classification society. 2. The crude oil washing is in a satisfactory condition. 3. Onboard records indicate that the crude oil washing system was pressure tested prior to use. 4. Records indicate that oxygen readings of the tanks to be crude oil washed have been checked by portable meter. 5. The connections on the crude oil washing lines not in use are fitted with blanks
8(P). 9	Static electricity precautions	Confirmation	<ol style="list-style-type: none"> 1. Operational procedures related to static electricity precautions. 2. All portable gauging and sampling devices are in a satisfactory condition. 3. Natural fibre ropes are used for dipping (manual gauging devices lowered to the tank bottom). 4. Cargo hoses have electric continuity. 5. Personnel are aware of the hazards associated with tank cleaning
8(P).10	Manifolds	Confirmation	<ol style="list-style-type: none"> 1. The manifolds are in a satisfactory condition. 2. Manifold pressure gauges are fitted outboard of the manifold valves on oil tankers and in a satisfactory condition. 3. Manifold blank flanges are of an equivalent rating to that of the manifold pipelines. 4. Vapour return manifolds are in a satisfactory condition. 5. Vapour return system manifolds (VRSM) comply with the requirements for use at single point moorings

No.	Item	Survey mode	Survey contents
8(P).11	Pump rooms	Confirmation	<ol style="list-style-type: none"> 1. All machinery, pipelines, valves and instrumentation in the pump room are in a satisfactory condition. 2. The bulkhead of pump room is in a satisfactory condition, especially seals of bulkhead penetrations. 3. Pump rooms are clean and tidy. 4. The pump room bilges are free of cargo product. 5. The level of lighting in the pump room is adequate
8(P).12	Cargo hoses	Confirmation	<ol style="list-style-type: none"> 1. All cargo hoses are in a satisfactory condition. 2. Records of pressure test of each cargo hose are maintained on board
8(P).13	Lifting equipment	Confirmation	<ol style="list-style-type: none"> 1. All lifting equipment is in a satisfactory condition. 2. Records of periodical test and survey of lifting equipment
8(P).14	Ship to ship transfer operations	Confirmation	<ol style="list-style-type: none"> 1. The ship owner or operator's procedures related to ship to ship transfer operations. 2. Personnel have experience in ship to ship transfer operations. 3. All closed fairleads are provided. 4. The ship to ship transfer is conducted in accordance with the recommendations of OCIMF/ICS STS Transfer Guide
8(P).15	Combination carriers	Confirmation	<ol style="list-style-type: none"> 1. Records maintained for changing from dry (dry cargoes in bulk) to wet (liquid cargoes in bulk) mode. 2. Personnel have experience operating in wet service. 3. Hatch covers are of the dual seal type for carrying dry and wet cargoes. 4. The hatch corners are in a satisfactory condition. 5. The cargo pipelines are clean and in good order. 6. The bilge pumping arrangements for forward spaces are in good order. 7. The water level alarms in cargo tanks have been handled in accordance with the cargoes to be carried. 8. Portable crude oil washing machines and hoses are in a satisfactory condition

No.	Item	Survey mode	Survey contents
8(P).16	Shuttle tankers	Confirmation	<p>Personnel management:</p> <ol style="list-style-type: none"> 1. Officers and ratings have experience in shuttle tank operations. 2. Officers have experience in dynamic positioning operations. 3. Officers and ratings attended dynamic positioning training. 4. Officers and ratings had training in helicopter operations. <p>Dynamic positioning and navigation equipment:</p> <ol style="list-style-type: none"> 5. The dynamic positioning equipment is in good order. 6. Failure Mode Effect Analysis (FMEA) is carried out for the design of dynamic positioning. 7. Failure Mode Effect Analysis (FMEA) is the most recent. 8. All position reference systems are in good order. 9. Procedure for the checking of the uninterrupted power supply system. 10. All thrusters are in good order. <p>Dynamic positioning operations:</p> <ol style="list-style-type: none"> 11. Cargo operations manuals for each offshore terminal to which the ship trades. 12. Weather assessment before commencing cargo operations. 13. Records of communications checks. 14. Checklist for machinery and control systems. 15. Green line interlocks. 16. A service report available for the tension load cells. 17. The pressure during loading to confirm that the deluge system is in good order. 18. The emergency shut-down system is in good order. 19. Telemetry is working and tested. <p>Dynamic positioning equipment:</p> <ol style="list-style-type: none"> 20. All thrusters are in good order. 21. Dynamic positioning is in good order. 22. Position reference and offset systems. 23. Records of all dynamic positioning parameters. 24. Secure power supply systems of dynamic positioning. <p>Bow loading systems (BLS) and submerged turret loading (STL) operations:</p> <ol style="list-style-type: none"> 25. Bow loading systems (BLS) and submerged turret loading (STL) systems are in good order. 26. Checklist for the operation of bow loading systems (BLS) and submerged turret loading (STL) systems. 27. Seals on the STL buoy hatch and the STL room watertight door in good order. 28. Alarms for the STL room watertight door are in good order. 29. All indicators for opening and closing devices are in good order. 30. Fire alarms and fire extinguishing arrangements are in good order
8(P).17	Safety management at offshore installations	Confirmation	<ol style="list-style-type: none"> 1. Communication system. 2. Emergency procedures provided. 3. Procedure for emergency tow

No.	Item	Survey mode	Survey contents
8(P).18	Pollution prevention specific to offshore installations	Confirmation	1. Shipboard Oil Pollution Emergency Plan. 2. BLS/STL spaces are free of oil. 3. The ship is remotely from BLS/STL
8(C)	Cargo and ballast (chemical tanker)		
8(C).1	Documentation of safe cargo operations on board	Confirmation	The same as oil tanker and the following are added: 1. Availability of Procedures and Arrangements (P&A) Manual. 2. Cargo Record Book is correctly completed. 3. Procedures for tank cleaning using chemicals and solvents
8(C).2	Documentation of ship stability and cargo operation limitations	Confirmation	The same as oil tanker and the following is added: 1. Information on ship's survival capabilities
8(C).3	Cargo operations and safety management	Confirmation	The same as oil tanker and the following are added: 1. Cargo compatibility chart. 2. Availability of information on cargo required to be inhibited. 3. Isolation measures for carriage of non-compatible cargoes. 4. Material Safety Data Sheets (MSDS) on board. 5. Emergency procedures for dealing with leakage, spill or fire involving the cargo. 6. Structure and ventilation of cargo sample locker to prevent cargo breakage
8(C).4	Cargo and ballast equipment	Confirmation	The same as oil tanker and the following are added: 1. Cargo pipeline drains. 2. Records of the calibration of cargo instrumentation, including temperature and pressure gauges
8(C).5	Ullaging, sampling and closed operations	Confirmation	The same as oil tanker and the following is added: 1. Closed ullaging arrangements of cargo tanks for ships carrying volatile or toxic cargoes
8(C).6	Venting systems	Confirmation	The same as oil tanker
8(C).7	Static electricity precautions	Confirmation	The same as oil tanker
8(C).8	Manifolds	Confirmation	The same as oil tanker
8(C).9	Pump rooms	Confirmation	The same as oil tanker
8(C).10	Safety equipment	Confirmation	1. Suitable protective equipment for personnel engaged in cargo operations. 2. Safety equipment is correctly located. 3. Safety equipment is tested as required and test records are available on board. 4. Decontamination showers and an eye-wash are readily available. 5. Means for hoisting an injured person of pump room
8(C).11	Cargo hoses	Confirmation	The same as oil tanker
8(C).12	Lifting equipment	Confirmation	The same as oil tanker
8(LPG)	Cargo and ballast (LPG carrier)		

No.	Item	Survey mode	Survey contents
8(LPG).1	Documentation of safe cargo operations on board	Confirmation	The same as oil tanker and the following are added: 1. Instructions and procedures with regard to safe cargo operations. 2. Availability of Procedures and Arrangements (P&A) Manual where dual code cargoes are carried. 3. Cargo Record Book is correctly completed. 4. Maximum loading rates
8(LPG).2	Documentation of ship stability and cargo operation limitations	Confirmation	The same as oil tanker and the following is added: 1. Confirming the information on ship's survival capabilities
8(LPG).3	Cargo operations and safety management	Confirmation	The same as oil tanker and the following are added: 1. Cargo compatibility chart. 2. Officers are familiar with the carriage requirements for the cargoes on board. 3. Availability of cargo compatibility chart. 4. Material Safety Data Sheets (MSDS). 5. Emergency procedures for dealing with leakage, spill or fire involving the cargo. 6. Responsible officers are familiar with the term "reference temperature". 7. Availability of information on cargo required to be inhibited. 8. If refrigerated cargoes are carried, a supply of freezing depressant is maintained onboard
8(LPG).4	Cargo operations and monitoring equipment	Confirmation	The same as oil tanker and the following are added: 1. Availability of emergency discharge equipment. 2. Availability of means for insulation of cargo system and hull. 3. Records of the calibration of key cargo instrumentation. 4. Availability of cargo tank heating system
8(LPG).5	Cargo compressor and motor rooms	Confirmation	1. The requirements for cargo compressor room are the same as those for pump rooms of oil tankers. 2. In accordance with the requirements for equipment located in a hazardous area, airlocks of motor room are in a satisfactory condition, except that the motor room is 2.4 m above the weather deck. 3. The gas detection equipment of cargo compressor and motor rooms is in a satisfactory condition
8(LPG).6	Seals of cargo tanks and void spaces of type C independent tanks	Confirmation	1. Void space seals are in a satisfactory condition. 2. Environmental control of void spaces is in a satisfactory condition. 3. Insulation means of cargo tanks are in a satisfactory condition

No.	Item	Survey mode	Survey contents
8(LPG).7	Void and inter-barrier spaces of other cargo tank types	Confirmation	<ol style="list-style-type: none"> 1. The oxygen and hydrocarbon content of the inter-barrier spaces is regularly monitored and the records are satisfactory. 2. The inter-barrier space nitrogen purging system is in good order. 3. The pressure relief system of primary and secondary barrier spaces is in good order. 4. Insulation means of cargo tanks are in good order
8(LPG).8	Inert gas system	Confirmation	<ol style="list-style-type: none"> 1. The inert gas system and associated pipelines are in good order
8(LPG).9	Pressure relief and venting system	Confirmation	<ol style="list-style-type: none"> 1. Record of calibration of pressure relief valves
8(LPG).10	Emergency shut down system	Confirmation	<ol style="list-style-type: none"> 1. Remotely controlled emergency shutdown valves. 2. Automatic shutdown of emergency shutdown valves of cargo pumps and compressors. 3. Test record of ESD system. 4. Guidance for ESD trips
8(LPG).11	Manifolds	Confirmation	The same as oil tanker
8(LPG).12	Safety equipment	Confirmation	<ol style="list-style-type: none"> 1. Suitable protective equipment for personnel engaged in cargo operations. 2. Safety equipment is correctly located. 3. Safety equipment is tested as required and test records are available on board. 4. Decontamination showers and an eye-wash are readily available
8(LPG).13	Cargo hoses	Confirmation	The same as oil tanker
8(LPG).14	Lifting equipment	Confirmation	The same as oil tanker
8(LPG).15	Ship to ship transfer operations	Confirmation	<ol style="list-style-type: none"> 1. The ship owner or operator's procedures related to ship to ship transfer operations. 2. Personnel have experience in ship to ship transfer operations. 3. All closed fairleads are provided. 4. The ship to ship transfer is conducted in accordance with the recommendations of OCIMF/ICS STS Transfer Guide
8(LNG)	Cargo and ballast (LNG carrier)		
8(LNG).1	Documentation of safe cargo operations on board	Confirmation	<p>The same as oil tanker and the following are added:</p> <ol style="list-style-type: none"> 1. Instructions and procedures with regard to safe cargo operations. 2. Availability of cargo loading limitations. 3. Cargo Record Book is correctly completed. 4. Maximum loading rates
8(LNG).2	Documentation of ship stability and cargo operation limitations	Confirmation	<p>The same as oil tanker and the following is added:</p> <ol style="list-style-type: none"> 1. Confirming the information on ship's survival capabilities

No.	Item	Survey mode	Survey contents
8(LNG).3	Cargo operations and safety management	Confirmation	<p>The same as oil tanker and the following are added:</p> <ol style="list-style-type: none"> 1. Cargoes included in the cargo operations manual. 2. Officers are familiar with the carriage requirements for the cargoes on board. 3. All crew members are familiar with emergency procedures for dealing with leakage, spill or fire involving the cargo. 4. Communication between the ship and the shore
8(LNG).4	Cargo operations and monitoring equipment	Confirmation	<p>The same as oil tanker and the following are added:</p> <ol style="list-style-type: none"> 1. Availability of emergency discharge equipment. 2. Availability of means for insulation of cargo system and hull. 3. Records of the calibration of key cargo instrumentation. 4. Remote and local temperature and pressure sensors and gauges. 5. Emergency discharge method. 6. Tank domes and associated fittings. 7. Insulation of low temperature cargo pipelines. 8. Cargo pipelines and system relief valves. 9. Screwed-in connections of cargo pipelines. 10. Gauging, high level alarm, overflow control. 11. Overriding arrangements of the high level and emergency shut-down systems
8(LNG).5	LNG cargo machinery rooms	Confirmation	<ol style="list-style-type: none"> 1. Compressor rooms, motor rooms and the reliquefaction plant are in a safe condition. 2. The bulkhead seals between the compressor room and the motor room are gas tight. 3. The motor room ventilation system is to maintain negative pressure. 4. The electrical fittings of machinery spaces are to be suitable for use in gas-hazardous areas. 5. The motor room in gas-hazardous area is to be provided with an air-lock. 6. The detection equipment is in a satisfactory condition. 7. Airlocks and alarms. 8. The compressor room is free of combustible gas. 9. The gas detection system in a satisfactory condition

No.	Item	Survey mode	Survey contents
8(LNG).6	Reliquefaction systems	Confirmation	<ol style="list-style-type: none"> 1. All the cargo reliquefaction plant, including but not limited to compressors, cold box or gas cooler, is in good order. 2. All the associated machinery is in good order. 3. The instrumentation of cargo system is in good order. 4. Records are to be available of the pressure testing of alarms and trips and of the calibration of cargo system instrumentation. Such testing is to be included under the PMS system. 5. The flow of N2 to the system is sufficient. 6. The reliquefaction plant is fitted with an independent emergency shutdown control independent of the cargo ESD system
8(LNG).7	Gas combustion systems	Confirmation	<ol style="list-style-type: none"> 1. The Gas Combustion Unit (GCU) is in fully operational condition. 2. The alarms associated with the GCU are tested in accordance with the Planned Maintenance System. 3. The automatic mode of GCU operations to allow for failure of the reliquefaction unit or the loss of gas combustion in the machinery. 4. The gas detection system for the machinery space is in good working order. 5. The gas fuel piping is not to pass through accommodation spaces, service spaces, or control stations. 6. The gas fuel piping is in good order. 7. The automatic gas shut-off system is in good order and regularly tested
8(LNG).8	Void and inter-barrier spaces and seals	Confirmation	<ol style="list-style-type: none"> 1. The oxygen and hydrocarbon content of the inter-barrier spaces is regularly monitored and the records are satisfactory. 2. The inter-barrier space nitrogen purging system is in good order. 3. The pressure relief system of primary and secondary barrier spaces is in good order. 4. Insulation means of cargo tanks are in good order
8(LNG).9	Inert gas systems	Confirmation	<ol style="list-style-type: none"> 1. The inert gas system and associated pipelines are in good order
8(LNG).10	Pressure relief and venting systems	Confirmation	<ol style="list-style-type: none"> 1. Record of calibration of pressure relief valves
8(LNG).11	Emergency shut down systems	Confirmation	<ol style="list-style-type: none"> 1. Remotely controlled emergency shutdown valves. 2. Automatic shutdown of emergency shutdown valves of cargo pumps and compressors. 3. Test record of ESD system. 4. Guidance for overriding alarms and ESD trips

No.	Item	Survey mode	Survey contents
8(LNG).12	Manifolds	Confirmation	The same as oil tanker
(LNG).13	Safety equipment	Confirmation	<ol style="list-style-type: none"> 1. Suitable protective equipment for personnel engaged in cargo operations. 2. Provision of safety equipment. 3. Safety equipment is correctly located. 4. Safety equipment is tested as required and test records are available on board. 5. Water spray systems are readily available
8(LNG).14	Cargo hoses	Confirmation	The same as oil tanker
8(LNG).15	Lifting equipment	Confirmation	The same as oil tanker
8(LNG).16	Ship to ship transfer operations	Confirmation	<ol style="list-style-type: none"> 1. The ship owner or operator's procedures related to ship to ship transfer operations. 2. Personnel have experience in ship to ship transfer operations. 3. All closed fairleads are provided. 4. The ship to ship transfer is conducted in accordance with the recommendations of OCIMF/ICS STS Transfer Guide
9	Anchoring and mooring		
9.1	Mooring equipment documentation	Confirmation	<ol style="list-style-type: none"> 1. Mooring equipment is furnished with certificates and marked with the safe working load. 2. Certificate of steel mooring tail. 3. Mooring lines, including steel wires and fibre wires, are in a satisfactory condition of maintenance. 4. Chain stoppers are furnished with certificates. 5. The ship owner or operator has provisions in place for the testing of winch brakes and the testing report of brake capacity is available on board
9.2	Mooring procedures	Confirmation	<ol style="list-style-type: none"> 1. Mooring lines of the same size and type are used for all leads. 2. Mooring lines are secured to bits and turned up correctly. 3. Winches are out of gear. 4. Steel wires are connected to fibre wires using appropriate shackles manufactured by Mandal, Tonsberg and Boss. 5. Mooring areas (adjacent to bits and mooring winches) are clear and unobstructed. 6. Mooring lines are stowed neatly

No.	Item	Survey mode	Survey contents
9.3	Mooring equipment	Confirmation	<ol style="list-style-type: none"> 1. Mooring winches are in good order. 2. If mooring winches in a gas hazardous area are electrically powered, the motors are Ex 'd' or Ex 'e' rated. 3. The insulation resistance of electrical equipment is at least 5 Megohm. 4. Mooring lines are in a satisfactory condition of maintenance. 5. Mooring lines have sufficient strength, i.e., the reduction of strength is not greater than 10% of the minimum breaking load (MBL). Splices in eyes and for repairs have a minimum of 5 tucks. There are not more than three broken wires in any strand, or five in any adjacent strands in a length of wire 10 times the diameter. 6. Each mooring fitting, including bits, bollards, fairleads and chain stoppers, are permanently marked with its SWL
9.4	Anchoring equipment	Confirmation	<ol style="list-style-type: none"> 1. Windlasses, anchors, chain stoppers and cables are in a satisfactory condition. 2. Anchoring equipment in use is locked and windlasses not in use are secured by brake. 3. The chain locker doors are securely battened down. 4. The foundation of chain stopper is in a satisfactory condition
9.5	Single point mooring equipment	Confirmation	<ol style="list-style-type: none"> 1. Single point mooring (SPM) and associated equipment are fitted and arranged in accordance with OCIMF recommendations. 2. Single point mooring (SPM) and associated equipment are in a satisfactory condition. 3. Chain stoppers are provided with means to prevent accidental release. 4. The foundation of chain stopper is in a satisfactory condition. 5. Confirming that the winch storage drum is of sufficient size for storage. 6. Confirming the arrangements at stern for tug escort and pull-back
9.6	Emergency towing arrangements	Confirmation	<ol style="list-style-type: none"> 1. The emergency towing arrangements are readily available for deployment. 2. The strong point foundation is in a satisfactory condition. 3. Procedures for deployment of emergency towing arrangements or emergency towing procedures. 4. Arrangement of emergency towing arrangements is posted on the navigation bridge

No.	Item	Survey mode	Survey contents
9.7	Emergency towing-off pennants (fire wires)	Confirmation	<ol style="list-style-type: none"> 1. Emergency towing-off pennants conform to OCIMF recommendations on the size of wires appropriate to ship size, and in a satisfactory condition. 2. Emergency towing-off pennants are properly rigged to meet requirements of port authorities
10	Communications		
10.1	Communications procedures	Confirmation	<ol style="list-style-type: none"> 1. Instructions for operating communications equipment in an emergency are clearly displayed. 2. The ship's call sign and Inmarsat ship station identity are clearly marked. 3. Officers have communications equipment operating certificates. 4. Periodical (e.g. daily, weekly, monthly) tests of communications equipments are carried out as required. 5. The radio log is maintained correctly and continuously. 6. The source of electrical power of communications equipment is sufficient
10.2	Communications equipment	Confirmation	<ol style="list-style-type: none"> 1. The communications equipment is in a satisfactory condition. 2. The communications equipment is fitted and labelled correctly. 3. The number of intrinsically safe portable radios is sufficient. 4. Confirming that the Lists of Radio Signals are the latest edition and corrected up to date
10.3	Daylight signaling lamp	Confirmation	<ol style="list-style-type: none"> 1. Two sources of electrical power are available, one of which is accumulator battery
11	Engine and steering compartments		
11.1	Documentation	Confirmation	<ol style="list-style-type: none"> 1. The ship owner or operator's documentation with regard to ship management. 2. Duties of crew are clearly defined. 3. Night orders of chief engineer. 4. The machinery log is correctly recorded. 5. Procedures for restarting critical equipment. 6. The ship owner or operator's procedures for periodic testing of fuel oil and lubricating oil. 7. Details of bunkering operations
11.2	Maintenance	Confirmation	<ol style="list-style-type: none"> 1. Maintenance plan. 2. The maintenance plan is implemented. 3. A comprehensive and up to date inventory of spare parts

No.	Item	Survey mode	Survey contents
11.3	Safety management	Confirmation	<ol style="list-style-type: none"> 1. The ship owner or operator's documentation with regard to safety management. 2. The engineer's call alarm is tested regularly. 3. Emergency escape routes clearly marked. 4. The level of lighting is adequate. 5. Confirming that emergency equipment is tested regularly and records are maintained. 6. Heated surfaces are well protected against spray. 7. The insulation resistance of electrical equipment is greater than 5 Megohm. 8. Machine tools have adequate eye protection available. 9. Confirming that bilges of machinery space are free of oil and rubbish. 10. Confirming that the bilge high level alarm of machinery space is in good order
11.4	Machinery equipment	Confirmation	<ol style="list-style-type: none"> 1. The machinery equipment is well maintained. 2. Every control station of machinery equipment is in good order. 3. Emergency operation procedures are available on the navigation bridge. 4. Procedures for operating emergency generators are clearly displayed. 5. The emergency generator reserve fuel tank is provided with sufficient fuel. 6. Where an emergency generator is not fitted, the emergency batteries can supply the designated power load for up to 18 h. 7. All electrical equipment including junction boxes and cable runs is in good order. 8. The electrical equipment is free of significant earth faults
11.5	Steering compartment	Confirmation	<ol style="list-style-type: none"> 1. Steering gear changeover procedures are clearly displayed on the navigation bridge. 2. The emergency steering gear is tested periodically as required. 3. Bilges of steering compartment are free of oil, water and rubbish. 4. The hydraulic steering gear emergency reserve tank has sufficient capacity and is fully charged. 5. Emergency steering positions are provided with means of communications for relaying heading information to such positions. 6. Communications between emergency steering positions and the navigation bridge are satisfactory. 7. The access complies with the requirements and unobstructed. 8. The steering compartment is fitted with suitable handrails, gratings or other non-slip surfaces

No.	Item	Survey mode	Survey contents
12	General appearance and condition		
12.1	General appearance of hull, superstructure and weather decks	Confirmation	<ol style="list-style-type: none"> 1. Hull, superstructure and weather decks are free of substantial defects. 2. The hull is free of oil staining, extensive coating breakdown or excessive marine growth. 3. Hull markings are clearly indicated. 4. The coatings of weather decks are satisfactory. 5. Confirming that decks in working areas have clearly identified non-slip surfaces. 6. Doors on deck, opening and closing arrangements are in a satisfactory condition. 7. Fuel, ballast and other space vents are regularly maintained and in a satisfactory condition. 8. All vents on decks are clearly marked to indicate the spaces they serve
12.2	Electrical equipment	Confirmation	<ol style="list-style-type: none"> 1. Deck lighting is adequate. 2. The general condition of electrical equipment, including conduits and wiring, is satisfactory. 3. Light fittings in gas-hazardous areas, e.g. vent fans motors, cargo pump and cargo winch motors and lighting, are Ex 'd' or Ex 'e' rated. 4. Light fittings in gas-hazardous areas are inspected by a competent authority and inspection report is kept on board
12.3	Internal spaces	Confirmation	<ol style="list-style-type: none"> 1. Internal spaces and storerooms are clean, free from debris and tidy. 2. Forecastle spaces are free of water. 3. The arrangements for the disposal of oily water in hydraulic pump spaces are satisfactory
12.4	Accommodation spaces	Confirmation	<ol style="list-style-type: none"> 1. Accommodation spaces are free of substantial defects. 2. Accommodation spaces are clean and tidy. 3. Access is free of obstructions. 4. Public spaces, including smoke rooms, mess rooms, sanitary areas, food storerooms, food handling spaces, refrigerated spaces, galleys and pantries are clean, tidy and in a hygienic condition. 5. The condition of electrical equipment in the accommodation space is satisfactory. 6. The level of accommodation lighting is satisfactory. 7. Alarms in refrigerated spaces are in good order and operational

No.	Item	Survey mode	Survey contents
13	Navigation in ice conditions	Confirmation	<ol style="list-style-type: none"> 1. A certificate of class notation for navigation in ice conditions is issued by the classification society. 2. Procedures for navigation and operations in ice conditions and low temperatures. 3. Effective maintenance and means for preventing the icing up of equipment for navigation in ice conditions. 4. Means for protection of vent pipes on fuel tanks of main and auxiliary engines. 5. Protection of deck machinery and deck piping. 6. Means for preventing the water service pipes from freezing. 7. Training addressing operations in cold temperatures is provided to personnel. 8. Thermal protective aids are provided to personnel. 9. Means for preventing the icing up of water levels inside tanks above the waterline. 10. Means for preventing the icing up and thermal protection in lifting equipment control cabin

2.3 Product surveys

2.3.1 Product surveys in relation to the equipment, loading and systems of tankers in accordance with the Guidelines contain survey items other than those required by classification rules and statutory requirements.

2.3.2 Surveys of the equipment, loading and systems in general consist of type approval and delivery survey. The survey procedures are to comply with the recognized provisions or relevant provisions of Chapter 3, PART ONE of ISC Rules for Classification of Sea-going Steel Ships.

2.3.3 The safe working load (SWL) or the minimum breaking load (MBL) of products is to be indicated by “tonnes” or the symbol “t”.

2.3.4 The safe working load (SWL) of anchoring and mooring equipment is to be indicated by “tonnes” or the symbol “t”.

2.3.5 The parameters, specification and type of products are to be stamped permanently on the body of products, generally consisting of:

- (1) Type approval product logos.



Figure 2.3.5(1)a Approval logo is stamped on the body



Figure 2.3.5(1)b Approval logo is stamped on the body

(2) Delivery survey product logos.



Figure 2.3.5(2)a The safe load of winches is stamped permanently on the body



Figure 2.3.5(2)b The safe load of double bollards is stamped permanently on the body



Figure 2.3.5(2)c The safe load of cruciform bollards is stamped permanently on the body

2.3.6 The product survey items are given in Table 2.3.6.

Product certificate items

Table 2.3.6

No.	Product name	Survey mode	Delivery survey contents
1	Chain stoppers	Unit survey	1. Carrying out visual inspection. 2. Confirming safe working load (SWL)
2	Mooring lines Emergency towing-off pennants	Unit survey	1. Carrying out visual inspection. 2. Confirming minimum breaking load (MBL). 3. Spot check of proof load tests
3	Mooring tails (pendant)	Unit survey	1. Carrying out visual inspection. 2. Confirming minimum breaking load (MBL)
4	Shackles connecting steel mooring lines and tails	Unit survey	1. Carrying out visual inspection. 2. Examining test reports. 3. Confirming safe working load (SWL)
5	Bollards (bits)	Unit survey	1. Carrying out visual inspection. 2. Confirming safe working load (SWL)
6	Fairleads	Unit survey	1. Carrying out visual inspection. 2. Confirming safe working load (SWL)
7	Reducers	Unit survey	1. Carrying out visual inspection. 2. Confirming safe working load (SWL)
8	Winches	Unit survey	1. Carrying out visual inspection. 2. Confirming safe working load (SWL)
9	Flashlights used in flammable atmospheres	Type approval	1. Examining atmosphere test reports. 2. Checking product certificates suitable for use in flammable atmospheres issued by a competent authority
10	Self-igniting lights of lifebuoys used in flammable atmospheres	Type approval	1. Examining atmosphere test reports. 2. Checking product certificates suitable for use in flammable atmospheres issued by a competent authority
11	Communications equipment used in flammable atmospheres	Type approval	1. Examining atmosphere test reports. 2. Checking product certificates suitable for use in flammable atmospheres issued by a competent authority

Chapter 3 Construction and Equipment

3.1 Materials of structure and equipment

3.1.1 Structural materials used for tank construction, together with associated piping, pumps, valves, vents and their jointing materials, are to be suitable at the temperature and pressure for the cargo to be carried in accordance with recognized standards. Steel is assumed to be the normal material of construction.

3.1.2 Where Thermo Mechanical Controlled Process (TMCP) steel is employed at least the bottom plating of all cargo tanks are to be protected by a hard coating.

3.1.3 Aluminium anodes for cathodic protection are not to be used in cargo or ballast tanks. If used in ballast tanks, necessary protective measures are to be taken to ensure that anodes are not to be placed higher than a position that may cause an impact energy greater than 20 kgf-m in the event of a fall.

3.1.4 If the cathodic protection (anodes) is placed higher than a position that may cause an impact energy greater than 20kgf-m in the event of a fall, protective measures are to be taken to prevent the anodes from falling from directly overhead and becoming a source of ignition.

3.1.5 If alloys are used for anodes, then they must contain no more than:

- (1) 0.02% magnesium;
- (2) 0.01% silicone.

3.1.6 The use of high strength steel for tanker structure is to be limited to no more than 30% of the vessel's steel weight. If this is exceeded, a structural analysis is to be submitted to ISC for review. The analysis is to incorporate a fatigue analysis that takes into account the anticipated life and trading pattern of the vessel, and relevant structural and fatigue calculations are to be provided.

3.1.7 All steel diminution during the vessel's service life is to be within meeting the criteria of substantial corrosion or renewal. Any required repair or replacement of a component is to meet the criteria of the Rules for Classification of Sea-going Steel Ships and all the anticipated trade patterns and purposes of the vessel.

3.1.8 The use of aluminium coatings is prohibited in cargo and adjacent areas, e.g. cargo tanks, cargo tank deck area, pump rooms, cofferdams or any other area where cargo vapour may accumulate. Aluminium coatings used in other areas are not recommended.

3.1.9 Unless special protective measures are provided, aluminium or aluminium alloys are not to be used as the elements of structure and equipment in the cargo area.

3.1.10 Cargo tank structural elements are to be made of steel or equivalent material. For vessels that may carry aviation fuels, the cargo tank structure and cargo handling equipment are to be free of copper, zinc, cadmium and their alloys.

3.1.11 Vessel cargo and bunker manifolds and associated valves, reducers and spool pieces are to be fabricated of steel or flexible material. Grey cast iron and aluminium are not recommended.

3.1.12 For tankers that may carry multiple chemical cargoes and clean product oil, the cargo tanks, including heating coils or heat exchangers, are to be fit for the conditions required for the cargo to be carried.

3.1.13 For cargo tanks fitted with heating means, its structure and paint used are to be fit for the cargo intended to be carried and to withstand the related operational pressure and cargo temperature in the cargo space.

3.1.14 If high-viscosity cargo is carried, sufficient heating means are to be fitted to meet the following requirements:

(1) The cargo heating system is to meet the requirements of cargo operation and navigational environment, capable of raising the temperature of the cargo to 57°;

(2) The cargo heating system is to be designed according to the following environmental conditions: seawater temperature 0°, air temperature 5°.

(3) The cargo heating system is to be so designed that it is capable of raising the temperature of the cargo to 57° and maintaining this temperature throughout loading, the loaded passage and discharge. However, the rate of temperature rise required is not to be more than 4° per day in order to avoid overheating of local hull structural elements.

3.2 Arrangement of equipment

3.2.1 Some oil companies, such as Exxon Mobil Corporation requires that if double hulled, the vessel must have a continuous longitudinal bulkhead in the cargo tanks in addition to the longitudinal bulkheads forming the cargo block.

3.2.2 The vessels, especially large vessels, are to be capable of handling at least 2 grades of cargo, and some oil companies, such as Exxon Mobil Corporation requires 3 grades of cargo.

3.2.3 Ballast tanks are to be provided with a means of safe and easy access for inspection of ballast tank internal coatings and surfaces. The use of horizontal flats at 4-6 m increments is preferred. Stringers or oversized longitudinals, with guard-rails, at the same spacing is also acceptable.

3.2.4 As a minimum, there are to be navigation bridge or bridge wings extending fully to the ship's side on at least the offtaking vessel.

3.2.5 Hard coatings are to be used in ballast tanks.

3.2.6 Some companies allow actions being taken in case of any possible intact stability failure during cargo and/or ballast operations. These actions are to be distinctly labelled in the operational manual as "Attentions for operators", requiring operators' attention to the actions and steps to resume stability in case of stability failure.

3.2.7 The centre of the cargo manifold arrangement is to be located at the mid-length of the ship, or as near as possible, but it is in no case to be more than 3 m forward or aft of the mid-length. For these purposes, the ship's length is to be taken as the length overall.

3.2.8 The vessel carrying 2 and more grades of cargo is to be provided with at least double valve segregation or equivalent means between grades, so as to prevent contamination between different grades during navigation or cargo operation.

3.2.9 During ship to ship transfer operations, the centre of the cargo manifold (flanges for cargo hose or loading arms) is to be forward of the mid-length of the ship (the ship's length is to be taken as the length overall). For ships of more than 60,000 DWT, the centre of manifold to the front bulkhead of navigation bridge is not to be less than 91 m.

3.2.10 During ship to ship transfer operations, the centre of the cargo manifold is to be so arranged that two closed fairleads for breast lines are to be located within 35 m forward and aft of the mid-length of the ship with associated twin sets of bollards and lead to winches.

3.2.11 The provision and arrangement of structure and equipment including cargo handling equipment are normally to be in accordance with the tonnage category. The designation of ship type and size by INTERTANKO is shown in Table 3.2.11.

Type of oil tanker corresponding to its size Table 3.2.11

	Ship type	Tonnage category (DWT)
1	Handymax	10,000-60,000
2	Panamamax	60,000-75,000
3	Aframax	75,000-120,000
4	Suezmax	120,000-200,000
5	VLCC	200,000-320,000
6	ULCC	Above 320,000

3.2.12 Cargo tanks are to be provided with high level alarm system and/or high high level alarm system.



Figure 3.2.12 Means of high and high high level measurement in cargo tanks

3.2.13 Where a slop tank is used to carry cargo or store dry crude oil for crude oil washing, the slop tank is to be treated as cargo tank, and to be provided with heating installations, inert gas and crude oil washing systems, etc.

3.2.14 For tankers carrying cargo the operating temperature of which is 80° and over, the cargo tank boundaries are not to be in contact with the sea.

3.2.15 For tankers carrying cargo the operating temperature of which is up to 0°, the cargo tank boundaries are to be protected by thermal insulation.

3.3 Cargo handling equipment on oil tankers

3.3.1 Cargo and bunker manifolds and manifolds for vapour return system are to be arranged on weather decks.

3.3.2 The minimum spacing of the cargo manifold as measured centre to centre along the line of presentation flanges is to be:

- (1) 1,500 mm for ships of 16,000-25,000 DWT;
- (2) 2,000 mm for ships of 25,001-60,000 DWT;
- (3) 2,500 mm for ships of 60,001-160,000 DWT;
- (4) 3,000 mm for ships above 160,000 DWT.

3.3.3 The minimum spacing between the bunker presentation flanges and the nearest cargo manifold, as measured from centre to centre, is to be:

- (1) 1,000 mm for ships of 16,000-25,000 DWT;
- (2) 2,000 mm for ships above 25,000 DWT.

3.3.4 The minimum spacing of the vapour manifolds, located forward or aft of the bunker lines, as measured from centre to centre from the bunker lines along the line of presentation flanges is to be:

- (1) 1,500 mm for ships of 16,000-25,000 DWT;
- (2) 2,000 mm for ships of 25,001 DWT and above.

3.3.5 The length of distance pieces is to be adequate to ensure that a minimum of 200 mm is allowed between each flange and the manifold support structure, i.e., the length of the distance pieces is to be at least equal to the width of the manifold support structure plus 400 mm.

3.3.6 Reducers are normally to have a minimum overall length of 500 mm in order to allow sufficient space for operation.

3.3.7 Spill tank end deck is to be provided with cruciform bollards, which are to be so arranged that:

- (1) the minimum spacing between the bollard centre and the spill tank fore end is 1,200 mm,
- (2) the minimum spacing between the bollard centre and the spill tank side end is 300 mm,
- (3) the minimum length of the bollard is 400 mm.

3.3.8 The centres of the presentation flanges are to be located at least 700 mm above the horizontal projection of the top of the hose support at the ship's side, and 900 mm above the working platform for handling cargo by means of cargo hoses or loading arms. The height of the centres of the presentation flanges above the deck is not to exceed 2,100 mm. The distance between the level of working platform and the centres of the presentation flanges is not to be less than 900 mm.

3.3.9 For ships of 160,000 DWT and upwards, twin sets of bollards at least of 550 mm diameter are to be located inboard of the closed fairleads for handling the moorings.

3.3.10 A horizontal curved plate or pipe section is to be fitted at the ship's side and above the fairleads to support cargo hoses.

3.3.11 The hose supports are to comply with the following requirements:

(1) The hose supports may be a horizontal curved plate or pipe section, with a minimum radius of curvature of:

- ① 150 mm for ships of 16,000-160,000 DWT;
- ② 300 mm for ships above 160,000 DWT.

(2) The hose supports are to lie in the fore and aft axis at the ship's sides and be at least 700 mm below the level of the centres of the presentation flanges.

(3) The hose supports are to be sized to cater for a minimum load of:

- ① 10 tonnes for ships of 16,000-60,000 DWT. Some oil companies require 15 tonnes;
- ② 20 tonnes for ships of 60,001-160,000 DWT;
- ③ 25 tonnes for ships above 160,000 DWT.



Figure 3.3.11 Hose supports in way of the ship's side abreast of the manifolds

3.3.12 The presentation flanges are to be “welded neck” flanges in order to provide a clear inner diameter for the insertion of alignment probes. If “slip on” flanges are fitted, the internal weld is to be ground flush to conform to the nominal bore specification outlined.

3.3.13 All unused piping on the deck are to be blanked by blank flanges at pipe ends.

3.3.14 The manifold blank flanges on deck are normally to be of an equivalent strength to that of the manifold pipe flanges, and of same material and thickness according to a recognized rating.

3.3.15 Blank flanges are to be fitted with handles at ends for operators.

3.3.16 Working platforms and safety means of access are to be provided below cargo hoses or above spill tank, for disconnecting cargo hoses or loading arms.

3.3.17 The strength of the working platform for disconnecting cargo hoses or loading arms is to be at least of 1 ton/m².

3.3.18 The cargo manifold supports, distance pieces and reducers are to be designed to be capable of withstanding the maximum loads imposed by unsupported loading arms as outlined in Table 3.3.18.

Strength requirements for presentation flange

Table 3.3.18

Tonnage category (DWT)	Vertical force (tonnes)	Lateral force (tonnes)	Axial force (tonnes)	Moment (tonne m)	Loading arm size (inch)
16,000-25,000	5	2	5	5	16"
25,001-60,000	10	3	7	10	20"
60,001-160,000	15	4	10	15	24"
Above 160,000	15	4	10	15	24"

3.3.19 Horizontal arrangement of manifolds and associated equipment is shown in Figure 3.3.19.

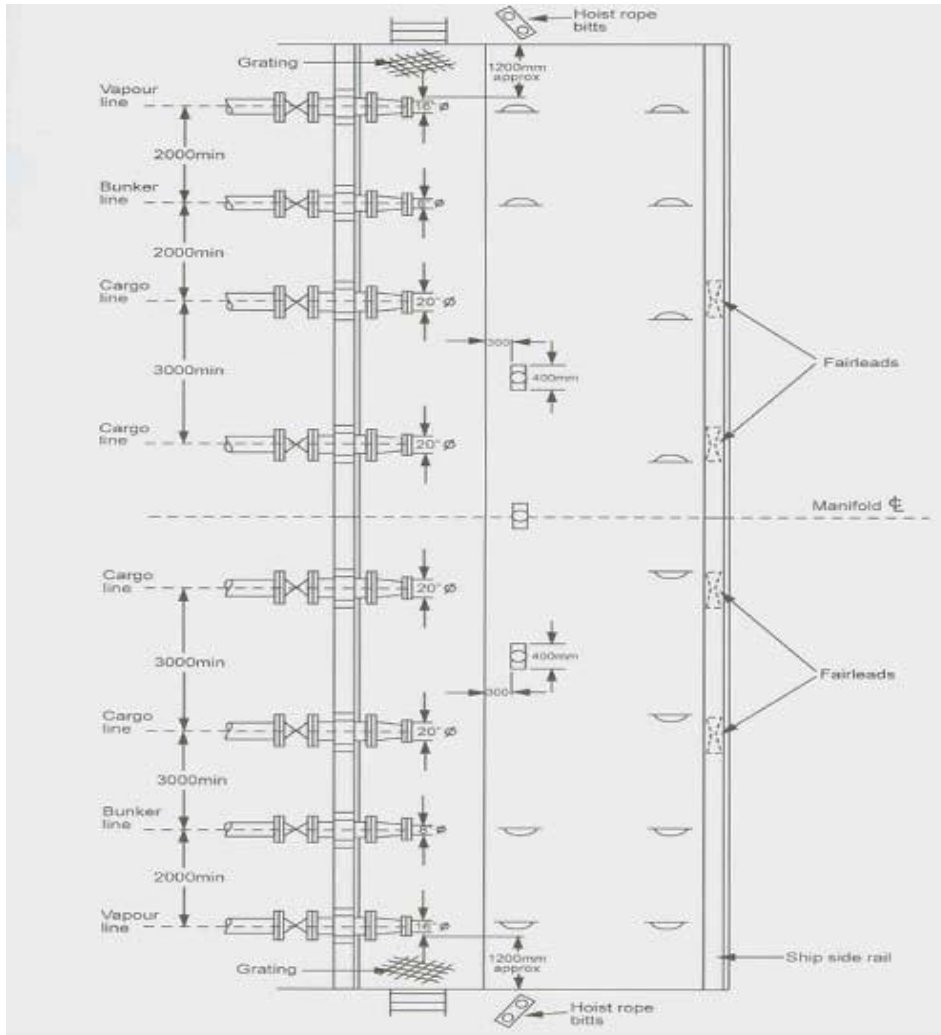


Figure 3.3.19 Manifold and associated equipment arrangement for VLISC

3.3.20 The material, strength and structural details of cargo, bunker and vapour return manifold flanges, manifold valves, distance pieces and reducers are normally to conform to B.S.1560 or ANSI B16 or other recognized standards that are at least equivalent to these two standards.

3.3.21 Adequate number of cargo, bunker and vapour return manifold flanges, manifold valves, distance pieces and reducers are to be provided. The number and size of cargo reducers are to at least comply with the specification outlined in Table 3.3.21.

Number and size of reducers

Table 3.3.21

Tonnage category (DWT)	Number of reducers	Size of reducers	Number and size of reducers (reserve reducer stocks)							
			Number Size		Number Size		Number Size			
16,000-25,000	8	12"	4	8"	4	10"	-	-	-	-
25,001-60,000	8	16"	4	8"	4	10"	4	12"	-	-
60,001-160,000	8	16"	4	8"	4	10"	4	12"	-	-
Above 160,000	8	20"	4	12"	4	16"	-	-	-	-

3.4 Cargo pump-rooms

3.4.1 Cargo pump-rooms are to be sufficiently ventilated to ensure that the concentration of flammable vapours in the air inside pump-rooms is below 10% LEL. The number of air changes is to be at least 20 per hour.

3.4.2 Cargo pump-rooms are to be provided with permanent mechanical ventilation system. The ventilation is to be of the extraction mode using fans of the non-sparking type.

3.4.3 The ventilation system of cargo pump-rooms is to be of two extraction fans. If only one extraction fan is installed, arrangements must be provided to provide extraction in case of failure.

3.4.4 If cargo pump-rooms are provided with pressure blowers and extraction fans, the fan outlets are to be kept as distant as possible from the blower inlets in order to prevent the discharged air from being re-sucked into cargo pump-rooms.



Figure 3.4.4 Cargo pump-room mechanical ventilation inlet and outlet arrangements

3.4.5 Mechanical ventilation system is to be provided with normal and emergency inlets. Normal inlets are to be located up to 800 mm ~ 1,000 mm above tank top, while emergency inlets are to be located up to 800 mm ~ 1,000 mm above floor plating.

3.4.6 Emergency inlets are to be closed in normal conditions, and are to be opened from outside only in emergency conditions, e.g. normal inlets are immersed due to flooding into pump rooms.

3.4.7 Main lighting in cargo pump-rooms is to be interlocked with ventilation such that the ventilation is to be in operation when switching on the lighting.

3.4.8 In order to prevent possible explosion due to accumulation of flammable vapours, some oil companies, such as STASCO, require that the ventilation should have been in operation for 5 to 10 minutes before switching on the lighting in cargo pump-rooms to ensure safety access to pump rooms, as in 5 to 10 minutes, 2 to 6 air changes have been achieved.

3.4.9 Cargo pump-rooms are to be kept clean, i.e., free from flammable substance and bilge water is not contaminated by cargo. Pump room bilge system is to be operated from outside of the room.

3.4.10 Flammable gas detection system is to be fitted in cargo pump-rooms with audible and visual alarms in cargo control room or station, navigation bridge and engine control room.

3.4.11 Flammable gas sensors are to be distributed considering specific gravity of cargo vapour and to avoid the effect of cargo pump-room ventilation system as far as possible.

3.4.12 For vessels carrying toxic substances, toxic gas detectors such as for measuring H₂S are to be fitted in cargo pump-rooms.

3.4.13 Arrangement details of cargo pump-room mechanical ventilation system are outlined in OCIMF publication — An Information Paper on Pumproom Safety.

3.4.14 Relative density of flammable gas is given in Table 3.4.14.

Flammable gas relative density **Table 3.4.14**

Gas	Flammable gas relative density (air density taken as 1.0)		
	Flammable gas only	50% flammable gas and 50% air (by vol.)	Mixture to LFL
Propane	1.55	1.25	1.0
Butane	2.0	1.5	1.0
Pentane	2.5	1.8	1.0
Methane	0.554		
Ethane	1.048		
Ammonia	0.597		

3.4.15 Where sea and overboard discharge valves are connected to the cargo system, the arrangement of cargo pump-rooms is to be in compliance with the ICS/OCIMF publication — Prevention of Oil Spillages through Cargo Pumproom Sea Valves.

3.4.16 Means of isolation are to be fitted in way of connection between cargo pump-room ballast installations and the dedicated ballast system, or a segregated cargo pump-room ballast system is to be provided.

3.4.17 Sea valves are to be located at both sides for cargo pump-rooms. If only one sea valve is fitted, this valve is not to be at the same side as the low level suction of the sea valve for machinery space.

3.5 Navigation in ice conditions

3.5.1 For ships constructed after 1 January 2011 and navigating in ice conditions or low temperatures (down to sea water temperatures of -2° and air temperatures of -25°), its structure, lifesaving and fire-fighting equipment are to comply with relevant requirements for operations in ice conditions or low temperatures. Existing ships are to comply with the requirements for operations in ice conditions or low temperature ice condition or low temperatures as far as reasonable and practical.

3.5.2 Written procedures for operations in ice conditions or low temperatures are to be provided to vessels.

3.5.3 The vessel is to have a valid ice certificate of adequate engine power on board for navigation in ice conditions or low temperatures.

3.5.4 The vessel is to have classification notation for navigation and operations in ice conditions or low temperatures.

3.5.5 All the ship's complement is to be provided with training addressing navigation and operation in cold temperatures and adequate cold weather clothing.

3.5.6 Adequate heating systems are to be provided for accommodation spaces, which are to have adequate redundancy.

3.5.7 Satisfactory means are to be provided to prevent the icing up of air pipes to settling and service tanks required for the operation of the main propulsion plant and essential auxiliaries.

3.5.8 Satisfactory precautions are to be taken to protect deck machinery from the risk of freezing.

3.5.9 Satisfactory means are to be provided to prevent the icing up of cargo tank primary and secondary venting arrangements.

3.5.10 Systems are to be in place for the routine receipt of navigational, meteorological and environmental data, including ice data and ice charts.

3.5.11 Satisfactory means are to be in place to prevent icing of the wheelhouse windows.

3.5.12 Where tanks intended to load water are above or partially above the waterline, e.g., ballast or fresh water tanks, and are exposed to or partially exposed to air, these tanks are to be provided with means to prevent the icing up of water levels inside tanks, e.g. heating system or other equivalent means fitted in ballast or fresh water tanks.

3.5.13 Satisfactory precautions are to be taken to prevent the fire main from freezing, and location of the "drain point" (lowest point in the system) is to be specified.

3.5.14 A heating connection is to be fitted to at least one sea water inlet, and the source of the heating (e.g. steam, water) is to be specified.

3.5.15 Systems are to be in place to ensure that the ballast system and drenching systems operate at sea temperatures of -2° and air temperatures of -25°.

3.5.16 If bridge wings are not totally closed, satisfactory means are to be in place to protect personnel on the bridge wings.

3.5.17 Operational searchlights are to be provided and mounted on each bridge wing and at the bow.

3.5.18 Radars are to be fitted that are of a type classed as being suitable for sub zero temperatures. All ships navigating in ice conditions are to be at least fitted with 2 radars, one being capable of operating in the 3 GHz, and the other in 9 GHz.

3.5.19 Heating Systems are to be provided for Air Driven whistles and Fog Horns.

3.5.20 Satisfactory measures are to be taken to ensure the proper closure of accommodation air intakes by preventing their freezing and/or snow blockage.

3.5.21 Personal protective equipment (PPE) is to be suitable for cold weather conditions.

3.5.22 Satisfactory protection is to be provided for the crane operator against wind chill. Protection could be provided by a crane control cabin provided with heating. Alternatively, the provision of winter clothing is an acceptable option.

3.6 Towing arrangements

3.6.1 Closed chocks and associated bitts for the guidance and attachment of the tug's towing line are to be evenly distributed at both sides of the ship. Adequate separation of chocks is to be provided and this separation is to be about 50 to 60 m.

3.6.2 Tug-pushing locations at both sides are to be clearly marked, as shown in Figure 3.6.2.



Figure 3.6.2 Marking of tug-pushing location

3.6.3 The forward and aft chocks are to be placed so that maximum leverage is provided for turning the ship, but not be so far towards the ends of the ship that the flare of the hull endangers the tug during pushing operations.

3.6.4 The tug push (and consequently chock) location is to be located as near to a web frame as possible.

3.6.5 An alternate neutral pull or push location is required midships to allow checking the lateral motion without applying a turning moment. The chock is generally located just aft of the hose saddle.

3.6.6 Means for hauling the tug's line aboard with a ship's heaving line are to be provided.

3.6.7 Chocks for tug handling are to be evenly distributed at both sides.

3.6.8 Bitts and chocks used for guiding and attaching tug's lines are to have minimum SWLs, in accordance with Table 3.6.8.

SWLs for bitts

Table 3.6.8

Ship size in DWT	Maximum rope loading in tonnes - attached with Eye (Figure-of-Eight belayed)	Nominal size of bitt in mm
16,000- 50,000	64 (32)	400
Above 50,000	92 (46)	500

3.6.9 Some high freeboard ships, such as large liquefied gas carriers, may be provided with recessed bitts on the ship's side shell as an alternative to sets of bitts and chocks, and they are to be as near to a transverse bulkhead or web frame as possible.

Chapter 4 Mooring Equipment

4.1 Design environmental conditions for mooring equipment

4.1 The most common terminals for tankers are piers or sea islands. Insufficient or inadequate moorings may lead to drifting of ships, injuries of persons and damage to terminal facilities and ships. Figure 4.1.1 shows a typical mooring pattern at a tanker terminal.

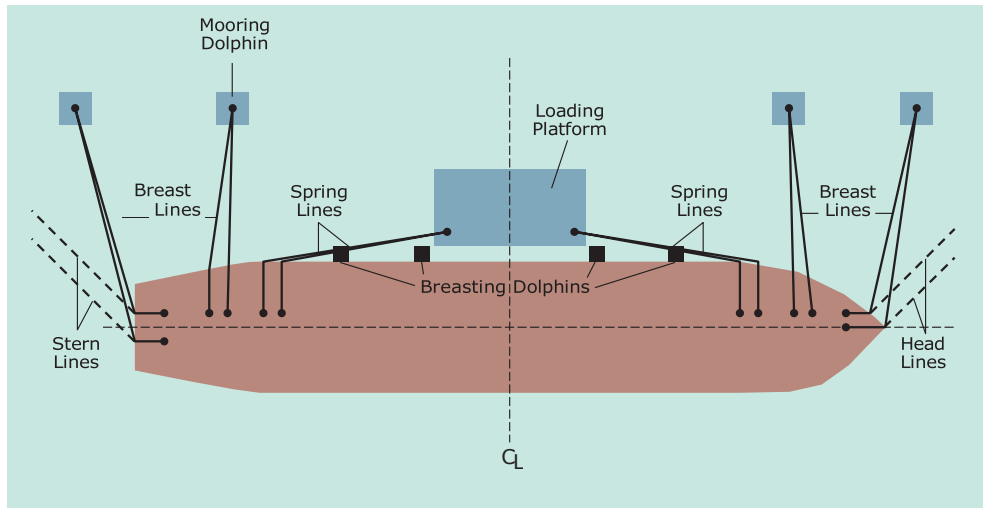


Figure 4.1.1 Typical mooring pattern at a tanker terminal

4.1.2 The above mooring pattern is based on a standard environmental condition that is representative of common piers or sea islands called by ships engaged in worldwide trades, and it is not intended to cover the worst possible conditions of all piers or sea islands.

4.1.3 In situations where the standard environmental criteria are likely to be exceeded due to worse conditions in some exposed piers or sea islands, the existing mooring capability of ships calling at such terminals may be insufficient and are to be supplemented by mooring equipment on shore.

4.1.4 A mooring system prevents the ship from drifting away from a terminal and holds the ship in place which may only have limited freedom of movement. Because any unlimited movement or the broken lines at the mooring site will cause the ship to drift away from her proper position, result in fire or explosion of the ship or terminal. The mooring system of a ship must resist the forces due to one or more of the following factors:

- (1) wind;
- (2) current;
- (3) tides;
- (4) surges from passing ships;
- (5) waves and swell;
- (6) change of draft and freeboard;

(7) ice.

4.1.5 The term “mooring” refers to the system for securing a ship to a terminal. For all ships above 16,000 tonnes deadweight intended for general worldwide trading, the mooring restraint available onboard the ship as permanent equipment are to be, according to the requirements of oil industry organizations, sufficient to satisfy the following conditions:

- (1) 60 knots wind (Beaufort scale 11) from any direction simultaneously with:
- (2) 3 knots current at 0° or 180°; or
- (3) 2 knots current at 10° or 170°; or
- (4) 0.75 knots current from the direction of maximum beam current loading.

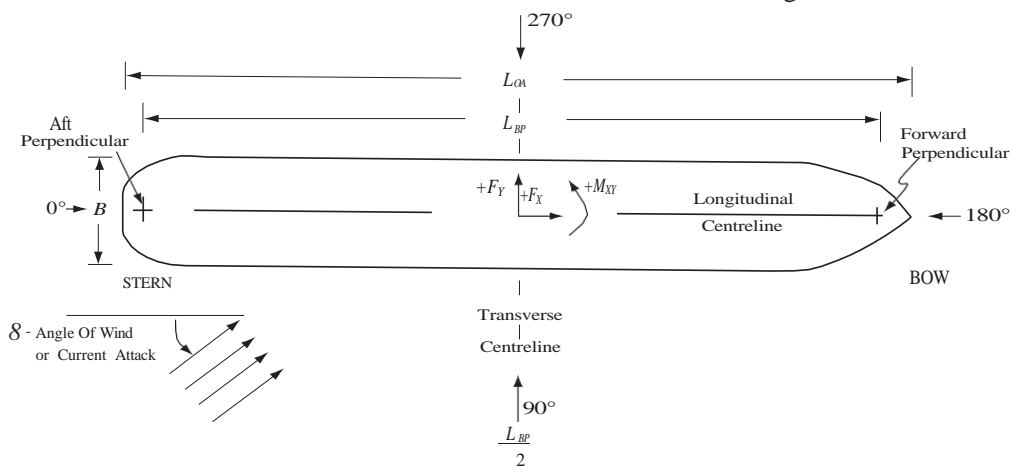


Figure 4.1.5 Single and integrated mooring arrangement for ships

4.1.6 For mooring of tankers of normal sizes at piers or sea islands, the mooring equipment are to be designed to be capable of withstanding loads not less than that given in Table 4.1.6, corresponding to ship sizes.

Loads on mooring equipment

Table 4.1.6

Ship size (DWT)		Transverse forces (tonnes)		Longitudinal forces (tonnes)	
		Wind	Current	Wind	Current
18,000	Loaded	33	16	17	6
	Ballast	84	9	21	4
30,000	Loaded	50	42	23	16
	Ballast	112	21	26	9
70,000	Loaded	67	78	25	30
	Ballast	168	21	34	18
150,000	Loaded	98	107	34	42
	Ballast	213	29	46	23
300,000	Loaded	156	171	51	67
	Ballast	336	48	72	25
LNG carrier	125,000 m ³	396	76	78	30

4.1.7 Mooring equipments for tankers are to be in accordance with the Mooring Equipment Guidelines and the Effective Mooring.

4.1.8 Mooring equipment are to be designed according to recognized standards or the approximate methods given in Appendices A, B, C & D for determining the strength of mooring equipment, e.g. lines, winches, bollards and fairleads provided in the Mooring Equipment Guidelines.

4.1.9 Exxon Moil requires that its Marine Environmental, Safety and Quality Assurance Criteria is to be complied with, in addition to the Mooring Equipment Guidelines and the Effective Mooring.

4.2 Arrangements of mooring equipment

4.2.1 Mooring equipment is to be satisfied for minimum number of mooring lines.

4.2.2 In the bow area (from accommodation space to bow mooring station), at least 5 closed fairleads, 3 bollards and in total 8 head lines are to be provided on each side of the ship.

4.2.3 In the stern area (from accommodation space to stern mooring station), at least 4 closed fairleads, 2 bollards and in total 6 stern lines are to be provided on each side of the ship.

4.2.4 Mooring patterns corresponding to tanker type and size are shown as follows:

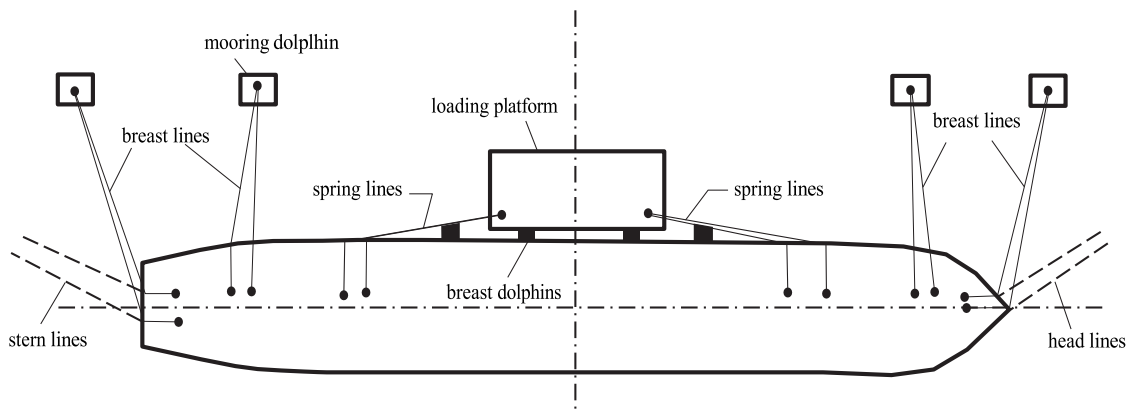


Figure 4.2.4a Mooring pattern at a tanker terminal

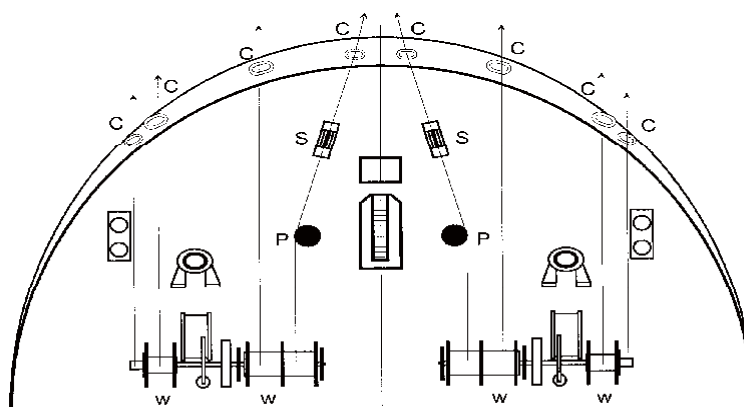


Figure 4.2.4b Anchoring and mooring arrangements

Winch (W); Closed fairlead (C); Bow chain stopper(S); Pedestal roller lead (P)

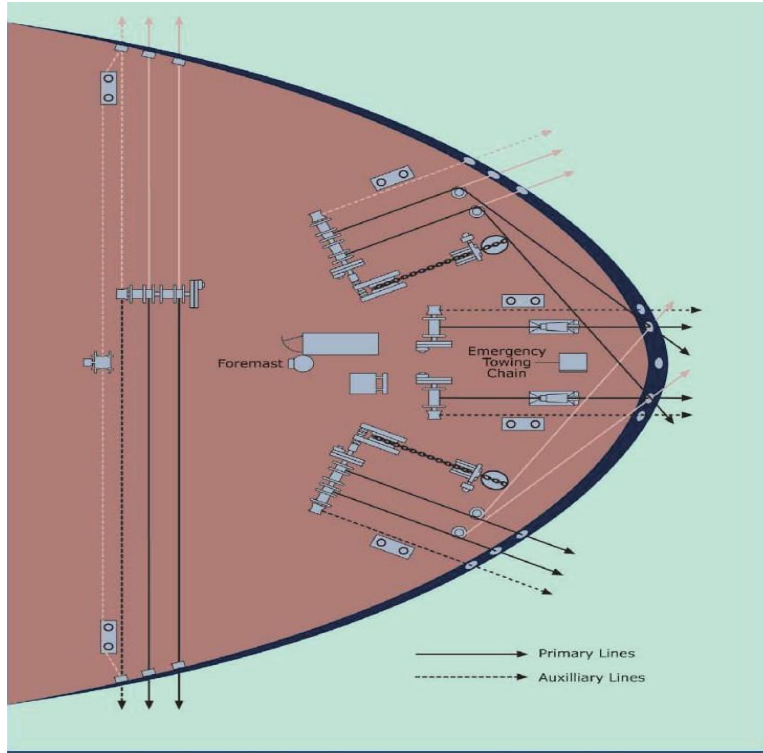


Figure 4.2.4c Oil and chemical tankers - mooring arrangement on the forward deck

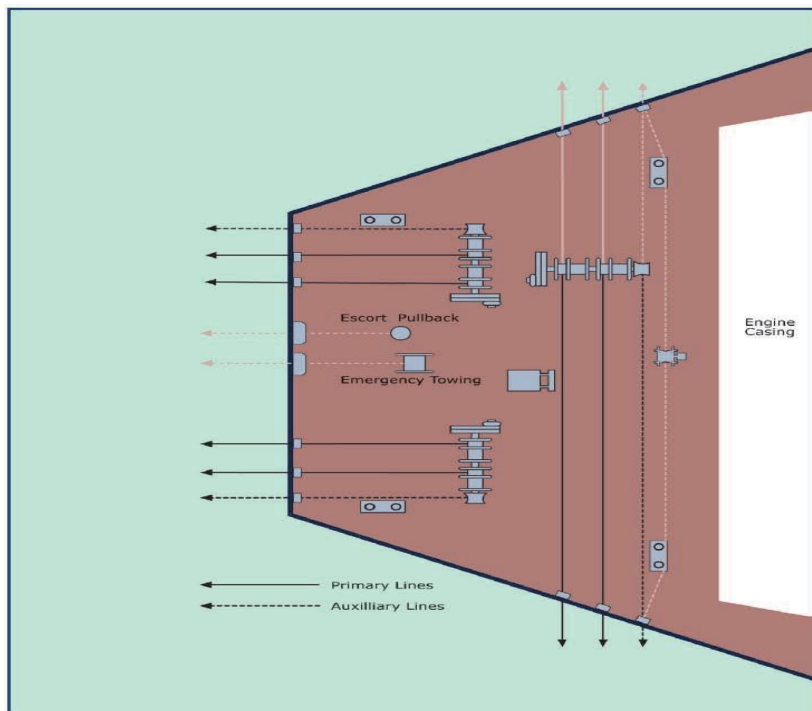


Figure 4.2.4d Oil and chemical tankers - mooring arrangement on the aft deck

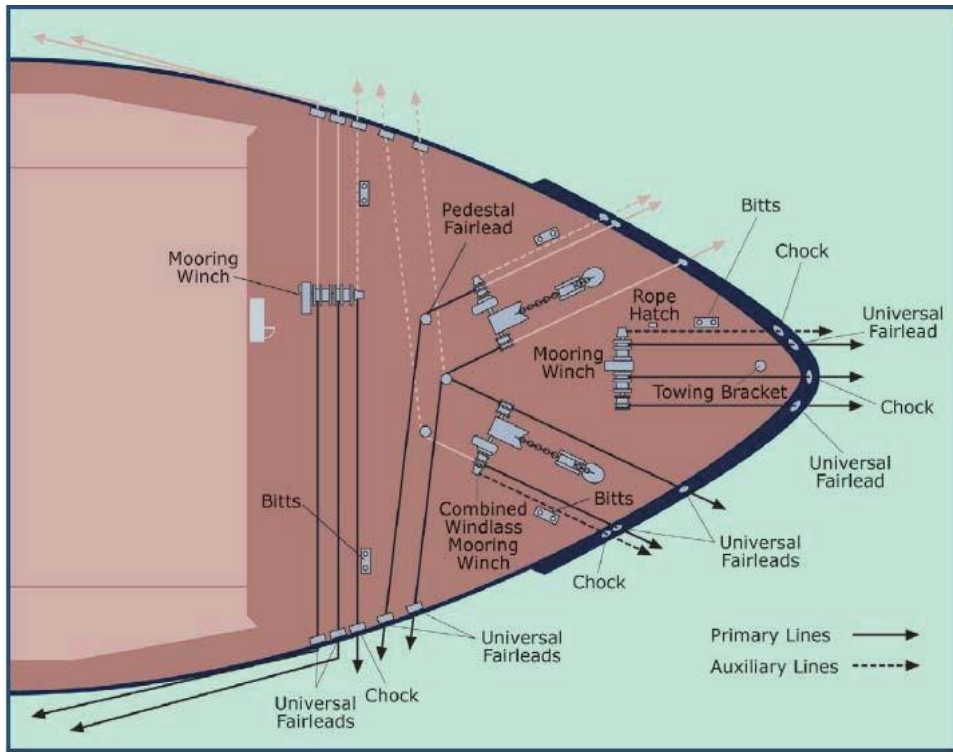


Figure 4.2.4e LNG carrier - mooring arrangement on the forward deck

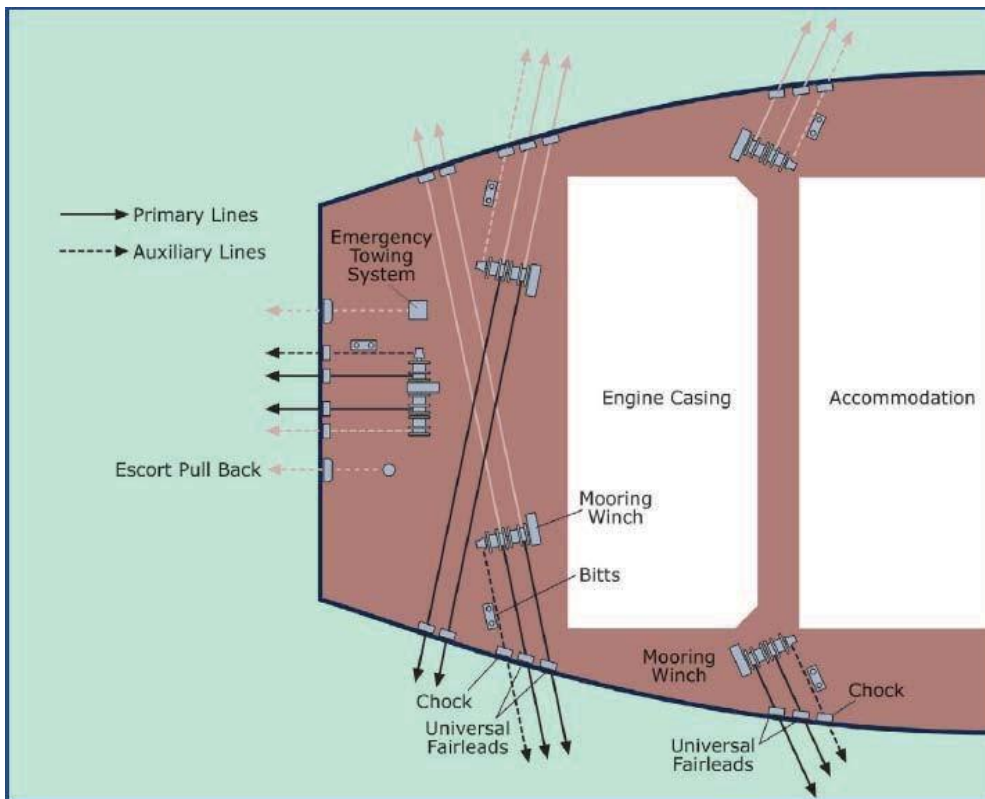


Figure 4.2.4f LNG carrier - mooring arrangement on the aft deck

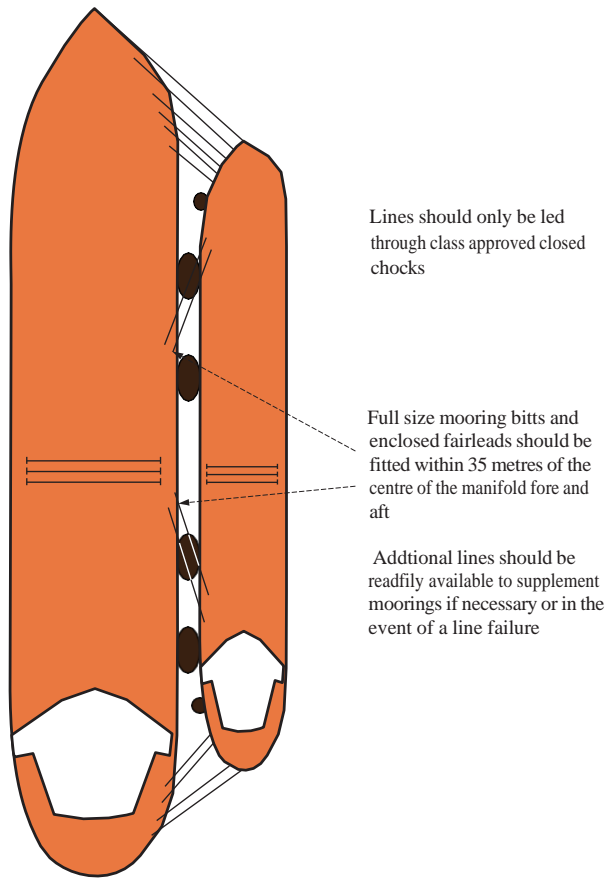


Figure 4.2.4g Mooring pattern during ship to ship transfer



Figure 4.2.4h Ship to ship transfer mooring arrangement

4.2.5 At least two closed fairleads are to be located within 35 m forward and aft of the centre of the cargo manifold with associated mooring bollards and lead to winches, especially during ship to ship transfer operations.

4.2.6 For vessels whose freeboard exceeds 16.5 m, closed fairleads are to be fitted within 10 m fore and after of the cargo manifolds.

4.2.7 During ship to ship transfer operations, sufficient number of closed fairleads is to be provided for all lines at bow, midship and stern depending on the sizes of the ships carrying out the operations. It is recommended that all the fairleads are of the closed type.

4.2.8 Arrangement requirements for gas carriers, especially large LNG carriers are as below:

(1) For flush deck LNG and LPG carriers the arrangement for spring lines and associated winches may be similar to those adopted for oil and chemical tankers.

(2) For spherical tank LNG carriers and lobe/cylindrical tank LPG carriers, it is usually not practicable to incorporate main deck winches and the lead of springs must be from aft of the accommodation deckhouse and from the forward main deck or the forecastle, as per Figures 4.2.4(e) and 4.2.4(f).

4.3 Mooring lines

4.3.1 Size and construction of mooring lines are to comply with OCIMF publication Mooring Equipment Guidelines and the requirements for tankers mooring at piers or sea islands.

4.3.2 Mooring lines may be made from steel or synthetic fibres. Low stretch ropes made from steel wire are recommended for large ships where limited movement is required at berths. However, more elastic mooring lines made from synthetic materials may also be used such as High Modulus Polyethylene (HMPE) or Aramid fibres.

4.3.3 Mooring lines other than single point moorings are to comply with the requirements for the mooring of large tankers at terminals. Recommendations on their use are contained in the OCIMF publication — Guidelines on the Use of High Modulus Synthetic Fibre Ropes as Mooring Lines on Large Tankers.

4.3.4 Polypropylene rope has approximately the same elasticity as polyester rope. However, as sparks may arise on polypropylene when subjected to break load, the use of tanker moorings manufactured from polypropylene is not recommended by oil industry organization.

4.3.5 For mooring lines made from steel wires, high modulus fibres are to be used for the manufacture of tails.

4.3.6 The traditional tail (pendants) length of 11 m is adequate for sheltered pierside moorings. At exposed pierside moorings where significant ship motions occur, the tail (pendants) length of 11 m may be inadequate. This could lead to immediate tensile failure, or in the longer term, lead to the fatigue failure of main winch ropes and/or mooring equipment on board or ashore.

4.3.7 Longer tail (pendants) lengths may be required for the most harsh conditions, where waves up to 2 m significant wave height and having periods in excess of 10 seconds may be encountered at exposed pierside. Increased tail (pendants) length will typically only be required for breast lines and may not be necessary for springs lines.

4.3.8 Mooring lines of the same size and material are to be used for same winches. It is recommended that mooring lines are to be so arranged that all lines in the same direction are of the same specification and construction (same size and material).

4.3.9 Synthetic tails are to have a minimum breaking load (MBL) at least 125% that of the mooring line to which it is attached. Polyamide tails are to have a MBL 137% that of the mooring line to take account of loss of strength when wet.

4.3.10 Mooring lines may be of various constructions. Typical wire line constructions are as follows:



Figure 4.3.10a Wire line constructions

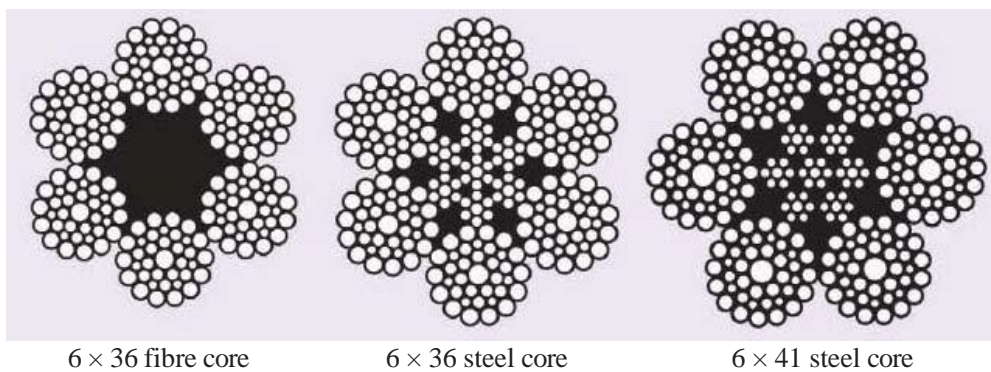


Figure 4.3.10b Wire line constructions

4.3.11 Synthetic tails (pendants) for wire mooring lines are to be replaced at least every 18 months unless experience, hours in use coupled with inspection by inspectors professionally trained with skilful assessment methods indicates a longer or shorter period is warranted. A record of service is to be maintained that includes time in use and inspection results. Tails are to be replaced prior to their residual strength falling to 60% of their original MBL.

4.3.12 The 18 month period mentioned above is based upon the actual time in use on an average ship in average trade. A tail inspection/assessment program is to be in place (with records). The inspector is to confirm that training for tail inspection/assessment has been effectively carried out.

4.3.13 Tails are to be connected to a wire mooring line using appropriate shackles, for example, those manufactured by Tonsberg or Mandal.



Figure 4.3.13a Synthetic tails connected to a wiring mooring line using Tonsberg shackle

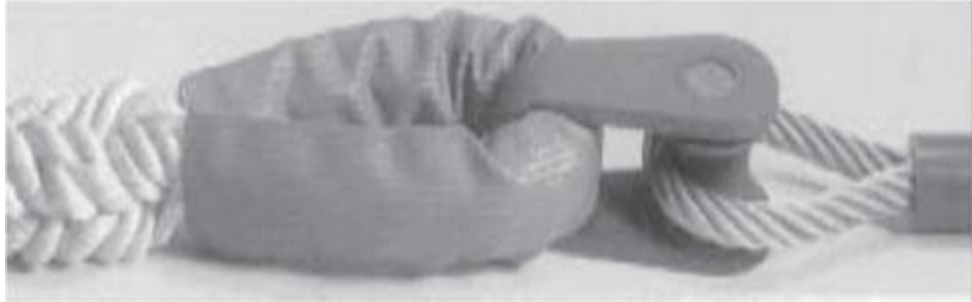


Figure 4.3.13b Synthetic tails connected to a wiring mooring line using Mandal shackle

4.3.14 A synthetic tail can be attached directly to a high modulus rope by using a cow hitch.



Figure 4.3.14 Synthetic tails connected by cow hitch

4.3.15 Tails may be connected to a wire mooring line using boss shackles.



Figure 4.3.15 Boss shackle

4.3.16 To ensure safe cargo operations, especially during ship to ship transfer, a vessel is to be provided with four snubbing ropes of minimum 20 mm diameter and 20 m length for hose handling at the manifold, and with four synthetic messenger lines.

4.3.17 Four synthetic messenger lines are to be so located that two forward and two aft, each a minimum of 100 m long \times 30 mm diameter.

4.3.18 Synthetic mooring lines can be constructed in a variety of forms. The common structures used in synthetic ropes are shown in Figure 4.3.18.

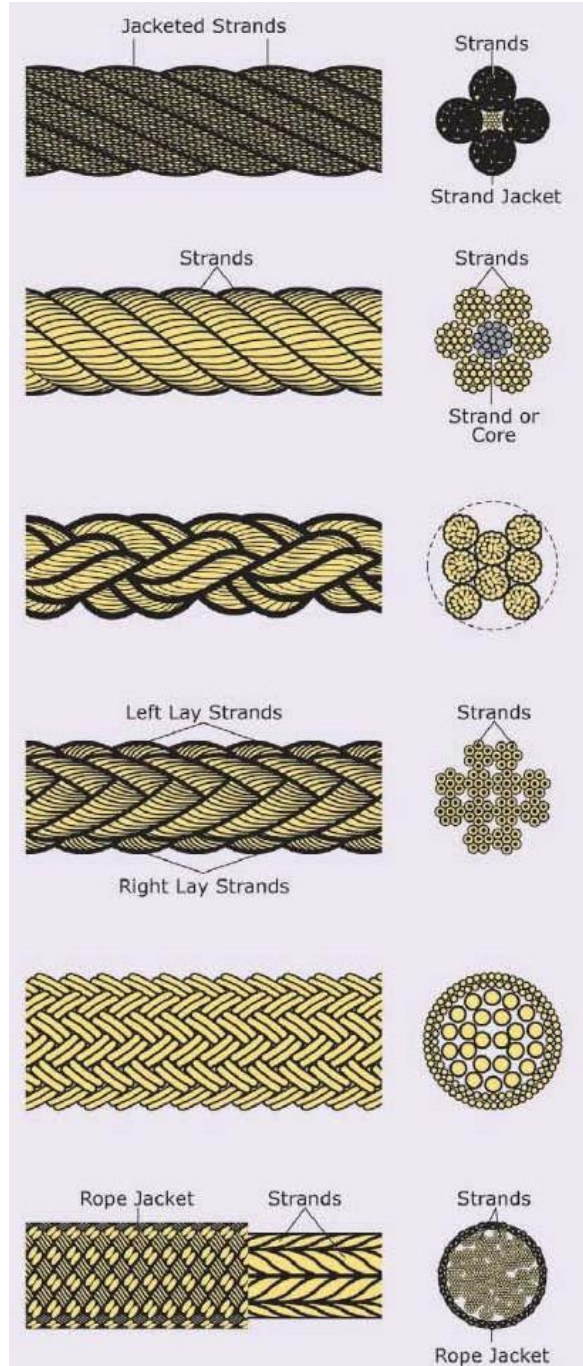


Figure 4.3.18 Construction of conventional and high modulus synthetic fibre ropes

4-Strand Rope	6-Strand Rope (with core) and 7-Strand Rope
8-Strand Rope	12-Strand Braided Rope
Double Braid Rope	Parallel Strand Rope

4.3.19 Three types of wire rope terminations are normally used: swaged, spliced, and socketed. Splices in eyes are to have a minimum of 5 tucks.

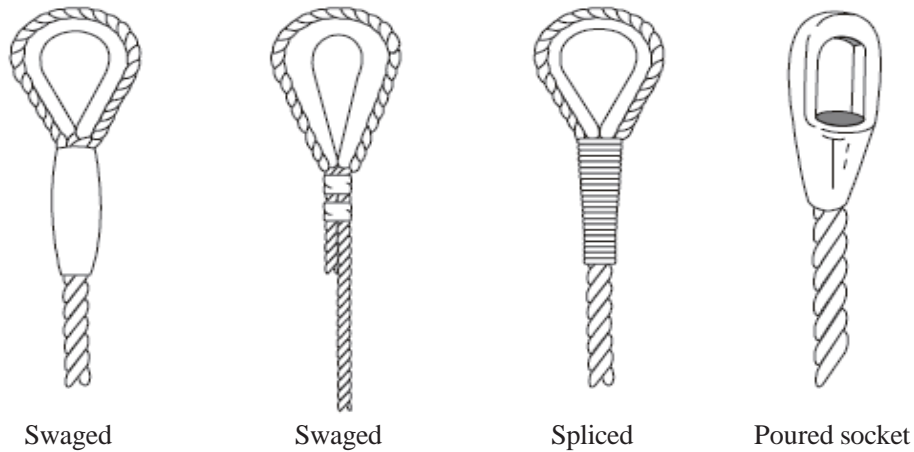


Figure 4.3.19 Types of wire rope terminations

4.3.20 For tankers above 16,000 DWT, mooring lines of low modulus material are recommended.

4.3.21 Minimum breaking loads of mooring lines are closely related to the material and construction of lines. Nominal MBLs for steel wire lines of 6 × 36 class are shown in Table 4.3.21.

Typical size and MBLs of 6 × 36 class steel wire mooring lines Table 4.3.21

Dia. mm	Weight kg/100 m	MBL kN
24	236	402
26	276	472
28	321	547
30	368	628
32	419	715
36	530	904
40	654	1,120
44	792	1,350
48	942	1,610
52	1,110	1,800
56	1,280	2,190
60	1,70	2,510
64	1,700	2,800
68	1,900	3,100
72	2,200	3,500
76	2,400	3,800
80	2,700	4,200

4.3.22 Exxon Mobil has a special criteria for provision of mooring lines which requires that Mooring Retention = Number of Mooring Lines × Winch brake holding capacity.

4.3.23 The following tables list minimum mooring requirements by vessel size.

(1) Vessels below 46,000 DWT are to provide a mooring retention capability in accordance with Table 4.3.23(1).

Mooring retention for tankers below 46,000 DWT Table 4.3.23(1)

Vessel size (DWT)	Number of mooring lines	Mooring Retention (Tonnes)
Below 2,000	6	90
2,000 - 3,000	6	105
3,001 - 4,000	6	125
4,001 - 5,000	6	150
5,001 - 15,000	8	220
15,001 - 20,000	10	320
20,001 - 46,000	10	360

(2) Vessels of 46,000 DWT and above are to provide a mooring retention capability in accordance with Table 4.3.23(2).

Mooring retention for tankers of 46,000 DWT and above Table 4.3.23(2)

Vessel size (DWT)	Number of mooring lines	Breaking strength (tonnes)	Winch brake holding capacity (tonnes)
46,000-75,000	8	35	25
75,001-100,000	8	70	40
	10	55	30
	12	50	30
100,001-140,000	8	80	45
	10	65	35
	12	50	30
140,001-160,000	8	85	50
	10	70	40
	12	55	30
160,001-250,000	10	85	50
	12	70	40
250,001-400,000	12	85	50
	14	80	45
	16	70	40

4.4 Bollards or bitts

4.4.1 Bollards are to be adequate for the mooring capacity as required by ship size and to be evenly fitted on each side of the ship.

4.4.2 All bollards/bitts are to be welded to the deck on each side of the ship in way of the location required.

4.4.3 Some high freeboard ships, such as LNG carriers, may be provided with bollards in the vicinity of the ship's side shell.

4.4.4 Bollards may be categorized into single bollards, double bollards and cruciform bollards.

4.4.5 Double bollards can normally withstand loads of lines that are twice that of a cruciform bollard.

4.4.6 Mooring bitts fitted onboard a ship, including that used for emergency towing-off wires, are to be double bollards.

4.4.7 The diameter of double bollards is normally not to be less than 10 times that of mooring lines, and at least greater than 300 mm.



Figure 4.4.7a Double bollards



Figure 4.4.7b Cruciform bollards

4.4.8 The Safe Working Load (SWL) marked on the bitts are to be the maximum allowed when using a wire or rope belayed in a figure of eight near the base of the bitts. The SWL is in no case to be less than the Minimum Breaking Load (MBL) of mooring lines. According to the conventional design, the SWL is to be twice the MBL of mooring lines.

4.4.9 Line stoppers are to be fitted in the vicinity of each set of double bollards and each cruciform bollard. The stoppers are to be provided with deck rings or lugs, the SWL of which is to be compatible with the working load of mooring lines and is not to be less than 15 tonnes.

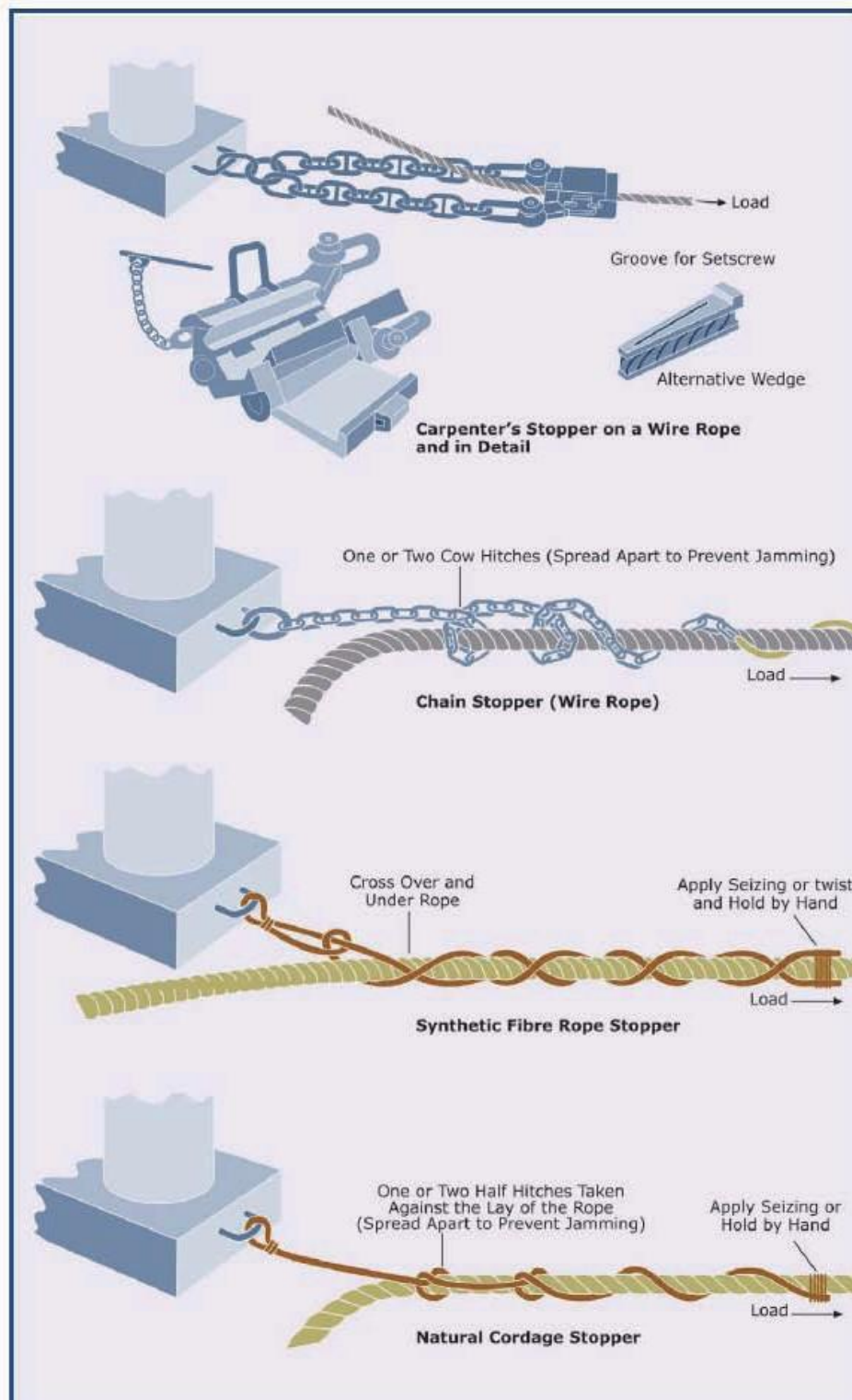


Figure 4.4.9 Stoppers for bollards

4.4.10 Double bollards of minimum 300 mm in diameter are to be fitted forward and aft of the cargo manifold on each side of the ship.

4.4.11 Cruciform bollards are of a minimum working load of:

- (1) 25 tonnes for ships below 60,000 DWT;
- (2) 40 tonnes for ships of 60,000 DWT and above.

4.4.12 A cruciform bollard is to be fitted in line, or nearly in line with the vapour return system manifold to allow securing of the VRS hose hang-off chain.

4.4.13 Two deck pad-eyes of size sufficient to secure 16" floating hose are to be provided, one to either side of the line from the closed chock to the vapour return system manifold.

4.4.14 Sets of cruciform bollards, minimum 600 mm in height above deck are to be fitted to the deck on each side of the ship in the vicinity of cargo manifold centreline. The bollards are to be fitted on the deck mid-way between each pair of cargo manifolds, allowing maximum clear area between the working platform and ship's side and yet giving sufficient room for safe access (about 300 mm) between bollard and spill tank.



Figure 4.4.14 Cruciform bollards in the vicinity of cargo manifold centreline on deck

4.5 Fairleads

4.5.1 All fairleads fitted onboard tankers are to be of closed type.

4.5.2 Only one line is allowed to pass through each closed fairlead in order to ensure safe mooring.

4.5.3 Clear openings of the fairleads are to be at least 400 mm × 250 mm and the minimum radius of curvature is to be 180 mm.

4.5.4 Clear openings of panama-type fairleads are to be at least 350 mm × 250 mm.

4.5.5 The working load of fairleads depends on the ship size and working conditions of the machine. However, it is in no case to be less than the MBL of the line passing through the fairlead.

4.5.6 The working load of fairleads during cargo operations is normally not to be less than:

- (1) 25 tonnes for vessels below 60,000 DWT;
- (2) 40 tonnes for vessels of 60,000 DWT and above.

4.5.7 Fairleads can be categorized into open fairleads, closed fairleads, panama-type fairleads, pedestal roller fairleads and universal roller fairleads.



Figure 4.5.7a Closed fairlead marked with SWL

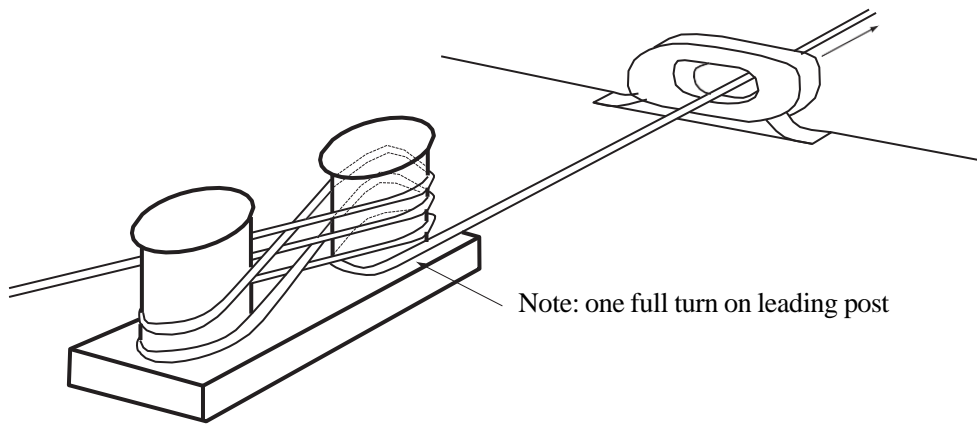


Figure 4.5.7b Closed fairlead



Figure 4.5.7c Closed roller fairleads

4.5.8 Tankers above 175,000 DWT are to be provided with lightning arrangements as follows:

- (1) Two additional sets of heavy duty closed fairleads with clear openings of 500 mm × 400 mm are to be positioned on the starboard side of the ship. The fairleads are to be located 35 m forward and aft of the mid-length of the ship or as close to this position as possible.
- (2) Twin sets of bollards of 550 mm diameter are to be located inboard of the fairleads.
- (3) All other fairleads used during mooring are to be of the closed type to avoid difficulties occurring owing to the large relative changes of freeboard experienced during lightning operations. Quick release mooring hooks are to be provided at terminals.



Figure 4.5.8 Quick release mooring hooks at a terminal

4.6 Winches

4.6.1 Winches may be categorized by their control type into manual and automatic tensioning.

4.6.2 Automatic tension winches are designed to automatically heave-in whenever the line tension falls below a pre-set value, or pay out if the line tension exceeds a pre-set value. Tension winches are not allowed to be operated in the automatic mode when the ship is connected to the shore cargo manifold.

4.6.3 Winches may be categorized by the type of drums into split and undivided types.

4.6.4 According to a recognized standard, the SWL of winches is to be greater than the line's MBL.

4.6.5 Winch brakes are to be designed to hold 80% of the line's MBL and have the capability to be adjusted down to 60% of the line's MBL, at which level they are to be set in service.

4.6.6 The primary brake is to be set to hold 60% of the mooring line's MBL. Since brakes may deteriorate in service, it is recommended that new equipment be designed to hold 80% of the line's MBL, but have the capability to be adjusted down to 60% of the line's MBL.

4.6.7 Tension winches are not allowed to be operated in the automatic mode when the ship is connected to the shore cargo manifold.

4.6.8 Winch storage drums used to stow the pick-up rope are to be of sufficient size to accommodate 150 m of 80 mm diameter rope.

4.6.9 The minimum distance between a fairlead and bitts is to be 1.8 m.

4.6.10 The minimum distance between a winch drum and the nearest fairlead or chock is to be such that the fleet angle does not exceed 1.5°.

4.6.11 Winches are to be provided with brakes which are normally divided into hydraulic brakes and manual brakes.

4.6.12 Mooring winches and bollards are normally bolted to foundations that are welded to the ship's deck.

4.7 Single point mooring (SPM) equipment

4.7.1 For ships likely to be moored at single point moorings, SPM equipment is to be equipped according to ship size.

4.7.2 New ships delivered during or after 2009 likely to visit SPMS are to be equipped with bow chain stoppers designed in accordance with the following:

- (1) up to 100,000 DWT: 1 stopper 200 tonnes SWL;
- (2) 100,000 to 175,000 DWT: 2 stoppers 250 tonnes SWL;
- (3) over 175,000 DWT: 2 stoppers 350 tonnes SWL.

4.7.3 Owners of ships under construction before 2009 are encouraged to consider fitting bow chain stoppers in accordance with the recommendations for new ships as far as reasonable and practical. However, the bow chain stoppers equipped according to the previous requirements are also accepted.

4.7.4 If the vessel is fitted with a hydraulically operated bow chain stopper, safeguards are to be provided to prevent its accidental release.

4.7.5 Bow chain stoppers equipped on ships likely to visit SPMS are to be designed to accept 76 mm chafe chain.

4.7.6 Each bow chain stopper for SPM is to be provided with one winch capable of lifting at least 15 tonnes.

4.7.7 Single point mooring equipment are to be arranged in line as far as possible. See figures below for drawings of the typical arrangements of SPM equipment.

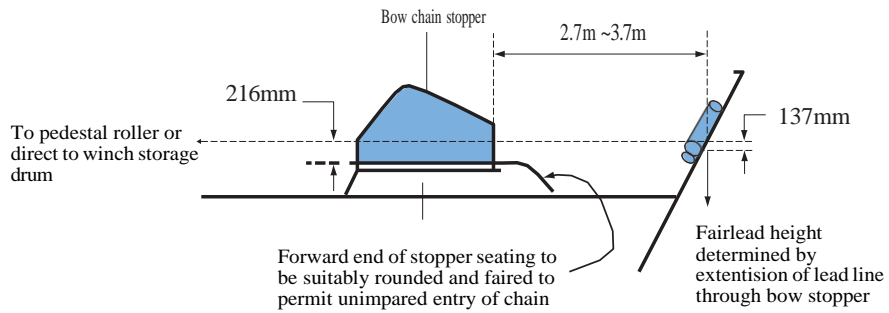


Figure 4.7.7a SPM arrangement

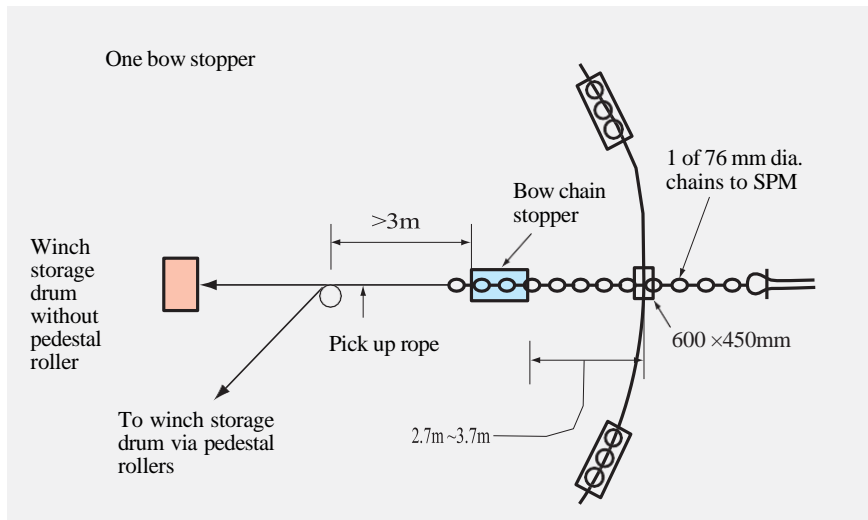


Figure 4.7.7b SPM arrangement - one bow chain stopper

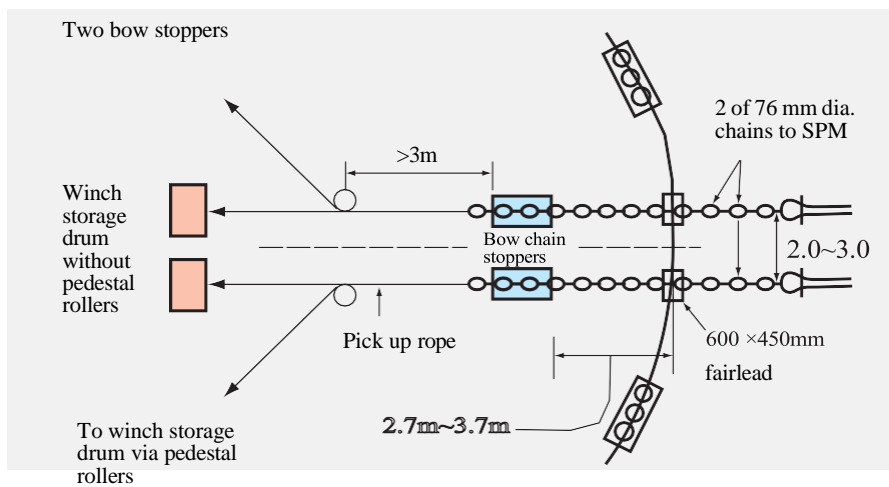


Figure 4.7.7c SPM arrangement - two bow chain stoppers

4.7.8 Size, quantity and type of stoppers are to be determined corresponding to the ship sizes categorized in the OCIMF guidelines.

4.7.9 Some oil companies such as Chevron, BP and STASCO require a higher standard for SPM equipment, that is, for tankers of 100,000 DWT two sets of SPM equipment are required to be fitted.

4.7.10 Single point mooring and conventional mooring modes are shown in figures below:



Figure 4.7.10a A single point mooring

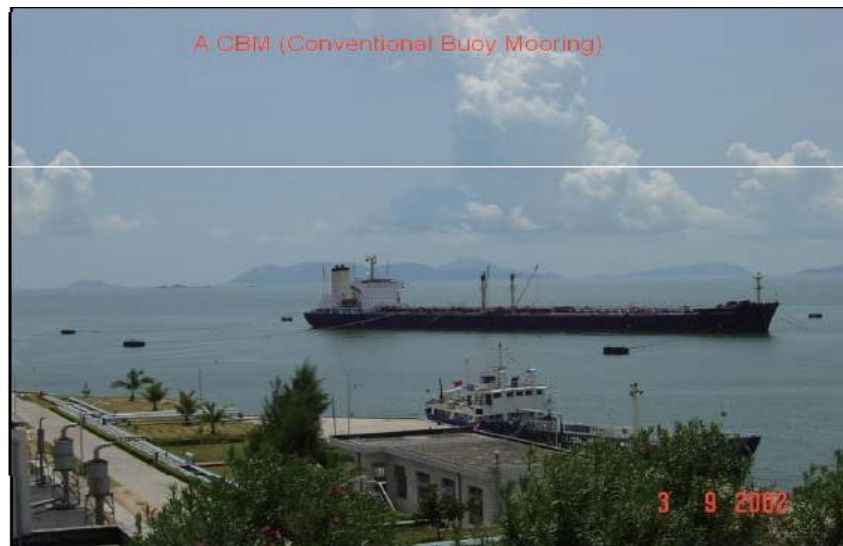


Figure 4.7.10b A conventional buoy mooring

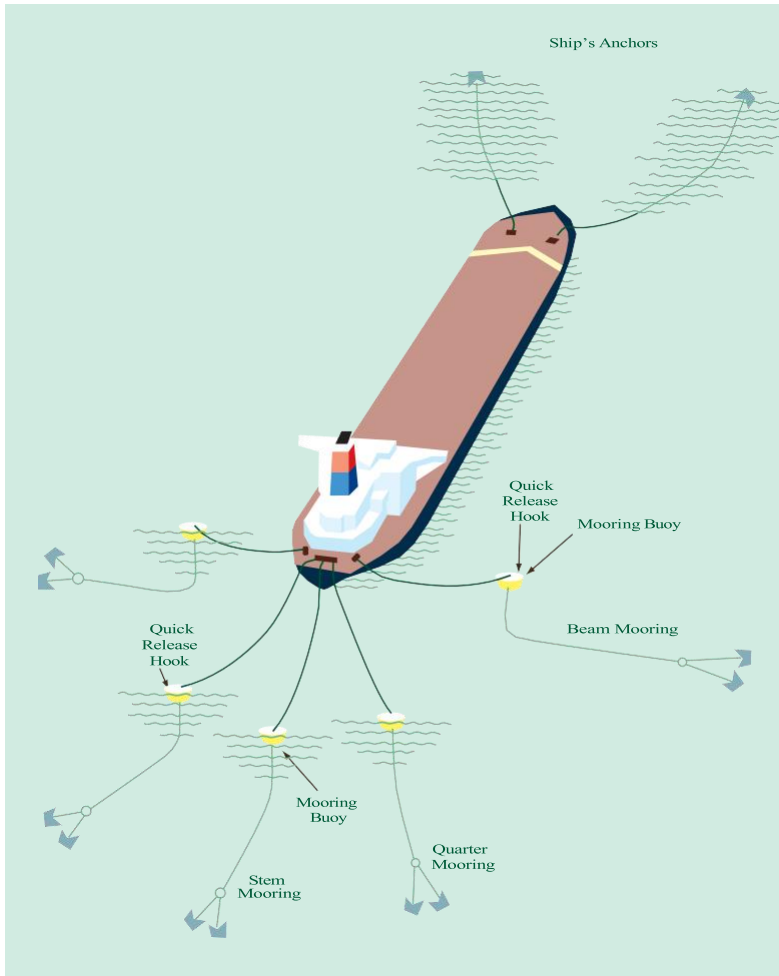


Figure 4.7.10c Multi-buoy mooring

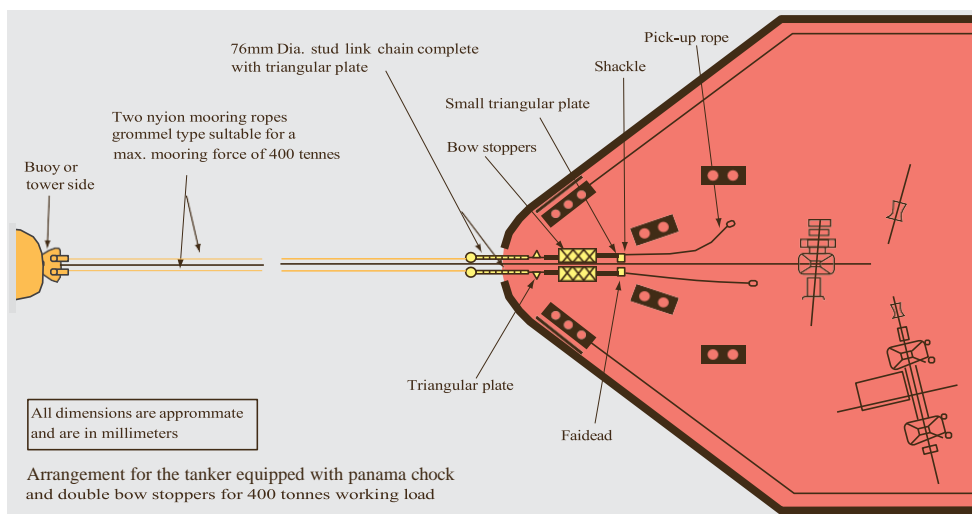


Figure 4.7.10d ULCC buoy mooring arrangement

4.8 Arrangement of SPM equipment

4.8.1 For new ships delivered during or after 2009 likely to visit SPMs, wherever possible, it is recommended that winch storage drums used to recover the pick-up ropes are positioned in a direct straight lead with the bow fairlead and bow chain stopper without the use of pedestal rollers. This relative positioning of the tanker SPM mooring equipment in a direct straight lead is considered the safest and most efficient arrangement for handling the pick-up ropes. However, recognising that not all new mooring arrangement designs will permit direct straight leads to a winch storage drum, consideration of safety and protection from risk of whiplash injury to mooring personnel is to take priority in determining number and positioning of pedestal rollers.

4.8.2 Remote operated winch storage drums may afford some additional whiplash injury protection for the winch operator.

4.8.3 Winch storage drums used to stow the pick-up rope for existing and new ships are to be capable of lifting at least 15 tonnes and be of sufficient size to accommodate 150 m of 80 mm diameter rope. Use of winch drum ends (warping ends) to handle pick-up ropes is considered unsafe and is to be avoided, and therefore a separate winch is to be provided for single point mooring.

4.8.4 Fairleads and their arrangement

- (1) For ships fitted with only one SPM equipment, the fairlead is to be on the centre line.
- (2) For ships fitted with two SPM equipment, the fairleads are to be spaced 2.0 m centre-to-centre apart, if practicable, and in no case to be more than 3.0 m apart.
- (3) All bow fairleads are to be measure at least 600 mm × 450 mm.

4.8.5 Stoppers and their arrangement

- (1) The stoppers are to be permanently marked with the mooring capability and provided with valid certificates.
- (2) Bow chain stoppers are to be located between 2.7 and 3.7 m inboard from the bow fairlead regardless of ship size.
- (3) Pedestal rollers are to be provided according to the arrangement of winches.
- (4) Pick-up rope is in no case to pass through more than one winch with pedestal roller.
- (5) There are to be at least 3 m distance between the bow chain stopper and the closest pedestal roller, if fitted.
- (6) If pedestal roller is not fitted, there are normally at least 3 m distance between the bow chain stopper and the winch to ensure safe operation.

4.8.6 Size and provision of winches

- (1) Winches may be used in conjunction with anchors, or independently. Winch storage drums used to stow the pick-up rope are to be of sufficient size to accommodate 150 m of 80 mm diameter rope.
- (2) The SPM equipment including stoppers, pedestal rollers (if fitted), winch foundations and supporting deck structure are to be adequately reinforced.
- (3) The capacity and arrangement of SPM equipment are to be in accordance with Appendix A of OCIMF publication Mooring Equipment Guidelines.

4.8.7 Existing ships delivered before 2009 likely to visit SPMs are to be so equipped that the number of pedestal rollers used for each bow chain stopper is not to exceed one and the angle of change of direction of the pick-up rope lead is to be minimized. SPM equipment, including fairleads, chain stoppers, pedestal rollers and winches, are to be arranged in line as far as possible. If not possible, they are to be so arranged that the angle of change of direction is not to exceed one. A vertical angle is not allowed. The inspector will normally accept the angle not less than 120° or sometimes require not less than 150° .

4.8.8 Ships mooring to an SPM are to be provided with fittings on the stern for tug escort and pull-back duties.



Figure 4.8.8 Fittings for tug escort and pull-back at SPM

- (1) Chock/fairlead and strong point
 - ① For tankers over 20,000 DWT but under 50,000 DWT, the chock arrangement is to have a minimum SWL of 100 t. The strong point arrangement is also to have a minimum SWL of 100 t when used with a single eye towing line or grommet.
 - ② For tankers of 50,000 DWT and above, the chock arrangement is to have a minimum SWL of 200 t. The strong point arrangement, with suitable reinforcement, is also to have a minimum SWL of 200 t when used with a single eye towing line or grommet.
- (2) The safety factor of major components for tug escort and pull-back is to be of 2 times the SWL rating.

(3) The chock/fairlead is to be located on the stern, as close as possible to the centreline of the ship. The chock opening is to be oval.

(4) The towing or connection point is to be aligned longitudinally with the chock and clear of all obstructions.

(5) The chock is to have a minimum diameter of 600 mm and a minimum height of 300 mm above deck.

(6) The minimum distance from strong point to chock is to be 4.0 m. Considering that this may be difficult to achieve on ships of less than 50,000 DWT, the distance from strong point to chock may be less than 4.0 m provided that it is ensured that the eye splice of the towing line sits inboard of the chock.

(7) Each Fitting for tug escort and pull-back is to be clearly marked with its SWL.

Note: The SWL is to be expressed in tonnes (letter 't') and other means of expression is not accepted.

(8) Fixed gear for tug escort and pull-back such as strong points, chocks, foundations and associated supporting structure are to be demonstrated as adequate for the loads imposed.

4.8.9 Ship owners may require that the emergency towing arrangements (ETA) fitted at both ends onboard tankers as required by SOLAS Regulation II-1/3-4 should be suitable for escort/pull-back duties while mooring to an SPM. In order to provide this dual purpose capability, escort/pull-back and SPM requirements are to be complied with while designing the emergency towing arrangement.

4.9 Emergency towing-off pennants (fire-wires)

4.9.1 If required, emergency towing-off pennants (fire-wires) are commonly provided at both ends on board tankers. If required at a buoy mooring, the wires will be rigged on the opposite side to the hose string. In order to facilitate emergency release of the wires, they are to be secured to bits and be led directly to a shipside chock with no slack on deck. The outboard end of the line is provided with an eye to which a heaving line is attached and led back to the deck. During loading or discharge, the heaving line is periodically adjusted to maintain the eye of the emergency towing-off pennant normally 2 m above the water.

4.9.2 Emergency towing-off pennants (fire wires) are to be of 6 × 36 IWRC construction and be made of the same type of steel as recommended for standard mooring wires. The use of synthetic or natural fibre ropes that do not have appropriate fire resistant characteristics (even for core) is not permitted as these would burn or fail in the event of a fire.

4.9.3 The strength and length of emergency towing-off pennants (fire-wires) for various ship sizes are given as follows:

- (1) 30 tonnes MBL (about 300 kN), 25 m in length for ships less than 20,000 DWT;
- (2) 55 tonnes MBL (about 550 kN), 45 m in length for ships of 20,000-100,000 DWT;
- (3) 100 tonnes MBL (about 1,000 kN), 60 m in length for ships of 100,000-300,000 DWT;

(4) 120 tonnes MBL (about 1,200 kN), 70 m in length for ships above 300,000 DWT.

4.9.4 The emergency towing-off pennants (fire-wires) are to be so arranged as to be readily available for immediate use during cargo operations. The diagram showing the arrangement of emergency towing-off pennants (fire-wires) are to be displayed on the navigation bridge.

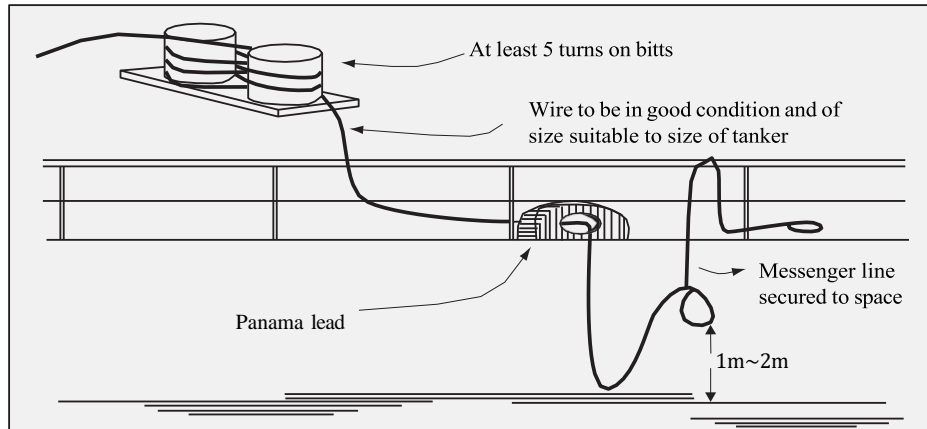


Figure 4.9.4 Arrangement of emergency towing-off pennants (fire-wires)

Chapter 5 Prevention of Pollution from Ships

5.1 Vessel Response Plan

5.1.1 In addition to the SOPEP or SMPEP provided onboard, a VRP (Vessel Response Plan) complying with the relevant requirements of USCG is to be carried for oil and chemical tankers trading to the USA. SOPEP, SMPEP and VRP can be either in a single combined plan or in separate documents.

5.1.2 According to the requirements of oil industry organizations, SOPEP or SMPEP of tankers and VRP (Vessel Response Plan) of oil tankers and ships carrying dangerous chemicals trading to the USA are to be examined by an authority issuing the International Oil Pollution Prevention Certificate (generally by a Classification Society issuing the International Oil Pollution Prevention Certificate).

5.1.3 A list of specific contact numbers is to be readily available to the master for SOPEP or SMPEP and VRP and displayed in the cargo control room or the cargo operation position. The list is to include the contact numbers for the P & I Club, the owner or operator, and the local agent from the Coastal Contact List.

5.2 Cargo operations and deck area pollution prevention

5.2.1 In order to prevent the sea from the pollution of deck spills, a continuous transverse fishplate is to be fitted in both sides of oil and chemical tankers, extending from bow to the aft end of cargo tank area. The height of the fishplate is to be determined based on the size, type, camber, trim and stability of the ship.

5.2.2 The purpose of this fishplate is to provide temporary oil retention at the after end of the main deck in the event of an oil spill, giving the crew sufficient time to deal with it and avoid oil entering the water.

5.2.3 Some oil companies, such as Exxon Mobil Corporation, require that the height of continuous transverse deck edge fishplate enclosing in the aft end of the cargo tank area is to comply with the following.

(1) For oil and chemical tankers greater than 100,000 DWT, the height of the continuous deck edge fishplate enclosing at the bow is at least to be of 250 mm, extending to the aft end of the cargo tank and connecting with the aft transverse fishplate, the height of the aft transverse fishplate is 400 mm.

(2) For oil and chemical tankers less than 100,000 DWT, the height of the continuous deck edge fishplate enclosing at the bow is at least to be of 150 mm, extending to the aft end of the cargo tank and connecting with the aft transverse fishplate, the height of the aft transverse fishplate is 300 mm.

(3) A sufficient number of scuppers of suitable size are to be fitted in the continuous deck edge fishplate. The capacity of the scupper is to comply with the requirements of International Convention on Load Lines (LLC).

5.2.4 Oil retention is formed on the deck by means of deck edge continuous fishplate and transverse fishplate and means are to be provided for removal or disposal of any spillage. Spilled oil is to be transferred to the slop tank by means of fixed transfer system. Where portable spill transfer pumps are provided, the piping is to be of the fixed type and the safe operation procedures are also to be provided.

Note: The filling pipe of the slop tank is to be extended to the bottom of the tank to prevent the risk of static electricity.

5.2.5 A sufficient number of scuppers are to be fitted on the deck edge to facilitate discharging of rainwater or seawater on the deck into the sea during the voyage. However, scupper plugs of the mechanical type or equally effective means on the deck edge are to be tightly sealed during cargo operations in order to prevent the leakage of spilled oil from cargo operation into the sea through the scuppers on the deck edge.



Figure 5.2.5a Deck scupper and mechanical plug



Figure 5.2.5b Closing condition of deck scupper



Figure 5.2.5c Closing facility of deck scupper

5.2.6 Deck dump valves are to be fitted to discharge the spilled oil or oily water from the deck into the slop tank.

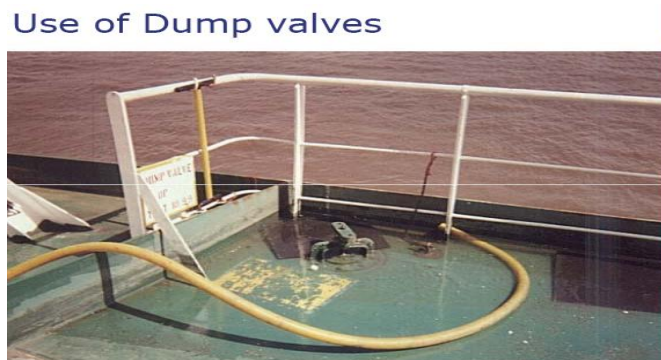


Figure 5.2.6 Dump valve

5.2.7 Where oil retention is formed on the deck by means of deck edge continuous fishplate and transverse fishplate, the disposal means are to be provided, including:

- (1) Where fixed spill transfer pumps are used, the spilled oil on the deck is to be discharged into the slop tank. Where portable spill transfer pump is used, at least 2 non-sparking spill transfer pumps (portable pumps) of suitable size are to be provided. Portable spill transfer pumps are to be bonded to the ship's structure to prevent static electricity. Bonding may be made by external means, or by the discharge hose of the pump. If this is attached by means of a flanged connection to the ship's structure, the spill transfer pump is to be properly installed to prevent movement and subsequent damage during operation.
- (2) For ships with inert gas, circular sealing arrangement is to be provided for the deck dump valve transferring the spilled oil to the slop tank.
- (3) For ships not with inert gas, dump valve may be used to transfer the deck spilled oil to the slop tank. The drain in the slop tank is to be extended to the bottom of the tank in order to prevent generation of static electricity (mist).



Figure 5.2.7 Portable pump and bonding arrangement

(4) The discharge pipeline used for discharging the stored spilled oil from the deck to the slop tank is to be the fixed type and is to extend to the spilling area between the aft part of the deck in cargo area and the fore part of the accommodation space. Unless otherwise stated in the manufacturers instructions, portable pumps are to be earthed at any time.

(5) Fishplates are to be provided in the lower end of the delivery pipeline used for discharging the spilled oil to the slop tank below the deck to prevent loss of pressure in the slop tank during transfer operation. The delivery pipelines together with the fishplate in the lower end are the dumping arrangements used for discharging the spilled oil from the deck into the slop tank.

(6) Where the valve of the discharging arrangement is fitted in the aft part of the upper deck, the spilled oil is to be discharged into the slop tank below deck once the valve is opened during disposal operation.

(7) Where portable spill transfer pumps are used, there is to be a fixed connection and closed filling system is to be used to discharge the spilled oil from the deck directly into the slop tank. And measures are to be taken to avoid the generation of static electricity (mist).

(8) If the use of a slop tank is not a viable option for some small ships, the deck tank with a capacity of at least 2 m³ is to be available for collecting the spilled oil from the deck. The deck tanks are usually used in chemical tanker. (Note: Deck tank is to be of the fixed type.)

5.2.8 Spill containers or spill tanks are to be fitted below the flanges of cargo, bunker and vapour return manifolds to prevent leakage of the spilled oil from deck into the sea during operation. The size of spill container or spill tank is to be determined according to the size of the ship:

(1) Length — The spill tank is to extend along the length of the ship, including the forward and aft ends of centres of the presentation flanges of the cargo and bunker manifolds. On ships provided with vapour return system, the forward and aft ends of centres of the presentation flanges of the vapour return manifold are to be included.

(2) Width — The spill tank is to have a width of approximately 1.8 m and is to be so positioned that about 1.2 m outboard of the reducer presentation flanges.

(3) Depth — The spill tank is to have a minimum depth of about 300 mm.

(4) Vertical positioning — The working platform is to be situated 900 mm below the level of the centres of reducer presentation flanges.

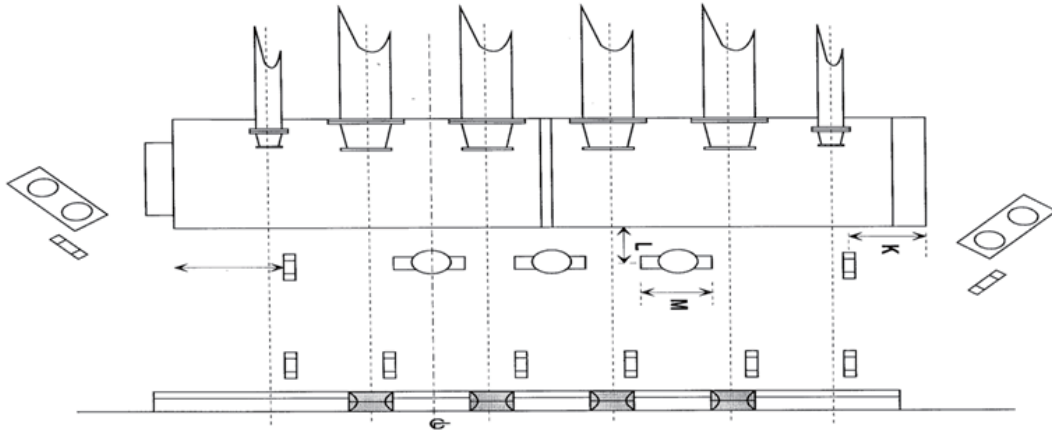


Figure 5.2.8a Arrangement of cargo and bunker manifolds

L — distance between spill tank and cruciform bollard;

M — length of the bollard;

K — distance between the end plane of spill tank and cruciform bollard.

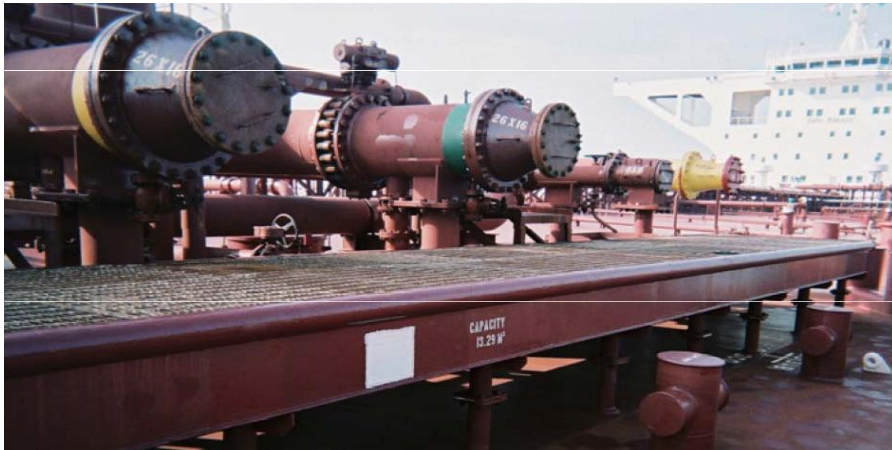


Figure 5.2.8b Arrangement for the spill tank below the flanges of cargo, bunker and vapour return manifolds

5.2.9 Fixed spill tanks are to be fitted in accidental spill tank of vent pipes (air pipes), and in the deck outlets of the vent pipes of all fuel tanks, fuel oil service, settling, storage and lubrication oil tanks and other tanks containing flammable fluids. The capacity of spill tank is normally determined by the size of the vent pipe, the length and width of the spill tank of vent pipes (air pipes) is at least to be 3 times of the diameter of the vent pipe, and the depth not less than 300 mm. However, the depth is not to be close to the openings of vent pipes.



Figure 5.2.9 Spill tank of enclosing of the vent pipes (air pipes) of tanks containing flammable fluids

5.2.10 Fixed spill tanks preventing accidental oil spill are to be fitted around the openings of the vent pipes (air pipes) of tanks containing flammable fluids such as fuel tanks, lubrication oil tanks and hydraulic oil tanks, the total capacity is suggested to be:

- (1) for spill tank of ships of greater than 75,000 DWT (Aframax), at least 1 barrel (about 0.16 m³);
- (2) for ships of less than 75,000 DWT, at least one-half barrel (about 0.080 m³);
- (3) for ships necessary for operating in US waters, the standards of USCG are to be used as follows:
 - ① 1 barrel for ships over 1,600 gross tonnage;
 - ② one-half barrel for ships of 300 to 1,600 gross tonnage;
 - ③ 5 U.S. gallon portable container for ships of 100 to 300 gross tonnage and 100 gross tonnage or over if constructed before July 1974.

5.2.11 The depth of spill tank is not to be less than 300 mm, but not to reach the opening of vent pipe (air pipe). Generally the spill tank is to be located at least 200 mm below the opening.

5.2.12 All spill tanks are to be the fixed structure, and mechanically tightened scupper plugs or means for removal of spilled oil are to be fitted.

5.2.13 All spill tanks are to be kept clean and dry.

5.2.14 Fixed containment is to be fitted around all deck and hydraulic machinery as the spill container for prevention of oil spill during operation. The height of spill container is usually not to be less than 150 mm. And mechanically tightened scupper plugs or means for removal of spilled oil are to be fitted in the spill container.

5.2.15 All unused flanges of cargo bunker and vapour return manifolds are to be blanked with blank flanges and fully bolted. Pipes of small diameter may be capped.

5.2.16 The strength of all blank flanges on the ship is to be equal to that of the rated pressure of pipeline manifolds.

5.2.17 Effective means for immediately disposing of the spilled oil are to be provided on the deck and manifolds. And such means are also to be provided in the aft part of the cargo area of the main deck.

5.2.18 Adequate fixed arrangements for the disposal of oily water are to be provided in the forecastle and other spaces.

5.3 Arrangements for prevention of pollution from cargo

5.3.1 According to the requirements in Annex I of MARPOL 73/78, the oil cargo system and ballasting system are to be separated as follows:

(1) Every crude oil tanker of 20,000 tonnes deadweight and above and every product carrier of 30,000 tonnes deadweight and above constructed on and after 1 June 1982 are to be provided with segregated ballast tanks.

(2) Crude oil tankers of 40,000 tonnes deadweight and above constructed before 1 June 1982 are to be provided with segregated ballast tanks. Crude oil tankers may, however, in lieu of being provided with segregated ballast tanks, operate with a cargo tank cleaning procedure using crude oil washing.

(3) Crude oil tankers of 40,000 tonnes deadweight and above constructed before 1 June 1982 are to be provided with segregated ballast tanks, alternatively may operate with dedicated clean ballast tanks, provided that the arrangements and operational procedures for dedicated clean ballast tanks comply with the revised Specifications for Oil Tankers with Dedicated Clean Ballast Tanks adopted by resolution A.495 (XII). Since dedicated ballast tank is provided for oil tank clean ballast tank with the pumps and pipes serving the same purpose, ships operating with dedicated clean ballast tanks are to be provided with an approved Dedicated Clean Ballast Tank Operation Manual.

5.3.2 Appropriate numbers of dipping gauges are to be provided in the aft part of every cargo tank to check the effectiveness of cargo tank cleaning.

5.3.3 For all ballast tanks adjacent to the cargo tank, such as wing tanks, bow ballast tanks, means for observing or examining the condition of ballast water inside the ballast tanks before discharging are to be provided on the weather deck. Such means for observation or examination are to be of adequate size and easy for operation. While dismantling the watertight or weathertight means of closure for examining the condition of ballast water, no excessive nuts are to be removed, normally 3 to 6 butterfly nuts, and not more than 4 nuts are recommended.

5.3.4 For ballast tanks with 2 accesses, means for observation and examination are suggested to be fitted in the access forward of the ballast tank. Such access is to be fitted in the hatch cover of small hatchway of the hatch coaming of 600 mm in height. An observation hole, with the diameter of not less than 250 mm to 300 mm, is to be made in the hatch coaming cover. The means for closure of the observation hole may be operated by not more than 4 to 6 butterfly nuts on the cover.



Figure 5.3.4a Sampling and observation arrangements of ballast tank



Figure 5.3.4b Sampling and observation arrangements of ballast tank

5.3.5 In order to prevent leakage from cargo pipelines, the valves of the cargo pipelines (cargo loading/discharging line, washing line), bunker pipelines, ballast pipelines on the deck are to be closed, blanked and fully bolted when not in use. The blank flanges are to be of sufficient strength to withstand the rated working pressure of the pipelines. Normally the thickness of the blank flange is to be the same of that of pipe flange. Where blank flanges are impracticable, 2 stop valves may be accepted and arrangements for bleeding air are to be provided in the pipelines between 2 stop valves. Where blank flange is impracticable for the end-blown of pipe with small diameter, it may be capped.

5.3.6 For the existing ships which are to carry additional ballast water in cargo tanks, the following requirements are to be complied with:

- (1) Where additional ballast water is to be carried in cargo tanks, it is to be filled over the top by means of dedicated ballast pumping and piping system and auxiliary arrangements.
- (2) The means of isolation is to be taken for ballast and cargo systems. Normally 2 isolation valves are to be taken for the above mentioned means of isolation, one stop valve and one non-return valve, and the non-return valve is to be fitted in the side of the cargo tank. Procedures for regular pressure checking and test are to be provided for the means of isolation. The results of the test are to be recorded and kept onboard the ship.

(3) Where the additional ballast water is to be carried in cargo tanks in severe weather, it is to be filled over the top with the filling pipe extending to the bottom of the cargo tank because of the flammable vapours in the cargo tanks. For cargo tanks not washed by water after crude oil washing, the same operation may be taken.

Note: The filling pipe of OVER THE TOP system is to be extended to the bottom of the tank and the ballast pipelines in the pump-room and those extending to the cargo tank for carriage of the additional ballast water are to be physically isolated. Blank flanges or removable spool pieces are normally used for physical isolation. OVER THE TOP is to be marked on the connection between ballast pipes of pump room and the filling pipes towards the cargo tank.

(4) Dipping gauges are to be fitted in the aft part of each cargo tank in order to check the effectiveness the discharge of cargo or crude oil washing or washing of the tank. The number of dipping gauge is to be determined basing on the structure of the tank.

5.3.7 Pollution control equipment or means for removal of spilled oil are to be available on oil tankers or chemical tankers in accordance with the requirements of oil industry organizations. As a minimum, the following equipment are to be available.

- (1) sorbents;
- (2) non-sparking hand scoops, shovels and buckets;
- (3) containers suitable for holding recovered waste;
- (4) emulsifiers for deck cleaning;
- (5) protective clothing;
- (6) 2 non-sparking portable pumps with hoses in good operating condition. Unless otherwise stated in the manufacturers instructions, all portable pumps are to be earthed when in use.

5.3.8 Oil industry organizations accept that the equipment onboard ships may be provided in accordance with Co-operation (OPRC Convention) 1990. Means for removal of the spilled oil are to be ready for use.

5.4 Ballast water management

5.4.1 Owner or ship operator is to develop the ballast water exchange plan according to International Convention for the Control and Management of Ship's Ballast Water and Sediments. Though this Convention has not yet entered into force, some countries have implemented the management of ballast water and report specifications in the waters under their jurisdiction.

5.4.2 For all oil tankers and chemical tankers, sampling and observation arrangements for ballast water or oil contamination are to be fitted before the discharge of ballast water by means of the ballast tank adjacent to cargo tank.

5.4.3 Sampling and observation are necessary for the ballast tank of gas carrier only in the situations that lines for fuel oil pass through the ballast tank or that the ballast tank is adjacent with the oil fuel tank.

5.4.4 Sampling and observation arrangements are to be safe and easy for operation, dismantling of too many nuts is not acceptable.

5.4.5 There are various forms for sampling and observation, such as:



Figure 5.4.5a Sampling and observation arrangements of ballast tank



Figure 5.4.5b Observation hole similar to the hatch cover of cargo tank

5.4.6 Integrated cargo and ballast system is suggested to be provided in tankers for the safe operation of cargo or ballast water. The functions and features of the integrated system are:

- (1) The integrated system includes the cargo and ballast system which is hydraulically or electrically driven.
- (2) The cargo and ballast system may enhance the safety of ship. And the cargo and ballast system including the safety system are to be independent in all cases, including emergency conditions.
- (3) Where the cargo and ballast system can not operate, independent emergency cut-off devices are to be fitted in the remote-controlled lines of cargo and ballast system.
- (4) Where the ballast system can not start due to power failure, cargo pump may be used manually for emergency stop.
- (5) The control system of the integrated system is to provide the power supply and two sets of power supply are gained from the main switchboard. The control panels in any positions are to give visual and audible alarm in the event of any power failure.

(6) In the event of damage of the automatic or remote control system of the integrated system, the second set of integrated cargo and ballast system is to be brought into action effectively by means of manual or remote controlled or auxiliary arrangements in the control system.

5.5 Pump rooms and oil discharge monitoring equipment

5.5.1 Cargo pump-rooms are to be provided with bilge level monitoring devices and alarms are to be fitted in the cargo control station. Bilge level monitoring devices are to be sited at a low point.

5.5.2 No cargo residues are allowed to be discharged into the bottom of pump room as the bilge water.

5.5.3 Arrangements for emergency disposal of pump room bottom accumulations are to be provided.

5.5.4 Onboard Oil Discharge Monitoring Equipment is to be regularly checked and the test record is to be kept.

5.5.5 Where sea chest valves connected to the cargo and sea water systems are fitted in the cargo pump room, means are to be provided to ensure that oil is not escaping through sea valves.

(1) Where pipelines connecting cargo and sea water systems are provided in cargo pump rooms, a watch is to be kept to ensure that oil is not escaping through sea valves during the operation of cargo pumps such as discharging, ballasting and tank washing. Therefore, means for prevention of leakage of oil or oily water from the sea chest valves of sea water system are to be provided. And arrangements for checking of the leakage of oil or oily water from sea chest valves of sea water system together with the testing arrangements are also to be provided. Typical arrangement for testing is shown in the figure below.

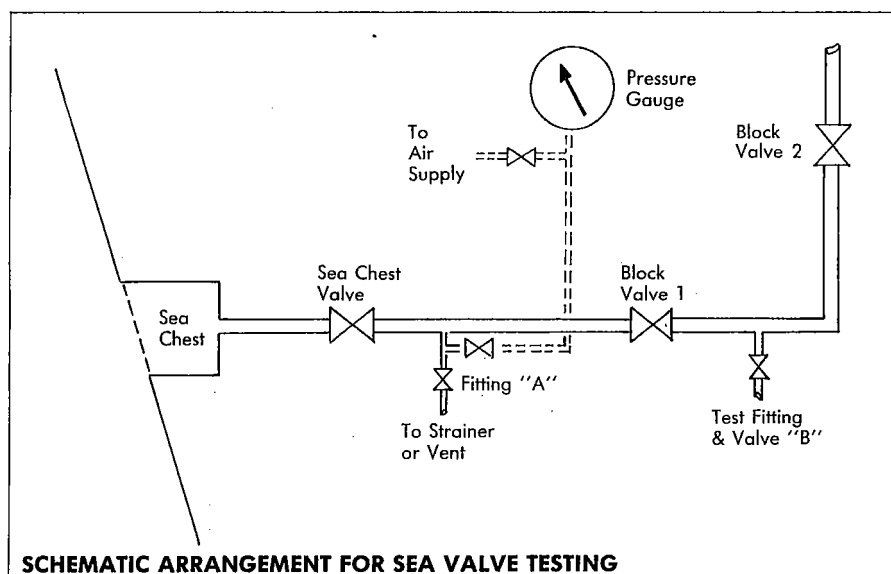


Figure 5.5.5 Arrangement of checking of leakage from pipes of cargo pumps and sea valves

(2) Pipes connecting cargo system and sea chest suction of sea water system in the cargo pump room are to be operated as follows:

- ① to check pipelines and fitting “A” and fitting “B” used for dumping located between sea valve and block valve 2 of sea water system;
- ② to close the sea valve and block valve 2 of sea water system;
- ③ to dump the residues between pipes of sea valve and block valve 2 of sea water system;
- ④ to close the block valve 1 of sea water system;
- ⑤ air pressure in the pipe is approximately 3.5 kg/cm² (50 pounds);
- ⑥ to observe the drop of pressure, about 15 min;
- ⑦ to check the blisters discharged from sea valve along the ship side if drop of pressure is found and to check leakage of fitting “B” at the same time, where necessary, to check the leakage by means of blisters in the fitting;
- ⑧ where the sea water system is tight, to test block valve 2; sea valve of the sea water system may be opened; close fitting “B” and to pressurized the pipeline to 0.35 MPa (3.5 kg/cm² or 50 pounds); check the drop of pressure with the test time of about 15 min.

(3) Test and testing devices for leakage of sea chest valves are to be of sufficient height, normally above the passages in the bottom of the pump room, to prevent the testing personnel from being exposed to high concentrations of flammable gas of for a long time. And OCIMF publication “Prevention of Oil Spillages Through Cargo Pump Room Sea Valves” (2nd Edition 1991) may be used as a guide for arrangement of the testing devices.

(4) For the standards for high concentrations of flammable gas, refer to the exposure limit* determined by international organizations, administrative departments of the State or local administrative standards.

Note: The exposure limit of oil industry and companies is normally specified according to AGGIH (American Conference of Governmental Industrial Hygienists) standard, the Conference has developed the guidelines for protection of the working environment of personnel and for prevention of harmful gases. The values used are called Threshold Limit Values (TLVs), its units are in [parts per million](#) for [gases](#).

(5) At least 2 stop valves are to be provided on the sea suctions and cargo pipes of the cargo pump, also the test fittings and auxiliary equipment such as devices for air charging/discharging, dumping and pressure/vacuum gauge are to be provided on the pipes between the two stop valves.

5.5.6 Overboard discharge valves are to be securely closed and lashed and may be sealed when not in use and warning against accidental operation is to be provided.

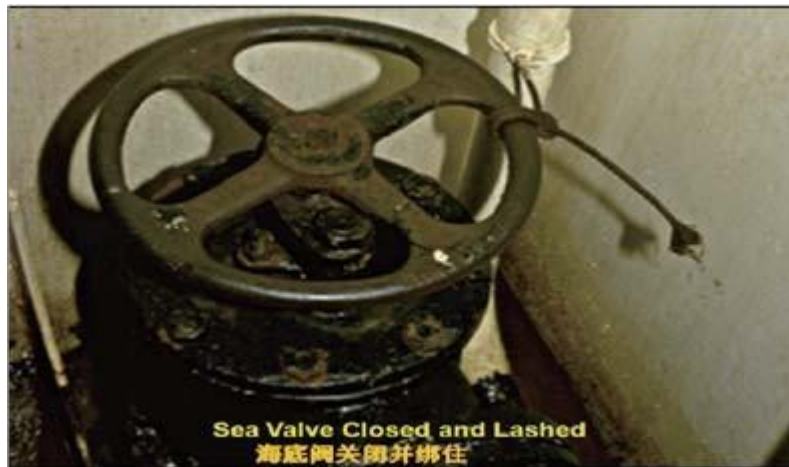


Figure 5.5.6 Sea valve closed and lashed

5.5.7 Procedures are to be provided for the operation of pump room sea valves to prevent pollution from leakage of cargo pump room sea valves. Ship operators of tankers, especially those with clean ballast tanks or the cargo tanks of which are to carry additional ballast water in severe weather conditions, are to develop the procedures for the regular test and operation of pump room sea valves and operation policies. The test pressures of sea valves are normally not to exceed 0.35 MPa (3 kg/cm² or 50 pounds). And procedures are to be provided for the operation and test for effective prevention of spillage of oil or oily water from sea chest suction through cargo pump pipes. The following steps are the recognized effective procedures:

- (1) start the cargo pump — open the valve close to the cargo pump to form “vacuum” in the pipeline between the cargo pump to sea chest valve — open the valve close to the sea chest — open the valve on the sea chest;
- (2) ship owner or operator is to develop procedures for regular examination of the equipment to prevent spillage of oil or oily water from sea valves of cargo pump room;
- (3) for some oil tankers not fitted with checking and test arrangements for oil spillage, including existing oil tankers and those constructed according to common rules, pipes connecting cargo pumps and sea chest may be removed and blank flanges are to be fitted in the pipe end as an alternative.

5.6 Pollution prevention equipment in engine and steering compartments

5.6.1 The spillage of bilge water from the operation of cargo system and machinery space on the deck is not to be discharged directly into the sea. Ascertain that no bilge or oily water in the machinery space may be discharged into the sea unless disposed.

5.6.2 The bilge system provided in accordance with SOLAS II-1/35-1 in machinery space may not be used for discharging of daily machinery space bilge accumulations.

5.6.3 The valves provided in the discharge outlet of bilge system in accordance with SOLAS II-1/35-1 are to be closed under normal conditions (without damage of hull and equipment) and sealed with numbers.

5.6.4 If the ship has an ejector as a substitute for one of the bilge pumps then it may be necessary to ensure that the suction valves are sealed with numbers and marked with a specific warning notice read that “This valve is prohibited to be opened without permission”.

5.6.5 The means by which operation of the emergency overboard valve is controlled to prevent unauthorized discharge of oil or oily mixtures are to be determined. Positive evidence that the overboard discharge valve has not been opened can be provided by use of a numbered seal, the number of which can be verified in official documents such as the Engine Room Log or the Oil Record Book Part I. Such a method of sealing must be easily breakable to allow the valve to be opened in an emergency.

5.6.6 Where the emergency bilge suction valve is provided in machinery space, such valve is to be closed and sealed under normal conditions and marked with the specific warning notice read that “This valve is prohibited to be opened without permission”.

5.6.7 Bilge water high-water-level alarm is to be provided in the machinery space. It is suggested that the bilge pump of the bilge system provided in accordance with SOLAS II-1/35-1 not initiated by the high-water-level alarm.

5.6.8 Where hydraulic, fuel or other oil may accumulate in steering compartment bilge wells, adequate arrangements are to be in place for the disposal of it. Where hand pumps or ejectors are fitted, there are to be pollution prevention notices posted and the overboard valves are to be secured against accidental opening.

5.6.9 Oily water separator is to be such as will ensure that any oily mixture discharged into the sea after passing through the system has an oil content not exceeding 15 parts per million.

5.6.10 Sludge pumps are to be free from any connection to a direct overboard discharge, other than the standard discharge connection to a deck discharge.

5.6.11 In order to safeguard against the accidental opening of the overboard discharge valve of the means for disposal of oily or bilge water in the machinery space, the overboard valve is to be closed, locked or sealed when the ship is in terminals or ports provided with a warning notice indicating that the valve is prohibited to be opened without permission when the ship is in port.



Figure 5.6.11a Oily water separator discharge valve in engine room closed and locked when in port



Figure 5.6.11b Overboard valve of oily water separator in engine room closed and sealed when in port

5.7 Machinery space bilge auxiliary discharge system

(1) If the disposal of engine room oily water or sludge to a cargo or slop tank has taken place, the event is to be recorded in both Parts of Oil Record Books.

Note: Part I of Oil Record Book is about machinery space operations and Part II is about cargo/ballast operations.

(2) There is to be no cargo in the slop tank and the arrangements for the discharge pipes transferring oily water in the machinery space to the slop tank are to be approved by classification society.

(3) Arrangement plan for the piping system transferring oily water of machinery space to the slop tank of cargo area is to be provided by the design department to the classification society for new buildings. Arrangement plan for the alteration of piping system transferring oily water of machinery space to the slop tank of cargo area is to be provided by the ship owner to the classification society for the existing ships.

(4) The oily water of machinery space is to be discharged into the slop tank in special circumstances. Where the ship is not in voyage or in the event of temporary failure of the means for disposal of bilge water, the oily water or sludge from engine room is to be discharged by means of the auxiliary discharge system for emergency discharge.

(5) Necessary means are to be provided to prevent the oily water or flammable gas entering the machinery space through bilge water auxiliary discharge system when the oily water is discharged into the slop tank, such as backflow or leakage of liquid or flammable gas being siphoned back to the machinery space.

(6) Measures are to be taken to prevent pollution of the auxiliary discharge system of machinery space or the risk of fire.

5.7.2 Bilge water auxiliary discharge system of machinery space is to include at least the following plans:

(1) Arrangement plan of bilge water auxiliary discharge system of machinery space;

- (2) Technical requirements for bilge water auxiliary discharge system of machinery space;
- (3) Operations manual for bilge water auxiliary discharge system of machinery space.

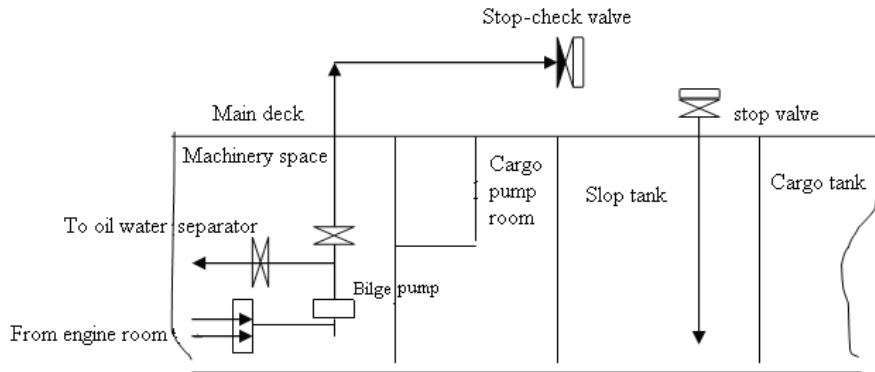


Figure 5.7.2 Bilge water auxiliary discharge system of machinery space

5.7.3 Technical requirements for discharging the oily water or sludge from machinery space into the slop tank

- (1) No flammable substances or slops containing flammable substances are to be filled from the top of the tank, and measures are to be taken to prevent the backflow of liquids or gases to the machinery space. Therefore, the discharge pipeline over the top when discharging the oily water (bilge water) to the slop tank of cargo area is to be extended to the bottom of the tank.
- (2) Residues in the transfer pipes in the machinery space are to be completely dumped when the auxiliary discharge system is not in use. Therefore, dump valves or cocks are to be fitted in the bottom of the transfer pipes in the machinery space of auxiliary discharge system.
- (3) Temporary connections, normally the spool pieces, are to be taken for transfer pipelines on weather deck.
- (4) Spool pieces are to be made of the material with electrical continuity, such as steel pipe.
- (5) Transfer pipes, spool pieces and filling pipes in the slop tank are to be made of material with electrical continuity.
- (6) Stop valves are to be fitted on both ends of transfer pipes and spool pieces, where the one close to machinery space is to be stop-check valve, and the other end the stop valve. And the valve ends are to be blanked and fully bolted when not in use.
- (7) In order to prevent the generation of static electricity (mist) due to the splashes of oily water during filling of the slop tank, measures taken to prevent static electricity are required such that the filling pipes of the slop tank are to be extended to the bottom of the tank.
- (8) In order to prevent leakage of oily water during loading/unloading of the spool pieces, fixed containments are suggested to be fitted as spill containers in the connections of spool pieces. The height of the containment is normally not less than 100 mm. And means for dumping or disposal of spill oil are to be provided in the spill container.

(9) Spool pieces are to be removed and blanked on both ends and the spill containers are to be cleaned after operation.

5.7.4 Procedures for operation of machinery space bilge water auxiliary discharge system are as follows:

(1) Application: the system is normally to be used when the ship is not in voyage or in the event of failure of bilge equipment.

(2) Sequence of operation of the means for preventing the backflow of oily water or siphoning of the flammable gases from slop tank to the machinery space.

(3) Management: before the operation of the system, it is to be ensured that no cargo is left in the accepted slop tank or cargo tank; after the operation of the system, the valves on the ends of the temporary connecting pipe of the transfer pipeline are to be closed, and the temporary connecting pipe is normally to be removed and blanked; to dump the oily water in the filling pipe over the top of the tank in the engine room.

(4) After the operation of the system, both parts (machinery space operations and cargo/ballast operations) of the Oil Record Book are to be recorded.

5.8 Control of other pollution

5.8.1 Operators are to have in place an Environmental Policy covering pollution from the following sources, as appropriate:

- (1) oil, associated products/chemicals, LNG & LPG;
- (2) noxious liquid substances;
- (3) sewage;
- (4) dangerous goods;
- (5) garbage;
- (6) ballast water (including the transfer of sediments and micro-organisms);
- (7) cargo vapour and engine exhaust emissions;
- (8) halons and CFCs;
- (9) noise;
- (10) anti-fouling paints.

Chapter 6 Prevention of Fire and Explosion

6.1 Control of flammable gas — prevention of excessive accumulation of flammable gas

6.1.1 Fixed inert gas system is to be provided in cargo tanks when carrying cargoes with a flashpoint not exceeding 60° (140°F) or when cargoes with a flashpoint exceeding 60° (140°F) are carried at a cargo temperature higher than their flashpoint less 10°.

6.1.2 Ventilating systems interlocked with the tank washing machine are to be provided in cargo tanks without fitting with inert gas system to keep effective and continuous ventilation during tank washing when carrying cargoes with a flashpoint below 60° (140°F) or when cargoes with a flashpoint exceeding 60° (140°F) are carried at a cargo temperature higher than their flashpoint less 10°.

6.1.3 Fixed inert gas system is to be provided in cargo tanks carrying cargoes with a flashpoint exceeding 60° (140°F) when individual tank washing machines have a throughput greater than 60 m³/h or the total water throughput per cargo tank exceed 180 m³/h.

6.1.4 Fixed flammable gas detection systems are to be fitted to detect the concentration of flammable gases in void space, ballast space or other spaces adjacent to cargo tank.

6.1.5 Level sounding device and level alarm systems are to be provided in all cargo tanks, slop tanks, oil fuel tanks or other spaces containing flammable liquids. Independent high level control units (spillage control) are to be provided in cargo tanks and slop tanks. Remote controlled digital display and alarm are to be provided in the cargo control station for the above-mentioned alarm system and control units.

6.1.6 Continuous mechanical ventilation is to be kept in the storage space of cargo operation equipment and working space in the cargo area to prevent excessive accumulation of flammable gases during the operation of the equipment.

6.2 Control of oxygen content — provision of inert gas system

6.2.1 Arrangement for inert gas system is at least to meet the following requirements:

(1) Stop valves are to be provided for branch piping of the inert gas supply main leading to each cargo tank. The stop valve is to be provided with a device indicating its working condition. Locking arrangements are also to be provided for stop valve in order to prevent inappropriate operation without permission and the key to the locking arrangement is to be kept by the person in charge onboard ship.

(2) Suitable emergency inert gas supply arrangements are to be provided to enable the inert gas system to be connected to an external supply of inert gas. These arrangements are to consist of a 250 mm nominal pipe size bolted flange, isolated from the inert gas main by a valve and located forward of the non-return valve. The design of the flange is to be compatible with the design of other connections in the ship's cargo piping system.

(3) Fixed flammable gas detection systems are to be provided in the venting systems of all double hull ballast tanks for ships fitted with fixed inert gas system. Charging pipes of fixed inert gas system and air purging arrangements are to be provided in double hull ballast spaces. And pipes for inert gas supply for the double hull ballast space are to be provided on the deck of cargo area.

(4) Closed gauging system and a gauge with vapour lock are to be provided in cargo tanks with inert gas system.

(5) Every inert gas system is required to be fitted with one or more pressure/vacuum breakers or other approved devices. These are designed to protect the cargo tanks against excessive pressure or vacuum and must therefore be kept in good working order by regular maintenance in accordance with the manufacturer's instructions.

(6) Before each tank is washed, the flammable gas detecting points are to be set, both at a point 1 m below the deck and at the middle level of the ullage space, to determine the oxygen content not to exceed 8% by volume. Where tanks have a complete or partial swash bulkhead, the measurement is to be taken from similar levels in each section of the tank. The oxygen content and pressure of the inert gas being delivered during the washing process are to be continuously recorded. During washing, the oxygen content in the tank is not to exceed 8% by volume and the pressure of the atmosphere in the tanks is no longer positive.

(7) The deck water seal of inert gas system is to be of the wet type.

(8) The operation manual for inert gas system complying with the Guidelines for Inert Gas Systems is to be provided onboard the ship fitted with inert gas system and is to be approved by classification society.

6.2.2 For ships fitted with inert gas system, means for inert gas supply for the void and ballast spaces in cargo area are to be provided on the deck.

6.2.3 For ships provided with external source of inert gas, non-return devices are to be fitted on the means for inert gas supply to prevent the backflow of flammable gas into safe space.

6.2.4 The oxygen content of the tank is to be controlled not to exceed 8% by volume in any circumstances to prevent the risk of fire or explosion.

6.2.5 The inert gas system is to ensure the required speed and quality for the supply of inert gas.

6.2.6 Arrangements are to be provided to enable the inert gas main to be connected to an external supply of inert gas in the event of failure of inert gas system. The arrangements are to consist of a 250 mm nominal pipe size bolted flange, isolated from the inert gas main by a valve and located forward of the non-return valve.

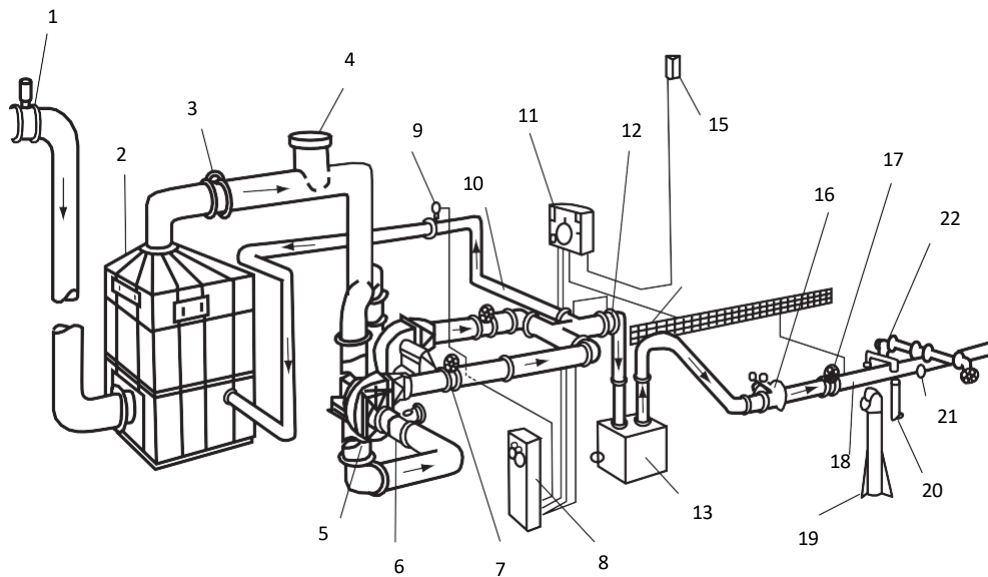


Figure 6.2.6 Arrangement of the inert gas system

- | | | | |
|---|--------------------------|----------------------------|---------------------------|
| 1. Boiler uptake valve; | 2. Scrubber; | 3. Scrubber outlet valve; | 4. Air intake; |
| 5. Blower; | 6. Blower inlet valve; | 7. Blower outlet valve; | 8. Oxygen analyzer; |
| 9. Control valve; | 10. Circulation line; | 11. Pressure delivery box; | 12. Gas regulating valve; |
| 13. Deck water seal; | 14. Vent valve; | 15. Pressure regulator; | 16. Non-return valve; |
| 17. Deck main isolating valve; | 18. Inert gas deck main; | 19. Pressure/vacuum valve | 20. Drainage appliance; |
| 21. Connection for measuring equipment; | | 22. Branch line valve; | |

6.2.7 Two fixed and portable oxygen-measuring equipment are to be provided in the inert gas system.

6.3 Suppression of ignition source

6.3.1 Reciprocating pumps are not allowed to be fitted for cargoes with flash points not exceeding 60° (140°F). And it is suggested not to use reciprocating pumps as far as practicable for cargoes with flash points exceeding 60° (140°F).

6.3.2 For cargo tank not fitted with inert gas system, earthing or bonding or other effective measures are to be taken to prevent static electricity for all the equipment in cargo tank, such as level sounding device, sampling device and temperature gauge. Earthing and bonding are to be achieved by means of connection between conductors with metal materials. Interlock system is to be provided for tank cleaning machine and ventilation system to ensure that the ventilation fan operate all the time during tank washing.

6.3.3 Fixed tank washing system is not to be provided in cargo tanks carrying cargoes with flash points not exceeding 60° (140°F) if the inert gas system is not provided.

6.3.4 Cargo pumps, ballast pumps, stripping pumps and bilge pumps of other types driven by shafts passing through pump room bulkheads are to be fitted with alarm devices, for indicating the excess temperature with temperature sensing devices for bulkhead shaft glands, bearings and pump casings, and trip gear.

- 6.3.5 All the cargo pipes and cargo operation equipment are to be bonded and effectively earthed.
- 6.3.6 The use of portable stoves and cooking appliances on board oil tankers is to be controlled.
- 6.3.7 Smoking places are to be confined to locations within the accommodation. And smoking places are not to have doors or ports that open directly onto open decks.
- 6.3.8 Safety matches or fixed (car type) electrical cigarette lighters are to be provided in approved smoking locations.
- 6.3.9 The use of all mechanical lighters and portable lighters with electrical ignition sources is to be prohibited on board tankers.
- 6.3.10 Torches used in flammable atmospheres are to be of a safe type approved by a competent authority.
- 6.3.11 Self-igniting lights of lifebuoys in the cargo area are to be of a safe type approved by a competent authority.
- 6.3.12 UHF/VHF walkie-talkie transceivers are to be intrinsically safe and international and US marine channels are suggested to be provided.
- 6.3.13 Window type air conditioning units are prohibited. Where such units are used in the existing ship, their use is to be strictly controlled and prohibited during cargo operation or in port.
- 6.3.14 The use of that employ naked flames is to be prohibited for tankers carrying flammable liquids, such as fuel oil or liquefied gas cooking appliances and other galley stoves. The use of galley stoves and other cooking appliances that employ naked flames is to be strictly controlled and prohibited especially during cargo operation or in port for other tankers. The use of cooking appliances is prohibited in the crew cabin.
- 6.3.15 Devices to prevent the passage of flame are to be fitted on the openings of ventilation system of all spaces and on the openings of vent pipes of all compartments in the cargo area, excluding those with the efflux velocity at the opening for high speed pressure release greater than 30 m/s.
- 6.3.16 Moving parts of fire fighting appliances such as nozzles, hose couplings are not to be made of aluminium or aluminium alloy.

6.4 Fire fighting

6.4.1 The classification of fires given below is that provided by International Safety Guide for Oil Tankers and Terminals (ISGOTT) and EU.

- (1) Class A – Ordinary (Solid) combustible material fires

Class A fires are those involving solid cellulosic materials such as wood, rags, cloth, paper, cardboard, clothing, bedding, rope and other materials such as plastic etc.

(2) Class B – Fires involving flammable and combustible hydrocarbon liquids

Class B fires are those that occur in the vapour/air mixture over the surface of flammable and combustible liquids such as crude oil, gasoline, petrochemicals, fuel and lubricating oils, and other hydrocarbon liquids.

(3) Class C – Flammable gases and electrical fires

Class C fires are those involving liquefied petroleum gases, compressed petroleum gases, liquefied natural gases, compressed natural gases and other flammable gases, and short circuit or overheating of electrical equipment.

(4) Class D – Combustible metal fires

6.4.2 Fire is caused by fuel (flammable gas), oxygen and temperature (ignition source) under certain conditions. Most flammable materials may release flammable gases under certain temperature, namely the flammable gases may be released when the material is heated. While such flammable gases are mixed with oxygen of certain proportion, such as ignition in the air, they will be burned (fire caused).

6.4.3 Fires are extinguished by the removal of heat, fuel or air as soon as possible. Therefore, the main objective of fire-fighting is to reduce the temperature, remove the fuel, and exclude the supply of air with the greatest possible speed.

6.4.4 Different extinguishing agents are to be used for different types of fires, such as cooling agents, smothering agents and flame inhibiting agents, as shown in following:

- (1) cooling agents, such as water and foam;
- (2) smothering agents, such as foam, carbon dioxide, steam and sand;
- (3) flame inhibiting agents, such as dry chemical, vaporising liquids.

Uses of extinguishing agents (including fixed and portable extinguishing media) Table 6.4.4

Type of fire (fire extinguishing medium)	Class A Combustible materials (e.g. wood, paper, fabrics)	Class B Flammable liquids and petroleum	Class C Electrical equipment fires	Class D combustible metals (e.g. magnesium, titanium, potassium and sodium)	Flammable gases	Cooking oil and fats
Water and water with additive	X					
Spray foam*	X	X				
Dry chemical	X	X	X		X	
CO ₂ gas		X	X			
Wet chemical	X					X
Fire blanket						X
Designed to match a particular type of fire				X		

Note: For aqueous flammable liquids, the foam of alcohol-resistant type is to be used for extinguishing. For flammable liquids other than aqueous ones, ordinary foam is to be used for extinguishing.

6.4.5 Since flammable liquids, which belong to Class B and Class C fires referred to in 6.4.1, are carried by tankers. These fires are extinguished by isolating the source of fuel (stopping the flow of fuel), inhibiting the release of combustible vapours or by interrupting the chemical reaction of the combustion process. Since most Class B fires burn with explosion, the surrounding spaces and areas are also to be cooled while extinguishing the liquid fires.

6.4.6 Only one type of foam concentrate of the fixed deck foam system in the cargo area is to be supplied and it is to be effective for the maximum possible number of cargoes intended to be carried in tankers. Where fixed deck foam system is used, the foam compound is to be suitable for the cargoes carried.

6.4.7 Where fixed deck foam system is used, suitable storage tanks containing foam concentrate are to be used to ensure the tanks are fully charged to prevent the foam from oxidation and deterioration.

6.4.8 The storage conditions of storage tanks containing foam concentrate are to be in accordance with the manufacturer's instructions.

6.4.9 Appropriate fire blankets are to be readily available to galley staff for emergency use.

6.4.10 Fixed fire-extinguishing system is to be fitted in the sample storage room.

6.4.11 Extinguishing agents such as dry chemical and foam concentrate are to be returned periodically to the manufacturer for testing and evaluation and replaced periodically according to the manufacturer's instructions.

6.5 Fire detection and fire alarm

6.5.1 Manual control is not to be taken for fixed fire detection and fire alarm systems in any machinery spaces.

6.5.2 Flammable gas detection devices are to be fitted in the galley and sample storage room.

6.5.3 Flammable gas detection devices are to be fitted in the void and ballast spaces of cargo area.

6.5.4 At least 2 devices for continuous monitoring of the concentration of hydrocarbon gases are to be fitted in cargo pump room, one of which is to be the fixed system for continuous monitoring and the alarm is to be initiated in the pump room, engine room centralized control room, cargo control room and navigation bridge once the concentration of hydrocarbon gases is below 10% LEL.

6.5.5 Automatic fire detection system is to be fitted in accommodation space and galley.

6.5.6 Flammable gas detectors are to be fitted in double-hull space, double bottom ballast space, top and bottom of the pump room where flammable gases are likely to accumulate.

Chapter 7 Cargo and Ballast Systems

7.1 Cargo tanks

7.1.1 To ensure safety of ships and avoid cargo overload, each cargo tank is to be fitted with a high-level alarm and a high-high-level alarm as required by International safety guide for oil tankers and terminals (ISGOTT).

7.1.2 In general, the setting of high level alarm is not to exceed 95% of the tank capacity and that of high high level alarm not to exceed 98%.

7.1.3 From the time a high-level alarm is sounded to the time the overfill control device shuts down filling operation, the control is to be stable in general. The duration generally is over 30 s but is not to exceed 1 min.

7.1.4 Cargo tanks are to be fitted with main venting system and secondary venting system.



Figure 7.1.4a Venting system



Figure 7.1.4b Venting system



Figure 7.1.4c High velocity/vacuum vents installed on the IGS main line

7.1.5 Relevant information on the approved auxiliary (secondary) venting system of cargo tanks are to be kept onboard ships.

7.1.6 Cargo tanks fitted with fixed inert gas system (IGS) are to be fitted with closed sounding devices.

7.1.7 For cargo tanks fitted only with limited sounding system, the number of tapes are to be the number of simultaneously gauges each tank being worked plus two spares.

7.1.8 For the crude oil washing (COW) system, the branch pipe connections of COW machines on the deck are to be closed and fitted with blind flanges when the system is not working, as the connections of fire hydrants are to be fitted with protective caps.

7.1.9 The waterline to manifold height is not to exceed 24 m. Vessels with waterline to manifold heights below 23 m are strongly preferred.

7.1.10 Limited sounding pipes are to extend from the open deck on top of the cargo tank to the bottom of the tank. In general, such pipes are slotted to ensure the liquid level inside the pipe is the same as that inside the cargo tank. Sounding pipes from which the liquid will not spill are to be fixed to the ship's deck by welding.

7.1.11 All pipelines in cargo tanks are to be arranged as close to bulkheads as possible, keeping a distance of not more than 300 mm from any members inside tanks, unless special earthing measures are taken.

7.1.12 Cargo tanks carrying flammable and toxic liquid are to be provided with vapour locks if limited sounding devices and sampling devices are fitted. In addition, at least two portable electronic measuring instruments are to be provided onboard the ship.

7.2 Cargo system

7.2.1 At least two pressure gauges are to be fitted in the cargo system, one of which is to be fitted on the cargo pipeline or the deck outside cargo pump room, the other on the outboard side of the cargo manifold valve.

7.2.2 Manifold valves are to be stop valves or screw-down valves. Such valves are used to make the control as stable as possible when the overfill control valve shuts down the filling operation so as to reduce the sudden rise of pressure caused by the shutdown of the overfill control valve.

7.2.3 Manifolds are to be connected to cargo hoses and cargo arms with flanges and manifold flanges fabricated of steel.

7.2.4 Cargo manifolds, bunker manifolds and vapour return manifolds are to be fabricated of steel. Grey cast iron and aluminum are not permitted.

7.2.5 An integrated cargo and ballast system are to be fitted to ensure the change of air draft is stable in cargo operations so as to avoid excessive stresses on the connections of cargo arms or cargo hoses to cargo manifolds. Such stresses may even cause fracture and falloff, leading to pollution accidents. The figures below are a falloff accident of a cargo arm.



Figure 7.2.5a Falloff accident of cargo arm during cargo operation



Figure 7.2.5b Falloff accident of cargo arm during cargo operation

7.2.6 Heights and horizontal distances of centerlines of cargo pipes, bunker pipes and vapour return system manifolds are to comply with the requirements of Recommendations for oil tanker manifolds and associated equipment of OCIMF.

7.2.7 Emergency stops of main cargo pumps are to be fitted in the cargo control room, at the upper pump room entrance and near the manifold.

7.2.8 Direct telephone connections, control system or telephone cables with cargo control room or other locations on shore are to be arranged outside hazardous areas (cargo areas).

7.2.9 When carrying goods of multi-grades, cargo pipes are to be designed to be mutually isolated. Two stop valves are to be fitted as isolating devices. In addition, de-aeration devices are to be fitted between the two valves.

7.3 Ballast tanks

7.3.1 Crude oil tankers of 20,000 DWT and above and product oil tankers of 30,000 DWT and above are to be fitted with segregated ballast tanks of sufficient capacity.

7.3.2 Segregated ballast tanks are to be of sufficient capacity as per the scantling of the ship so that the ship can maintain sufficient safety draft during navigation and sufficient safety air draft or suitable freeboard during cargo operations.

7.3.3 The capacity and rate of the ballast system are to be compatible with the ship's cargo operation system to ensure that the ship has sufficient intact stability and the change of freeboard is stable during cargo operations.

7.3.4 For oil tankers of 5,000 DWT and above, the entire cargo area is to be protected by double hull. Where fixed inert gas system is fitted, means are to be provided for supplying inert gas to the double hull spaces and ballast spaces.

7.3.5 Ballast tanks, including wing ballast tanks and double bottom ballast tanks, are to be provided with means to facilitate sampling and observing ballast water from the deck.



Figure 7.3.5 Sampling and observing hole

7.3.6 The openings or outlets of the vent pipes of the ballast tanks and other spaces adjacent to cargo tanks are to be fitted with flame screens.

7.4 Ballast system

7.4.1 Ballast pumps are to be fitted in cargo pump rooms or similar spaces in cargo areas complying with the requirements for cargo pump rooms.

7.4.2 For tankers of 5,000 DWT and above, relevant piping of the ballast system, including ballast pipes, vent pipes and sounding pipes, generally are not to pass through cargo tanks. However, pipes passing through cargo tanks are to be heavy steel pipes without any detachable pipe joints, i.e., piping in the cargo tanks are to be of full welded construction.

7.4.3 For tankers of less than 5,000 DWT, pipes passing through cargo tanks are to be heavy steel pipes without any detachable pipe joints, i.e., piping in the cargo tanks are to be of full welded construction.

7.4.4 Any piping passing through cargo tanks or associated piping of ballast tanks adjacent to cargo tanks, is not to be led to or pass through spaces where ignition sources exist in normal circumstances.

7.4.5 The ballast system is to coordinate with the cargo system during cargo operations, i.e., keep the changes of the following values to a minimum.

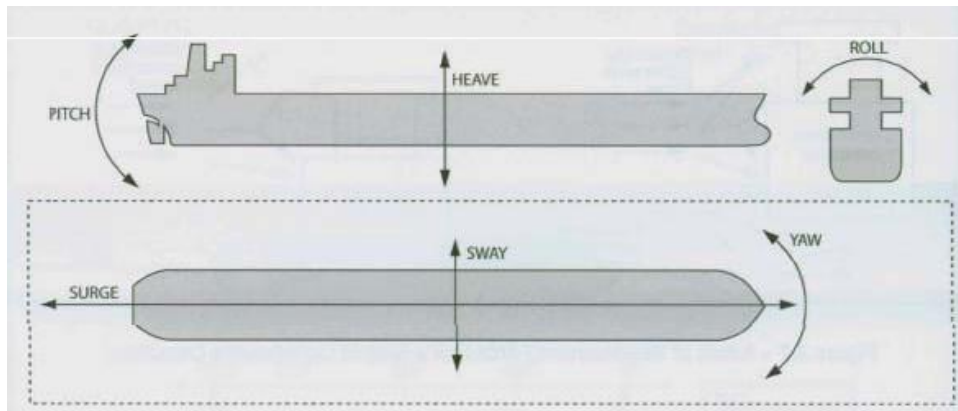


Figure 7.4.5 Possible movements of ships during mooring

Chapter 8 Safety Facilities

8.1 Cargo tanks

8.1.1 For ships which need to carry electrostatic concentrating goods and in which fixed inert gas systems have not been fitted, any protruding equipment in cargo tanks is to keep a distance from the ship's structure (generally more than 300 mm from structural members of the ship) and be reliably earthed.

Typical conductivity of products

Table 8.1.1

Product	Typical Conductivity (picoSiemens/metre)	Classification
Non-Conductive		
Xylene	0.1	Accumulator
Gasoline (straight run)	0.1~1	Accumulator
Diesel (ultra-low sulphur)	0.1~2	Accumulator
Lub oil (base)	0.1~1,000	Accumulator
Commercial jet fuel	0.2~50	Accumulator
Toluene	1	Accumulator
Kerosene	1~50	Accumulator
Diesel	1~100**	Accumulator
Cyclohexane	< 2	Accumulator
Motor gasoline	10~300**	Accumulator
Semi-Conductive		
Fuel with anti-static additive	50~300	Non-Accumulator
Heavy black fuel oils	50~1,000	Non-Accumulator
Conductive crude	> 1,000	Non-Accumulator
Bitumen	> 1,000	Non-Accumulator
Alcohols	100,000	Non-Accumulator
Ketones	100,000	Non-Accumulator
Conductive		
Distilled water	1,000,000,000	Non-Accumulator
Water	100,000,000,000	Non-Accumulator

** Some additives used for performance improvement can increase conductivity significantly.

8.1.2 Automatic ullage gauges or manual ullage gauges with vapour locks are to be provided in cargo tanks when carrying cargoes with a flashpoint not exceeding 60° (140°F) or when cargoes with a flashpoint exceeding 60° (140°F) are carried at a cargo temperature higher than their flashpoint less 10° or when carrying toxic gas cargoes.



Figure 8.1.2a Vapour lock ullage gauge



Figure 8.1.2b Automatic ullage gauge

8.1.3 Cargo tanks are to be watertight; any inlets and outlets, tank washing openings and other similar openings of cargo tanks are to be on the open deck, such as freeboard deck, forecastle deck and top of expansion tank.

8.1.4 The structure of the ship's sounding pipes is to be such that if automatic level sounding devices or closed sounding devices are not fitted, a full depth sounding pipe is to be utilized. Full depth sounding pipes are to extend to the bottom of the cargo tank. Air holes are to be fitted on the sounding pipes which are to be effectively earthed.

8.1.5 The watertight integrity of any openings of cargo tanks, such as inlets and outlets, tank washing openings and other similar openings is to be maintained and watertight hatch cover of steel is to be fitted.

8.1.6 Spaces storing chemicals are to be provided with safety equipment, including protective masks, aprons, gloves and eye-washing equipment.

8.2 Cargo piping

8.2.1 Cargo piping is to be fitted and arranged as per Recommendations for oil tanker manifolds and associated equipment of OCIMF.

8.2.2 The design load of all manifolds is to be permanently and clearly marked.

8.2.3 Cargo piping is to be independent of any other piping, except for emergency connection to the ballast system.

8.2.4 Cargo piping is to be fitted on the open deck in the cargo area and is not to be led outside of the cargo area, except for bow or stern cargo operations.

8.2.5 Cargo piping is to not pass through bunker tanks or any machinery spaces where ignition source exists.

8.2.6 For ships of 5,000 DWT and above, cargo piping is not to pass through ballast tanks. For ships of less than 5,000 DWT, cargo piping is to observe this requirement as far as possible; if cargo piping passes through ballast tanks, there are to be no detachable pipe joints inside the tanks.

8.2.7 All openings of piping on the deck, such as cargo piping, COW piping, bunker piping and vapour return piping are to be blanked and fully bolted.



Figure 8.2.7 Spare manifolds fully bolted on the deck

8.2.8 All manifolds or similar manifold arrangements on the deck are to be marked on each side of the ship.



Figure 8.2.8 Marks of manifolds or similar manifold arrangements on one side of the ship

8.3 Spaces in cargo area

8.3.1 Spaces in the cargo area, such as void and ballast tank spaces, are to be routinely monitored and inspected to check that no leakage has occurred from adjacent cargo tanks.

8.3.2 Monitoring is to include routine check of inflammable gas and level sounding, particularly to ensure that ballast, before it is discharged, is clean.

8.4 Pump-rooms

8.4.1 Pump-rooms, including cargo pump-rooms and ballast pump-rooms, are to be provided with means for hoisting an injured person.

8.4.2 All valves in the cargo pump-rooms, such as operating valves of cargo system, ballast system and bilge system, are to be operable from outside the cargo pump-room. Generally, the valves are to be operable in the cargo control room.

8.4.3 Means are to be provided to deal with emergency drainage of bilge water in pump-rooms.

8.4.4 Cargo pump-rooms are to be provided with inflammable gas detection devices, the sensors of which are to be arranged in the lower part of the cargo pump-room spaces, generally less than 1 m above the bottom of cargo pump-room. In addition, to ensure the safety of personnel entering the pump-room, it is recommended to fit sensors of the inflammable gas detection device in the upper part of the cargo pump-room.

8.5 Electrical equipment

8.5.1 Lighting is to be sufficient on the deck in the cargo area. The levels of illumination are to at least comply with the following requirements of Recommendations for oil tanker manifolds and associated equipment of OCIMF:

- (1) The levels of illumination in way of the cargo manifold are not to be less than 50 lux when measured on a parallel with and 1 m above the deck.
- (2) The illuminated area specified above is to extend outside to the waterline in light displacement in order to provide illumination for handling hoses at sea berths.
- (3) Levels of illumination over the rest of the working deck are to have an average minimum lighting intensity of 10 lux when measured on a parallel with and 1 m above the deck.
- (4) For ships operating ship to ship transfer, levels of illumination over the deck and operation area, such as ship's mooring area and cargo hoses connecting area, are not to be less than 5 candelas or 5 lumens when measured on a parallel with and 1 m above the deck.

Notes:

The lux is the unit of illuminance. It can be measured by a lux metre directly.

The candela is the unit of luminous intensity.

The lumen is the unit of luminous flux.

For objects illuminated by lights evenly, when the luminous flux in 1 m² is 1 lumen, the illuminance is 1 lux.

8.6 Gas welding equipment

8.6.1 The gas welding equipment, oxygen and acetylene cylinders, are to be kept in separate storage rooms. However, they may be stored in the same compartment during the operation of gas welding equipment when the distance between oxygen and acetylene is not less than 1 m.

8.6.2 Piping of oxygen and acetylene are to be of steel welded construction. Copper, rubber or braided lines are not to be used, except that braided lines may be used for the short length from the cylinder heads to the manifolds within the storage space. Pipework and fittings are to be free of grease.

8.6.3 Oxygen and acetylene cylinders are to be stored in well-ventilated segregated storage spaces outside the accommodation and engine room.

8.6.4 Oxygen will not burn or explode, it only supports combustion; however, a small amount of excess oxygen will allow materials which are not normally combustible to burn with ferocity. Industrial oxygen cylinders are painted blue. Acetylene is 92.3% carbon and 7.7% hydrogen, is lighter than air and is highly flammable with a LEL of 2.5%. Acetylene cylinders are painted maroon.

8.6.5 Oxygen and acetylene cylinders are to be stowed away from heat sources and are not to be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps are to remain on cylinders not connected for use.

8.6.6 Full and empty cylinders are to be segregated. Cylinders are to be stored with the valve end up. Storage areas are to be free of combustible material and not exposed to salt or other corrosive chemicals.

8.6.7 Long lengths of piping are to be fitted between the cylinders and the blowtorch. Flashback arrestors are to be fitted between the cylinders and the workstation. Additional flashback arrestors may also be fitted at the cylinders.

8.6.8 Generally two flashback arrestors are required to be fitted at the cylinders and the workstation respectively. The fitting of flashback arrestors can also follow recommendations from the USA Operational Safety and Health Admin (OSHA), the UK Health and Safety Executive and other national safety authorities.

8.7 Safety facilities

8.7.1 The deck of tankers is prone to slip and fall accidents. Owners, operators and crew members are to pay special attention to prevent slip and fall accidents of working personnel who are operating equipment or when circumstances are changed. Non-slip surface and gratings are required in the area mentioned above.

8.7.2 The working area and access thereto, including the following area, are to be fitted with non-slip surface and gratings:

- (1) manifold area;
- (2) sounding and sampling area of handle drip type;
- (3) walkways;
- (4) walkways above the piping.
- (5) Access, ladderway, and hatchway are to be designed as such to minimize accidents mentioned above. The structure is to avoid metal protruding edge on the top of the ladders and unevenness of the stairs of the ladders as far as possible.
- (6) All tops where metal protruding edges exist are to be painted in different colors, marking clearly: "Dangerous area prone to trip, slip, and fall, or where metal protruding edges exist".



Figure 8.7.2 Non-slip surface and gratings

8.7.3 Walkways in non-slip areas are to be clearly marked as indicated by figures below:



Figure 8.7.3a The mark of a walkway in a non-slip area



Figure 8.7.3b The mark of a walkway in a non-slip area

8.7.4 When the airborne concentration of toxic gas is likely to exceed Time Weighted Average of Threshold Limited Value (TLV-TWA), respiratory equipment is to be provided and procedures are to be made on the application of respiratory equipment.

8.7.5 Flashlights suitable for use in flammable atmospheres are to be used on board ships.

8.7.6 Flashlights suitable for use in flammable atmospheres are to be approved by a competent organization recognized by the Administration.



Bright Star Approved Safety Flashlight

Figure 8.7.6 Approved safety flashlight

8.7.7 UHF/VHF portable transceivers are to be of an intrinsically safe type and equipped with all international and U.S. marine channels.

8.7.8 During ship to ship transfer, three fixed and independent VHF sets are to be provided, two on the navigation bridge, and one in the cargo control room.

8.7.9 Emergency escape breathing devices (EEBDs) are to be provided for personnel working in hazardous area. The devices are to be light and quick to wear once toxic gases are detected.

8.7.10 Respiratory equipment is to be provided for personnel working under the following circumstances:

- (1) Whenever they are at risk of being exposed to hydrogen sulphide (H₂S) vapours in excess of the TLV-TWA.
- (2) When TLV-TWAs specified by national or international authorities are likely to be exceeded.
- (3) When monitoring cannot be carried out.
- (4) When closed operations cannot be conducted for any reason.

8.7.11 Signs are to be posted in conspicuous positions. Signs can be illustrated by words or pictures. It is recommended to combine words with pictures.



Figure 8.7.11a Signs onboard ships



Figure 8.7.11b Signs onboard ships

8.7.12 All vessels are to carry at least the following portable gas detection equipment:

- (1) two explosimeters;
- (2) two oxygen analysers;
- (3) toxic gas detection devices or analysers suitable for the range of products being carried;
- (4) One Measurement Systems Analysis (MSA) tankscope or equivalent for measuring hydrocarbons on vessels operating with IGS. Two units are strongly preferred;
- (5) Personnel working in hazardous areas or areas where toxic gases concentrate are to be provided with multi-gas detectors with alarms;
- (6) Tankers constructed on and after July 1, 2002 are to at least be provided with one portable flammable gas concentration measuring device and sufficient spares. Means are to be provided to calibrate these instruments: two oxygen analysers, two hydrocarbon gas concentration (percentage of volume), LEL and toxic gas analysers.

8.7.13 Testing devices for calibrating measuring devices and instruments are to be provided onboard ships, such as specimen gas.

8.7.14 For ships with double wing ballast tanks and/or double bottom ballast tanks, means are to be provided to detect flammable gas into the atmosphere at outlets of vent pipes of ballast tanks and to inert (fitted with IGS) and purge air.

8.8 Personal protective equipment (PPE)

8.8.1 All personnel engaged in cargo operations are to wear suitable protective clothing and equipment.

8.8.2 Protective clothing is to at least include overalls or equivalent clothing covering all skin, safety footwear, protective goggles and safety helmets.

8.8.3 Protective equipment is to include lifejackets or equivalent life-saving appliances.

8.8.4 PPE, including breathing apparatus, is to be free from the influence of the weather and clearly marked.

8.8.5 Ships are to carry PPE, including clothing, protective footwear and safety helmets, for visitors.

8.8.6 Ships are to carry testing devices to check the air quality of breathing apparatus of PPE.

8.8.7 Ships are to carry sufficient fire-fighter's outfits. If recharging devices are provided for the cartridge of fire-fighter's outfits, means are to be provided to check the air quality.

8.9 Prevention of the dangers of static electricity

8.9.1 The most important strategy in the prevention of the dangers of static electricity is to bond all equipment with metallic objects (bonding). This strategy rules out the hazard of an incentive discharge between possible current-carrying objects and insulated objects. To avoid conductors discharging electrostatic to earth, common practices also include earth bonding, i.e. earthing. Effective earthing onboard ships is to connect all metallic objects with metal structure of the hull. The hull is earthed through seawater.

8.9.2 The following objects may be insulated objects in hazardous environment and thus must be bonded:

- (1) butt connection and flange of cargo hoses connecting ships and terminals, insulating flange for connection between ships and shores, except when insulated non-conductive hoses are provided;
- (2) moveable tank washing machines;
- (3) manual ullage gauges and sampling devices of tanks (moveable gauging and measuring devices);
- (4) automatic ullage gauges, such as float type when metal tapes as a means of earthing is lacking;
- (5) bonding is connecting all conductors with metallic materials, or using other bonding methods which have been proved effective in practice, such as semi-conductive (dissipation type) piping and O-ring, instead of using embedded sheet metal in GRP piping and metallic butt connectors thereof;
- (6) safety measures are to be taken when equipment is fitted to avoid electrostatic hazard of moveable equipment;
- (7) All earthing or bonding can only be disconnected when the equipment is out of use.

8.9.3 For ship/shore measures to prevent electrostatic built-up, while some national and local regulations still require mandatory connection of a bonding cable, OCIMF strongly recommended the use of a insulating flange. Various measures to prevent electrostatic built-up are to be considered onboard ships.



Figure 8.9.3a Bonding cable installations on shore



Figure 8.9.3b Bonding installations onboard ships

8.9.4 Some countries forbid the use of cables in bonding and require using insulating flange as mandatory. In principle the regulations of the Administrations are to be obeyed. Insulating flange is strongly recommended. Ships are to consider various suitable precautions of static electricity.

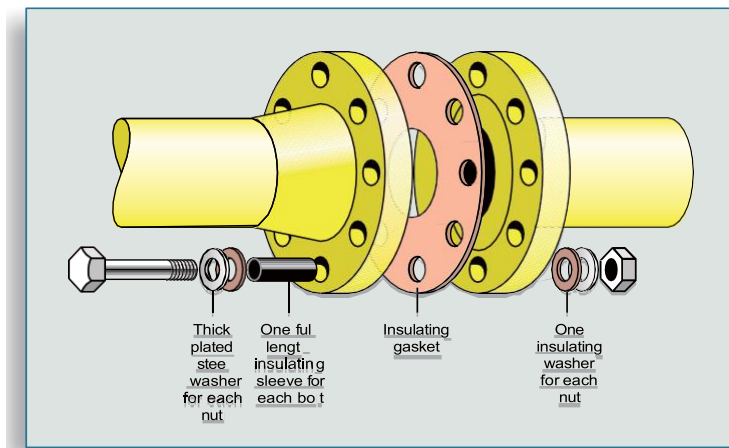


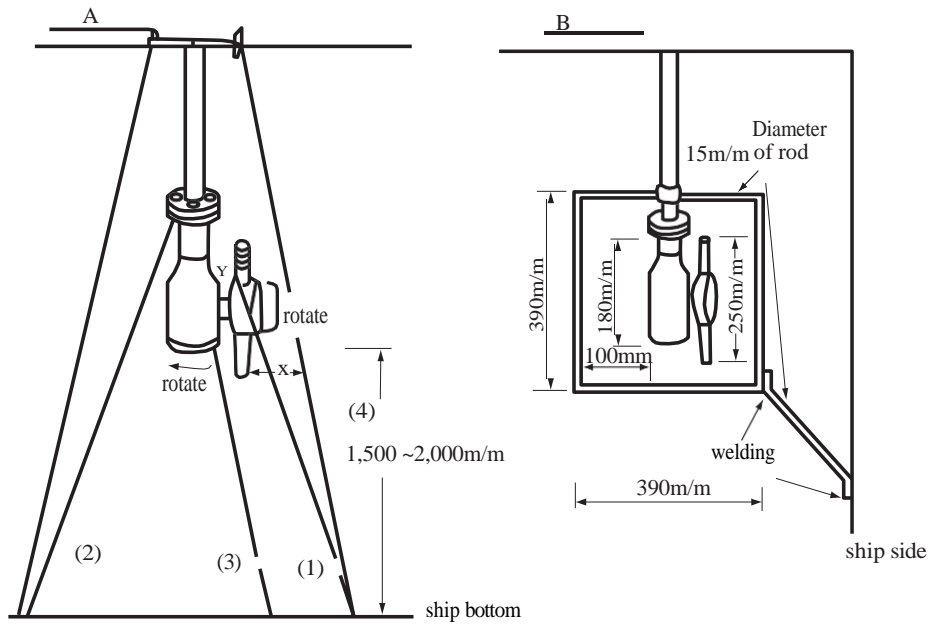
Figure 8.9.4 Ship/shore insulating flange

8.9.5 Cargo area spaces, such as forecastle storage rooms and stores, if openings (such as doors, windows or other similar openings) facing cargo areas are fitted, lights and electrical equipment in the spaces are to be of safe type.

8.9.6 Any metal that is far from tank structure or in close proximity to surface of liquid containing high concentration of electricity, in particular non-inerted tanks carrying goods that build up electrostatic, any protrusion therein, such as hot water tank washing machines, sensors for gauging, pressure and temperature, steam pipelines, drainage pipelines, level sounding and other equipment, are to be earthed.

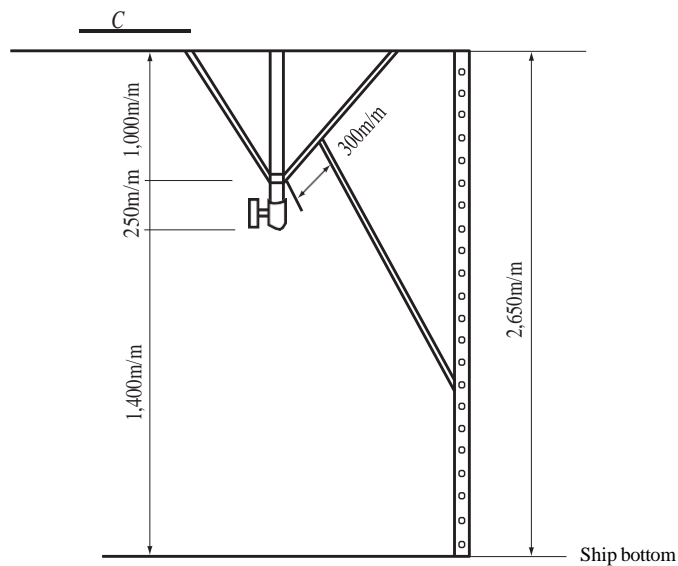
8.9.7 Earthing of installations in cargo tankers is to be firm. Common practices are as follows:

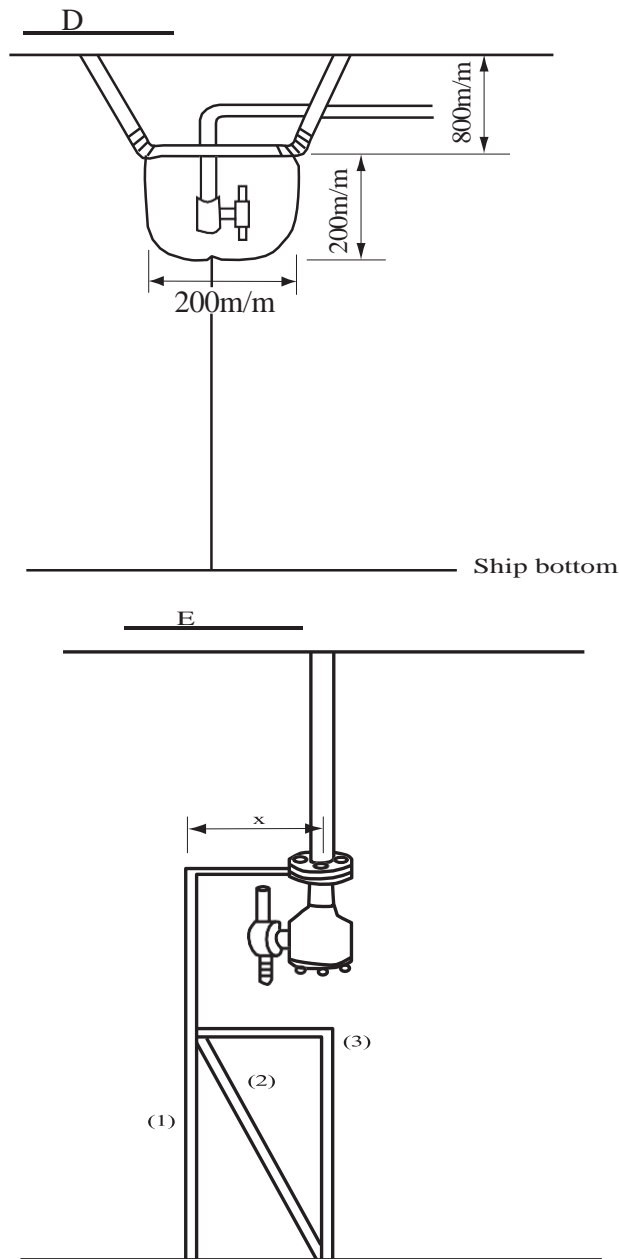
- (1) Earthing arrangements of moveable hot water tank washing machine:



- ① Figure A: (1) metal wires the diameter of which is 3 mm or above, wind the nozzle of the tank washing machine 2 or 3 times on one end, the other end secured on the member of the ship bottom. Tank washing machines are to be installed before arriving at ports and removed after the tank washings is discharged.
- ② Figure A: (2) and (3) are earthed as (1), using stainless steel wire to earth. Tank washing machines are to be installed before arriving at ports and removed after the tank washings is discharged.
- ③ Figure A: (4) stainless steel rod the diameter of which is 3 mm or above, is earthed in three parts from the top to the bottom of the tank. Metal rod is to be in a position untouchable from the fore end of the tank washing machine when working.

(2) Fixed tank washing machines use earthing:

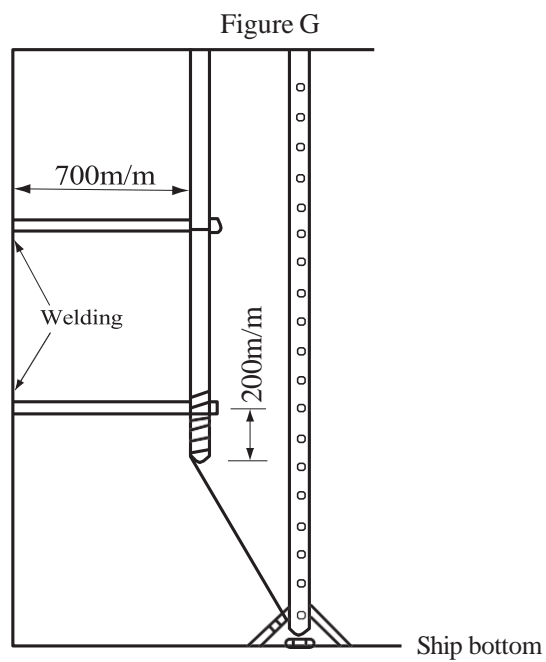
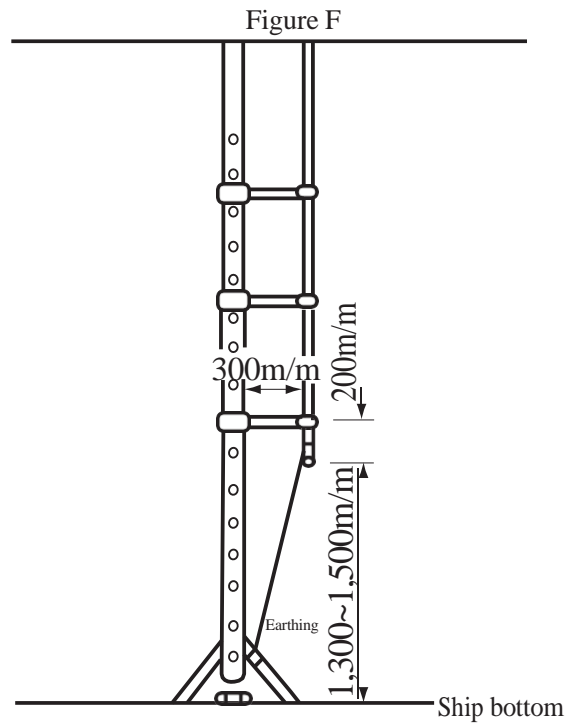




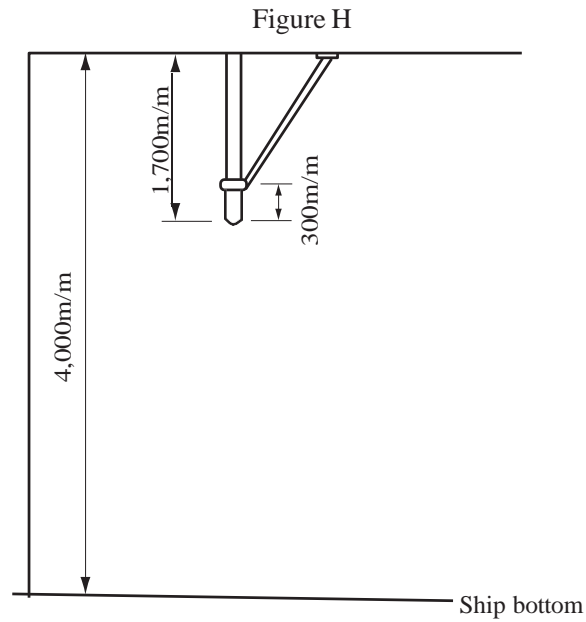
- ① Figure C: The fixed tank washing machine has been earthed to the bottom.
- ② Figure D: The fixed tank washing machine may not be earthed.
- ③ Figure E: The arrangements of (1), (2) and (3) are acceptable, providing that the distance (x) of the centerline of the tank washing machine from members of the bulkhead is less than 300 mm.

(3) Earthing arrangements for thermometer:

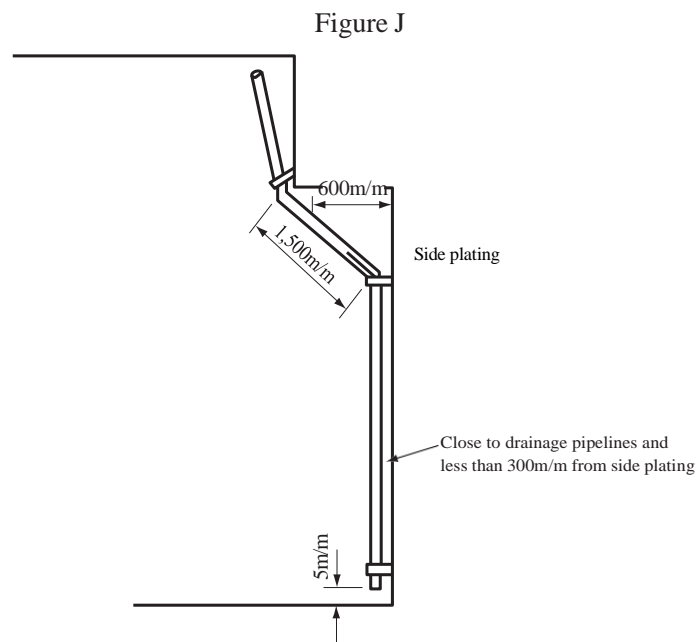
- ① Figure F: Stainless wire the diameter of which is 3 mm is used to earth the metal rod of thermometer to the top and the bottom of the tank.
- ② Figure G: Both ends of thermometer are earthed while plank and other parts may not be earthed; 200 mm at the end of thermometer is earthed by metal while members may not be earthed; ends that do not exceed plank may not be earthed.



- (4) Earthing arrangements for steam pipelines:
 Figure H: Earthing through plank may be considered



- (5) Earthing arrangements for drainage pipelines:



- (6) Earthing arrangements for other installations:

- ① Figure L: Draining valve is to be less than 300 mm from members, otherwise it is to be earthed; or height of the protrusion downwards is to be kept to the minimum.

- ② Figure M: Flange is bonded from the top or transversely.
- ⑤ Figure N: Pipeline plank downwards may be fitted from the top of the tank. Both ends of plank (protrusion) are to be less than 100 mm.
- Í Figure P: All connecting members, such as cotter pins and bolts, are to be of good workmanship.

Figure L

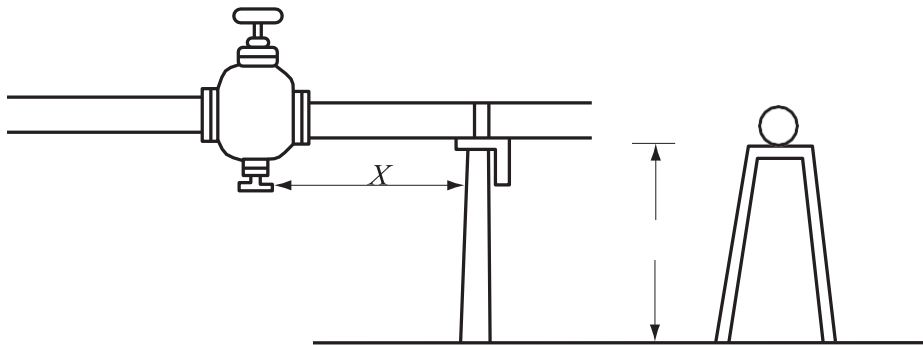


Figure M

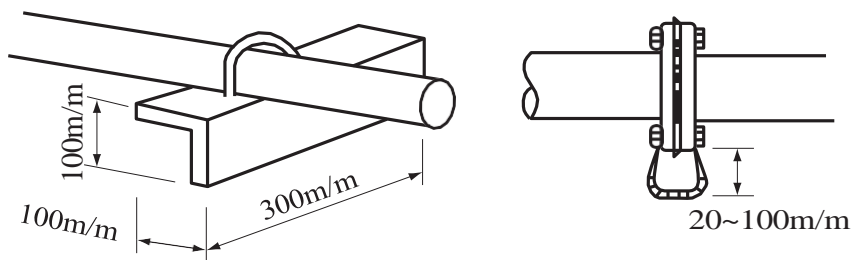
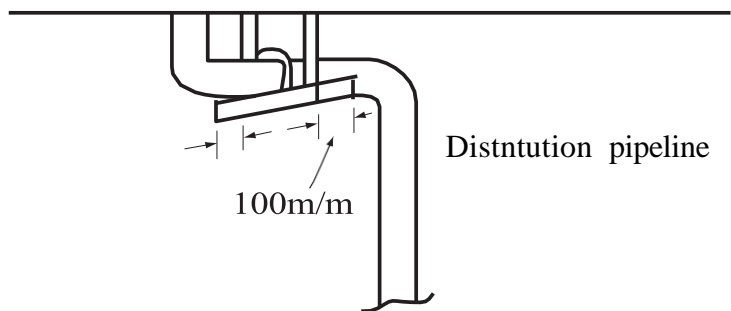
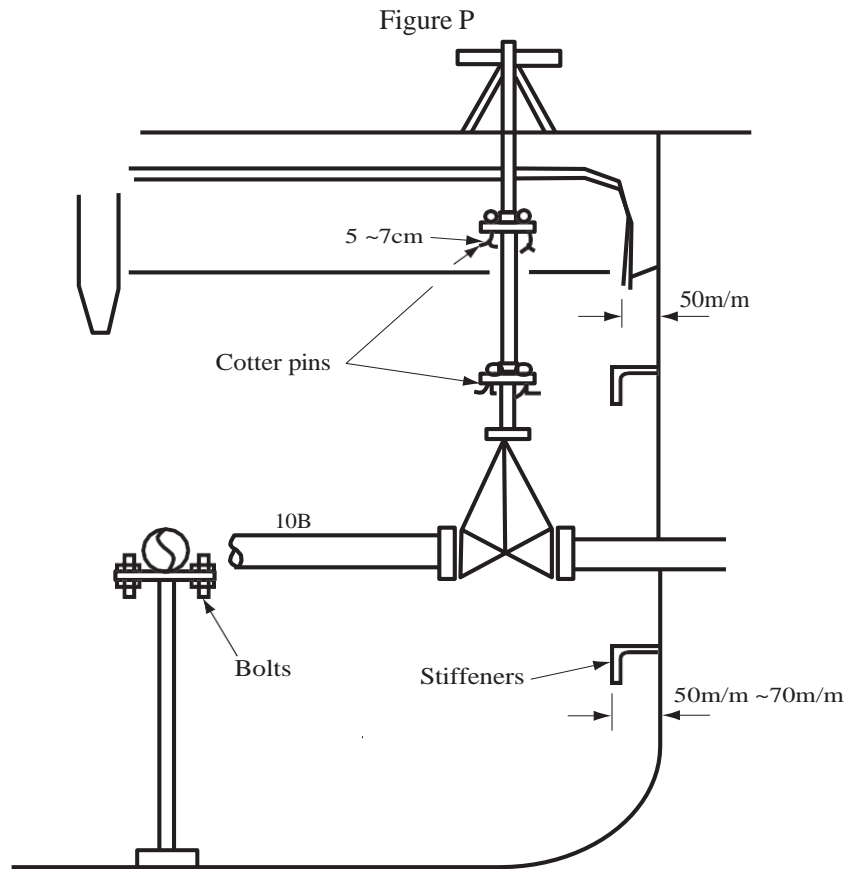
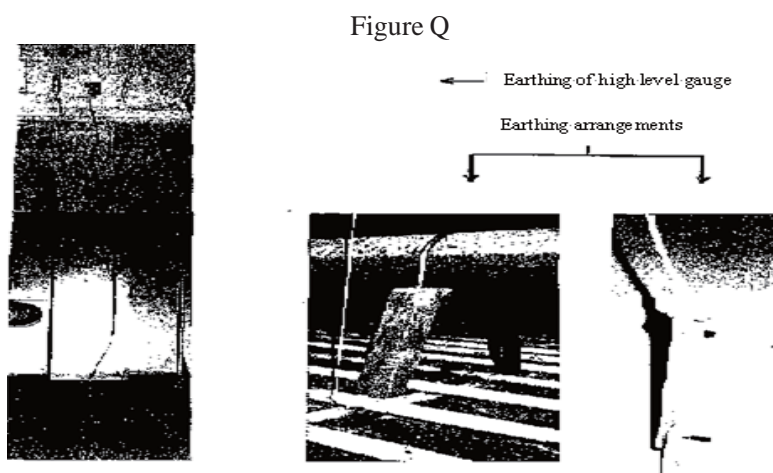


Figure N





(7) Earthing arrangements for level sounding gauge:



8.10 Helicopter and ship operations

8.10.1 A landing area is the area where a helicopter can land directly. Landing areas can usually be arranged as shown in Figures 8.10.2 and 8.10.3 below.

8.10.2 According to Guide to helicopter/ship operations of International Chamber of Shipping (ICS), landing areas are to comply with the following requirements:

- (1) Mark three concentric circles with solid lines as below. These circles form the landing area and are to be painted yellow.
- (2) Inner circle: aiming circle the diameter of which is $0.5D$, no obstruction higher than 0.1 m.
- (3) Middle circle: clear zone the diameter of which is D , no obstruction higher than 0.25 m.
- (4) Outer circle: manoeuvring zone the diameter of which is $1.3D$, no obstruction higher than 1.25 m.
- (5) The letter 'H' is to be painted at the center of inner circle (aiming circle) in white, forming a letter of dimensions 3.6×1.8 m.
- (6) Middle circle (clear zone) is divided into four parts by white paint, as shown by the Figure below.
- (7) Where a landing area is in the middle of the ship, no obstruction is allowed from the ship's side to the landing area.

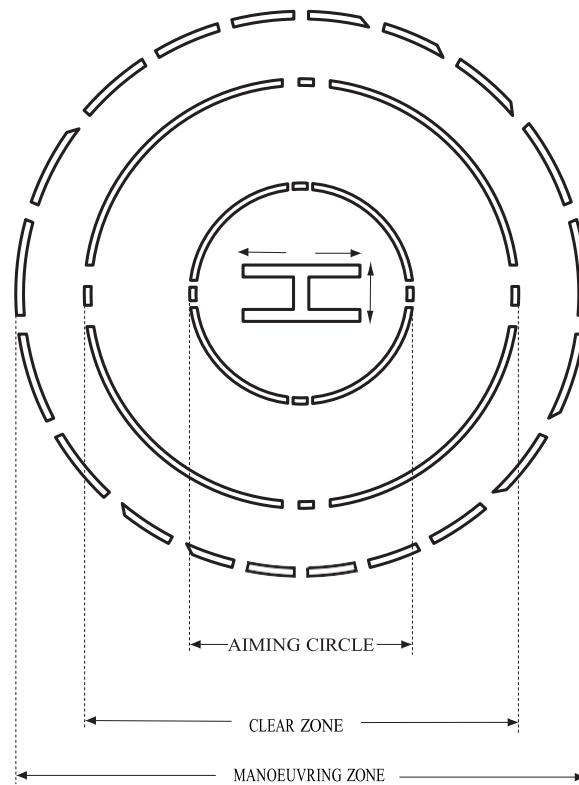


Figure 8.10.2 Landing area without unobstructed access from ship's side

8.10.3 Generally landing areas may be arranged in a suitable position off the centerline as indicated by the figure below. Shiplide rails close to landing areas are to be able to collapse inwards.

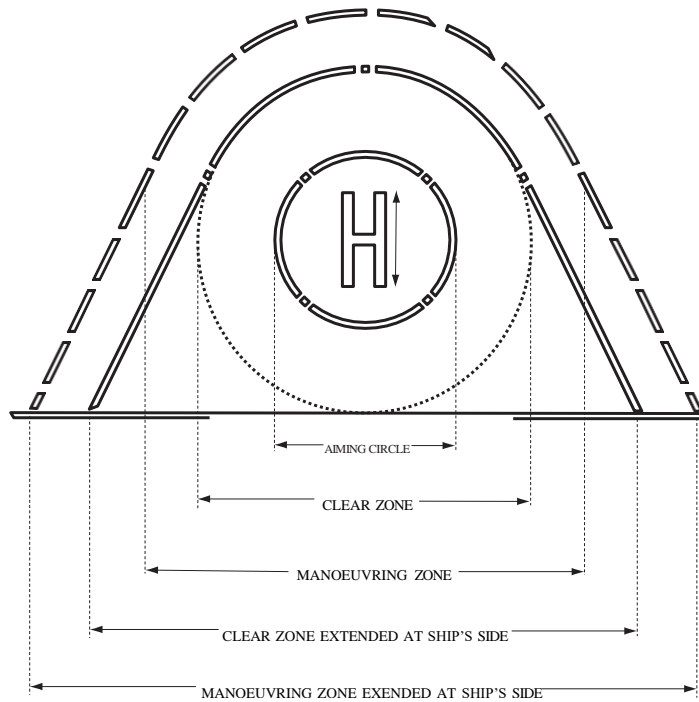


Figure 8.10.3a Landing area at ship's side



Figure 8.10.3b Arrangement of landing area onboard ships

8.10.4 Winching areas are the areas over which a helicopter can hover while winching people to or from the ship.

8.10.5 According to Guide to helicopter/ship operations of International Chamber of Shipping (ICS), winching areas are to comply with the following requirements:

(1) Inner zone is the clear zone with a minimum diameter of 5 m. The clear zone is to be marked with a solid yellow line and be clear of all obstructions.

- (2) Outer zone is the manoeuvring zone the diameter of which is $2D$. The manoeuvring zone is to be marked with a broken yellow line. Ideally there is to be no obstructions in the manoeuvring zone higher than 3.0 m.
- (3) Obstructions of not higher than 6 m may be permitted in the outer part of the manoeuvring zone between $1.5D$ and $2D$.
- (4) Obstructions in the manoeuvring zone are to be painted distinctively in colors contrasting with other paintwork.
- (5) Manoeuvring zone is to be marked with the words 'WINCH ONLY' in white letters.
- (6) Arrangement of winching area is shown as the figure below:

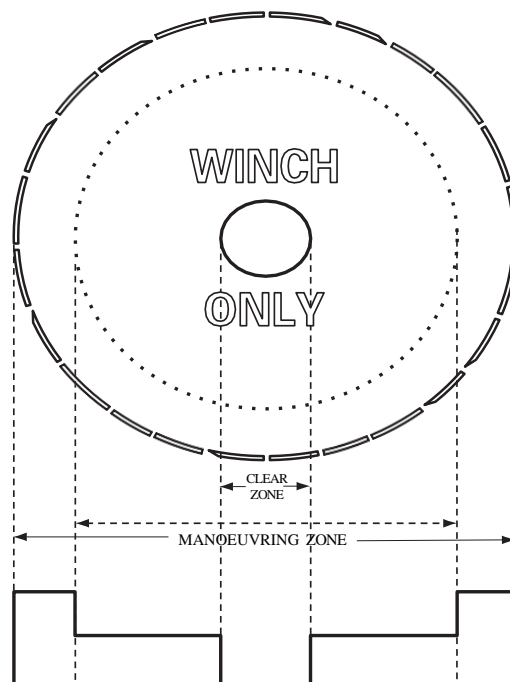


Figure 8.10.5a Winching area



Figure 8.10.5b Arrangement of winching area onboard ships

8.10.6 The clear zone of the landing area is to be as large as practicable. D quoted above refers to the overall length of a helicopter or the diameter of rotors of a helicopter.

8.10.7 The following fire fighting equipment are to be available during all helicopter operations. The equipment may be the existing equipment onboard ships:

- (1) at least two dry powder extinguishers with an aggregate capacity of not less than 45 kg;
- (2) a suitable foam application system (fixed or portable) capable of delivering a foam solution at a rate of not less than 6 litres per minute for each square metre of clear zone for at least 5 min;
- (3) carbon dioxide (CO₂) extinguishers with an aggregated capacity of not less than 18 kg;
- (4) a deck water system capable of delivering at least two jets of water to any part of the helicopter operating area;
- (5) at least two fire hose nozzles which are to be of the dual purpose type;
- (6) fire resistant blankets and gloves;
- (7) sufficient fire proximity suits.

8.10.8 The following auxiliary facilities are to be available during all helicopter operations:

- (1) large axe (fire axe);
- (2) crowbar;
- (3) wire cutters;
- (4) red emergency signal/torch, marshalling batons;
- (5) first aid equipment.

8.10.9 For very large crude carrier (VLCC) or ships of 175,000 DWT to 320,000 DWT, and ultra-large crude carrier (ULCC) or ships of 320,000 DWT to 600,000 DWT, landing areas are to be designed according to the maximum overall length of commercial helicopters (with rotors) in marine use.

8.10.10 The minimum overall length of helicopters in marine use (with its rotors) is 12 m, the maximum 22 m. Table 8.10.10 lists commercial helicopters in marine use:

Commercial helicopters in marine use **Table 8.10.10**

No.	Helicopter Type	Overall Length (<i>D</i>) (in m)
1	Bell 206*	11.9
2	Bolkow 105D	11.9
3	Aerospatiale SA 316/319 Alouette 3*	12.8
4	Aerospatiale AS 350 Squirrel*	13.0
5	Aerospatiale AS 355 Twin Squirrel	13.0
6	MBB-Kawasaki BK117	13.0
7	Bell 206L*	13.0
8	Agusta 109	13.1
9	Aerospatiale SA-365C Dauphin 2	13.3
10	Aerospatiale SA-365N Dauphin 2	13.5
11	Bell 222A	14.7
12	Bell 222UT	15.3
13	Westland W30-100	15.9
14	Sikorsky S-76	16.0
15	Bell 412	17.1
16	Bell 204/205*	17.5
17	Bell 212	17.5
18	Aerospatiale 330J Puma	18.2
19	Aerospatiale 332L Super puma	18.7
20	Bell 214ST	19.0
21	Sikorsky S58T	20.1
22	Sikorsky S61N	22.3

*single engined

Notes: 1. This is not an exhaustive list of helicopters which may be encountered in marine use. It is essential that the type and overall length of a helicopter as known before it is accepted by the ship.

2. The figure quoted (*D*) is the overall length of the helicopter (with its rotors).

8.11 Safety of navigation

8.11.1 Equipment showing rate of revolution of main engines are to be available in the navigation bridge.

8.11.2 For ships of 25 m more in breadth, the following equipment are to be fitted at the wings of the navigation bridge:

- (1) Rudder indicators;
- (2) Propeller speed indicators;
- (3) Working condition indicators of controllable pitch propeller (including controllable pitch propellers of side thrusters) (if applicable).

8.11.3 Vessels are to have a means to provide warning if the vessel deviates off her intended course; e.g. GPS cross track error, autopilot alarm etc. An independent magnetic off course alarm is strongly preferred.

8.11.4 Tankers above 160,000 DWT are to be fitted with dual Doppler logs and rate-of-turn indicators. The rate-of-turn indicators may include vessel speed.

8.11.5 It is strongly preferred that vessels have two gyro compasses or, one gyro compass and one transmitting magnetic compass.

8.12 Operational safety

8.12.1 Cargo control rooms are to be fitted with remote control devices for cargo system, ballast system and inert gas system, remote level reading devices of cargo tanks, remote control devices for rates of cargo and ballast pumps.



Figure 8.12.1 Control panel for cargo and ballast operations in cargo control room

8.12.2 Cargo control rooms are to be fitted with alarms and indicators for cargo and ballast operations, indicators for valves, as well as control and alarms for the gas detection system.



Figure 8.12.2a Alarm panel for high level and high high level in cargo control room

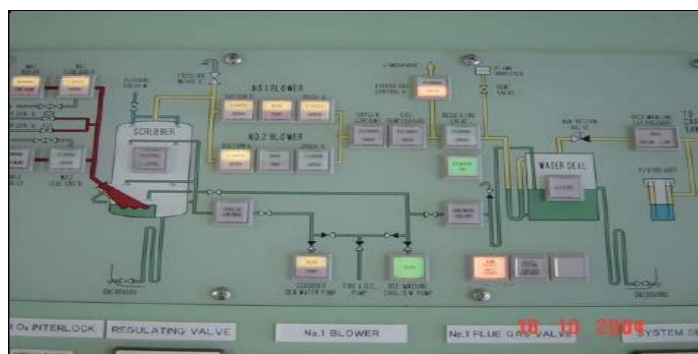


Figure 8.12.2b Control panel for inert gas system in cargo control room



Figure 8.12.2c Control panel for inert gas system in cargo control room



Figure 8.12.2d High level indicators in cargo control room

8.12.3 Cargo control rooms are to be fitted with indicators for wind speed.

8.13 Life-saving appliances

8.13.1 Additional liferafts stowed at the stem or stern of the ship are to be stowed as far forward or aft as practicable so as to facilitate release and boarding.

Notes:

(1) Stem is to be forecastle areas. For ships without forecastle, stem is to be the area forward of the bulkhead of the first cargo tank. In principle stem is not to be in the cargo areas. Stern is to be aft house areas, generally aft of accommodation spaces.

(2) Liferafts are to be capable of quick release from the stowage deck, i.e. such liferafts are not necessary to be lifted higher than bulwark or rails to be released. In principle detachable rails or openable bulwark may be used.

(3) Embarkation areas at the stem or stern are to be provided with embarkation facilities and emergency lighting.

8.13.2 Lifebuoys capable of quick release are to be of sufficient weight (generally over 4 kg) and be fitted with self-activating smoke signals and lights. This kind of lifebuoys is to generally be arranged in the navigation bridge and be released backwards or towards both sides of the ship.

8.13.3 Embarkation areas are to be provided with lifebuoys with self-activating lights and buoyant lifelines.

8.13.4 Self-activating lights fitted on lifebuoys are to be of intrinsic safe type.

8.14 Machinery spaces

8.14.1 Hydraulic oil pumps driving hydraulic machinery (e.g. deep-well pumps, mooring winches, deck machinery and anchor windlasses), if fitted in machinery spaces, are to be provided with oil mist detectors, unless such spaces are independent spaces.

Chapter 9 Lifting Equipment

9.1 General requirements

9.1.1 Owners and operators of tankers install lifting equipment mainly because their major task is to lift cargo hoses. Therefore, lifting capacity of lifting equipment of tankers is to be sized according to scantlings of ships and types of cargo hoses. The minimum safety working loads (SWLs) are as follows:

- (1) Up to 16,000 DWT: 5 t SWL;
- (2) 16,000 DWT to 60,000 DWT: 10 t SWL;
- (3) 60,001 DWT to 160,000 DWT: 15 t SWL;
- (4) above 160,000 DWT: 20 t SWL.

9.2 Operation performance

9.2.1 The lifting equipment is to be fail-safe in the event of loss of power.

9.2.2 The lifting equipment is to slew both ways by power (not manually) under load, both when topping and lowering and when not topping and lowering.

9.2.3 The hook and runner are to run free without manual intervention under conditions of no load.

9.2.4 The lifting equipment is to lift and lower at a rate at the hook of between 10 and 15 m per minute under load and approximately 20 to 30 m per minute under conditions of no load.

9.2.5 The lifting equipment is to operate smoothly during lifting or lowering to a fineness of control of a maximum of one inch at the hook. The equipment is to have a similar smoothness of operation when slewing.

9.2.6 During cargo operations or ship to ship transfer operations, the lifting equipment is to lift cargo hoses and maintain at a suitable height.

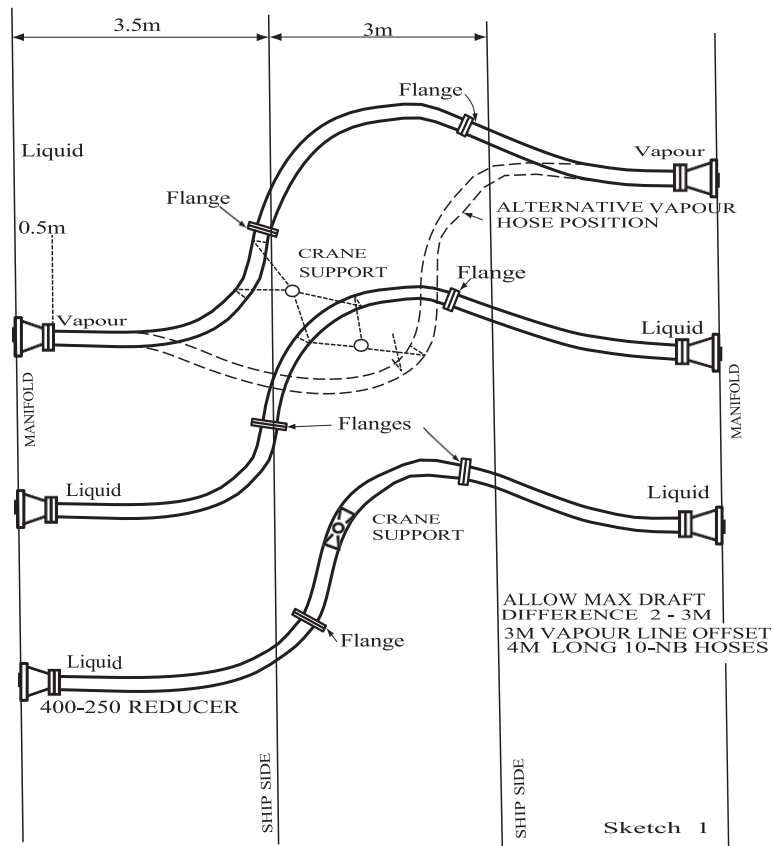


Figure 9.2.6a Lifting equipment lifts cargo hoses and maintain at a suitable height in ship to ship transfer operation

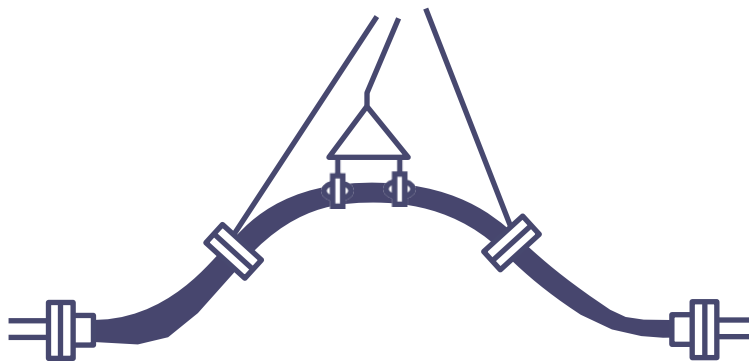


Figure 9.2.6b Cargo hose lifted and maintained at a height in cargo operation

9.2.7 The lifting equipment can be operated from a central control position for all functions— lifting and lowering, topping and lowering and slewing. The duplicated control position at the ship’s side enables the operator to see all stages of the operation.

9.2.8 The operator can see the hook or shackle on a single part of wire at the water’s edge.

9.2.9 All operations—lifting and lowering, topping and lowering and slewing—are to be carried out by a single winch complex.

9.2.10 For lifting equipment of other types, such as derricks, all slewing operations are to be operated by a single winch. All operations—lifting and lowering, topping and lowering and slewing—are to be carried out by a single winch complex.

9.3 Special circumstances

9.3.1 Because of offshore oil exploitation, tankers often carry out cargo operations with offshore facilities, lifting oil hoses from the sea bottom in particular, requiring lifting equipment of tankers above 60,000 DWT to have a 7 m outboard reach from ship's hull.

9.3.2 Lifting equipment is to provide a clear lift 10 m above the freeboard deck.

9.3.3 Although OCIMF has requirements on working capacity and performance of lifting equipment of tanks specified in Recommendations for oil tanker manifolds and associated equipment, requirements of the flag State or international regulations may be in excess of the above recommendations and are to be observed in the event of conflicting criteria.

9.3.4 For ships which have cargo operations in marine terminals, and ships above 16,000 DWT in particular, the minimum SWL of lifting equipment is 15 t.

Appendix A Approximate Methods for Determining the Strength and Number of Mooring Lines for New Ships in the Design of Ship's Mooring Equipment

1.1 General considerations

1.1.1 The Guideline assists in the determination of the strength and number of mooring lines for new ships in the design of ship's mooring equipment. Appendix A is the approximate methods for determining the strength and number of mooring lines for new ships in the design of ship's mooring equipment provided in Mooring Equipment Guidelines 2nd edition (MEG2). The parameters and calculation methods are also detailed in the 2nd and 3rd editions of MEG.

1.2 Standard environmental criteria

1.2.1 For tankers above 16,000 DWT intended for international voyages, standard environmental criteria used in the calculation of forces on the ship in the design stage are to be sufficient to satisfy the following conditions promulgated by OCIMF:

60 knots wind (having a mean velocity of 30 m/s) from any direction simultaneously with:

3 knots current at 0° or 180°; or

2 knots current at 10° or 170°; or

0.75 knots current from the direction of maximum beam current loading.

For tankers, water depth to draft ratios for these conditions is to be taken as 1.1 when loaded and 3.0 when in ballast. The average draft in ballast is about $0.02 Lbp + 2m$.

For gas carriers above 150 m in length the same standard environment criteria are to be applied. The water depth to draft ratio may be taken as 1.1 for all conditions.

Wind velocity is the velocity measured at the standard datum height of 10 m above ground or water surface and is representative of a 30 second average mean velocity.

The current velocity is to be taken as the average velocity over the draft of the ship.

1.3 Calculation of forces

Environmental loads of wind and current can be calculated as follows.

1.4 Mooring forces

Having determined the environmental forces acting on the ship, it is necessary to calculate the strength and number of mooring lines required to balance these forces.

Computer programs are widely available to calculate mooring forces for any combination of wind and current speeds and angles. These calculations are especially suitable to explore the adequacy of the mooring equipment of a ship at a terminal known to have unusual environmental conditions or mooring geometry.

In practice it is often necessary to evaluate a ship's mooring equipment without the detailed knowledge of all ship and berth parameters. For this purpose the formula quoted below may be used, providing the underlying assumptions on which they are based are applicable.

Assumptions:

- (1) Environmental conditions correspond to the standard criteria
- (2) The mooring layout follows good mooring practices. A layout efficiency factor based upon experience with good layouts has been used.

$$\text{Efficiency} = \frac{\text{restraint capability of line group}}{\text{max. load in any one line} \times \text{no. of lines in group}}$$

Line groups are broken down into spring lines, forward breast lines and aft breast lines. One hundred percent efficiency would represent equal length breast lines at 90° to the longitudinal axis of the ship and equal length spring lines parallel to the longitudinal axis, all in the horizontal plane.

The following efficiencies are assumed:

Spring lines 0.90, breast lines 0.70

- (3) All mooring lines are of steel.
- (4) The maximum allowable tension in any one line is 55% of the minimum breaking load of the line, and the winch brakes must be capable of holding this load.
- (5) Springs and breast lines are arranged symmetrically about midships so that the forward number of lines is equal to the aft number.

1.4.1 Mooring restraint requirements for oil tankers above 160,000 DWT

1.4.1.1 Wire systems

$$\text{Spring lines: } S \times MBL = 1.992A_{TB} + 0.369(0.01L_{BP}^2 + L_{BP})$$

$$\text{Breast lines: } BR \times MBL = 1.476A_{LF} + 1.291TL_{BP}$$

where:

- S — total number of spring lines;
- BR — total number of breast lines;
- MBL — minimum breaking load of each line in kN;
- T — maximum (summer) vessel draft;
- A_{TB} — transverse above water area in the ballast condition, in m²;
- L_{BP} — length between perpendiculars in m;
- A_{LF} — longitudinal above water area in the full load condition, in m².

1.4.1.2 Synthetic line systems

According to the *MBL* values of wires specified above, it is recommended that the *MBL* values be increased by 20% for nylon and by 10% for other conventional synthetic mooring lines. In case of newer, low stretch, synthetic material, the *MBL* values are to be increased as recommended by OCIMF.

1.4.2 Rough spring line restraint determination for oil tankers above 160,000 DWT when the ship's transverse or lateral wind area is unknown:

$$\text{Spring lines: } S \times MBL = 1.992DB - 0.0398L_{BP} + 19.9B + 40 + 0.369(0.01L_{BP}^2 + L_{BP})$$

$$\text{Breast lines: } BR \times MBL = L_{BP} [1.550(D - T) + 1.291T + 2.0664] + 517$$

where:

D — moulded depth, in m;

B — moulded breadth, in m;

S, *BR*, *MBL*, *T*, *L_{BP}* are the same as defined in 1.4.1.1.

1.4.3 Mooring restraint requirements for gas carriers

1.4.3.1 For a 75,000 m³ gas carrier:

$$S \times MBL = 2.228A_T + 0.170TL_{BP}$$

$$BR \times MBL = 2.012A_L + 1.291TL_{BP}$$

where:

A_T — transverse above water area in the mean ballast draft condition, in m²;

A_L — longitudinal above water area in the mean ballast draft condition, in m²;

S, *BR*, *MBL*, *T*, *L_{BP}* are the same as defined in 1.4.1.1.

1.4.3.2 For a 125,000 m³ gas carrier:

$$S \times MBL = 2.388A_T + 0.170TL_{BP}$$

$$BR \times MBL = 1.898A_L + 1.291TL_{BP}$$

where:

A_T, *A_L*, *S*, *BR*, *MBL*, *T*, *L_{BP}* are the same as defined in 1.4.1.1.

Appendix B Design Loads, Safety Factors and Strength of Mooring Equipment

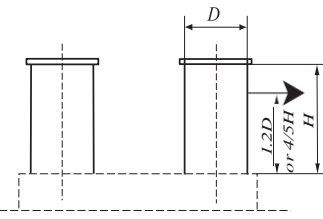
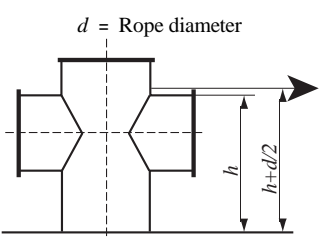
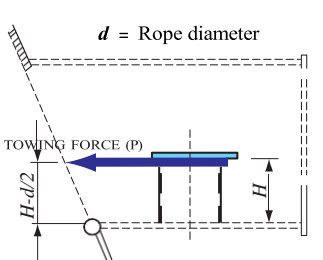
1.1 General

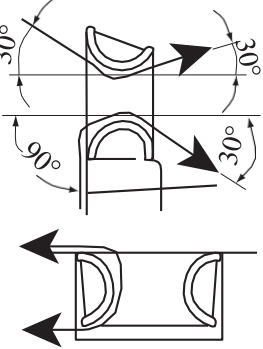
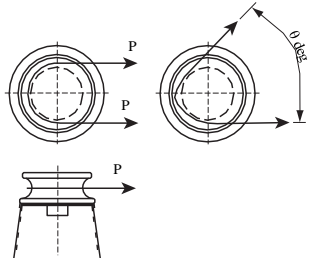
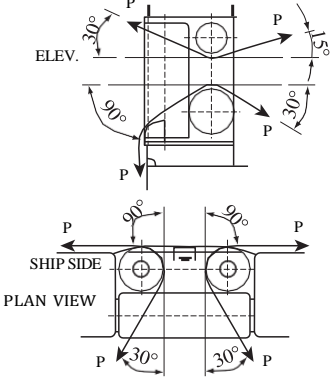
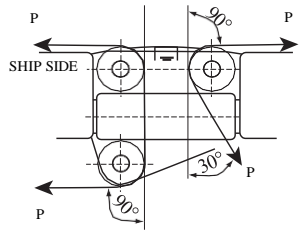
To determine the required design strength of a particular fitting or piece of mooring equipment, the following information is needed:

- (1) The design loads is equal to the Minimum Breaking Load (*MBL*) of the line. The Safety Working Load (*SWL*) that will be marked on the fitting is then normally equals to the *MBL*.
- (2) The magnitude, position and direction of application of the most severe load that can be applied to the fitting in service. The force given by this calculation is called the Design Basis Load (*DBL*).
- (3) The safety factor is specified on the stresses caused in the fitting by the *DBL*. It provides a margin of safety against the permanent deformation (yield) of any part of the fitting or its attachments to the ship.

1.2 Recommended design criteria

- (1) Mooring fitting

Fitting	Diagram	Geometric Factor	Load Position	Marked SWL of Fitting	Design Basis Load	Stress Limit	Test Load
Bits (Double Bolland)		2.00	1.2D above base of a bitt of diameter 'D'	MBL	DBL = MBL×GF	85% of SMYS	DBL
Cruciform Bolland		1.00	Cross bar height+0.5 rope diameter	MBL	DBL = MBL×GF	85% of SMYS	DBL
Recessed Bitt		1.00	Top of Bitt	MBL	DBL = MBL×GF	85% of SMYS	DBL

Fitting	Diagram	Geometric Factor	Load Position	Marked SWL of Fitting	Design Basis Load	Stress Limit	Test Load
Closed Chock		2.00	Outboard, horizontal $\pm 90^\circ$, vertical up 30° , down 90° Inboard, horizontal $\pm 90^\circ$, vertical $\pm 30^\circ$	MBL	$DBL = MBL \times GF$	85% of SMYS	DBL
Pedestal Fairlead		2.00 This value may be reduced if the actual angle is limited	180° wrap at upper end of cylinder or conical part of throat (at center of roller)	MBL	$DBL = MBL \times GF$	85% of SMYS	DBL
Universal Fairlead		2.00	Outboard, horizontal $\pm 90^\circ$, vertical up 30° , down 90° Inboard, horizontal $\pm 30^\circ$, vertical up 15° , down 30°	MBL	$DBL = MBL \times GF$	85% of SMYS	DBL
Fairlead (Closed Chock)		2.00	Outboard, horizontal $\pm 90^\circ$, vertical up 30° , down 90° Inboard, horizontal $\pm 30^\circ$ / 90° , vertical up 15° , down 30°	MBL	$DBL = MBL \times GF$	85% of SMYS	DBL

(2) Emergency towing arrangements

See the requirements of the Rules for classification of sea-going steel ships.

(3) Single point mooring equipment

See the above requirements, noting that test load is to be equal to SWL.

(4) Mooring winches

Fitting	Geometric Factor	Load Values and Position	Marked SWL of Fitting	Design Basis Load	Stress Limit	Test Load
Mooring Winch Frames, Foundations	GF=N/A	Split Drums: on first layer. Single Drums: normal working layer (second or third)	MBL	DBL = MBL	85% of SMYS	DBL
Mooring Winch Drum, Shafts, Bearings	GF=N/A	Split Drums: on first layer. Single Drums: normal working layer (second or third)	MBL	DBL = MBL	See note 1	DBL
Mooring Winch Drive Components	GF=N/A	N/A	MBL	DBL = Stall Load	See note 2	See ISO 3730
Mooring Winch Brakes	GF=N/A	Split Drums: on first layer. Single Drums: normal working layer (second or third)	MBL	DBL = 80% of MBL	85% of SMYS	DBL

- Notes: 1. Mooring winch drum, shafts and bearings are to be designed so that the maximum stress at DBL is $\leq 90\%$ of yield, or so that the maximum stress at rated pull is $\leq 40\%$ of yield, whichever is the most severe requirement (definition of 'rated pull' can be found in 1.5(1) of Appendix D) as per ISO 3730 parts 4.2.2 and 4.2.1 respectively.
2. Mooring drive components are to be designed so that the maximum stress at Stall load is $\leq 90\%$ of yield, or so that the maximum stress at rated pull is $\leq 40\%$ of yield, whichever is the most severe requirement (definition of 'rated pull' can be found in 1.5(1) of Appendix D) as per ISO 3730 parts 4.2.2 and 4.2.1 respectively.

Comparison of combined stresses with the 85% of yield criterion

$$\sigma_e = (\sigma_x^2 + \sigma_y^2 - \sigma_x \sigma_y + 3\tau^2)^{1/2} \leq 0.85\sigma_0$$

1.3 Strength test of mooring fittings

A manufacturer's test certificate is acceptable, unless the fittings have been manufactured strictly according to recognized standards such as test load, safety factor, load application, a load test is to be performed on one fitting of each type. A manufacturer's test certificate is acceptable if the test is witnessed by an independent authority (such as a Classification Society) and the witness certificate lists all details such as test load, load application, dimensions of scantlings and materials.

The test load is to be applied with a rope of adequate strength to allow a line tension equal to the 'test load'. Alternative arrangements are acceptable if the test load is equivalent to the resultant load from a line application.

The load test may be performed aboard the ship after all installation and structural reinforcements are completed.

1.4 Marking of mooring fittings

- (1) Mooring fittings are to be marked in order to provide ship operators with information on the strength of fittings.
- (2) Each fitting is to be clearly marked by weld bead outlined with its SWL. The SWL is to be expressed in tonnes (letter 't') and be located so that it is not obscured during operation of the fitting.
- (3) The ship is to be provided with all relevant information, including actual test load applied, geometry of load application, bitt strength, maximum size and MBL of application line or chain, test certificates, standard drawings, etc. Such information is to be incorporated in a mooring layout plan available on the ship.
- (4) The marked SWL is to correspond to the load in the associated line or chain. Therefore, the marked SWL will normally be the mooring line's MBL. It will not be the resultant load on the fitting which may be higher.

1.5 General recommendations

Recommendations for ship designers

- (1) Minimum safety factors listed in the table are to be incorporated in all new equipment and mooring fittings.
- (2) All equipment and fittings are to be clearly marked with their SWL.
- (3) The designer is to prepare a mooring layout plan.

Appendix C Reinforcements of Mooring Equipment and Ship Structure

1.1 Basic considerations

(1) Mooring fittings and equipment are to be connected to the ship structure in such a way that no failure will occur under anticipated static and dynamic loadings. Appendix B gives the recommended minimum strength criteria for the fittings or equipment and the Design Basis Loads given in Appendix B are also to be used for the supporting structure. However, in principle, the strength of the supporting structure and its connection to the fitting are always to be greater than the marked SWL of the fitting. In order to achieve this, it is recommended that the stress limit for supporting structure is taken as 80% of SMYS.

(2) For heavy equipment such as winches, the weight of the equipment itself, including dynamic loads in a seaway, are also to be taken into account. It is not usually necessary to add the static and dynamic loads caused by the ship's seaway motion to the loads generated by mooring lines or chains, since the ship will rarely be subjected to excessive motion while moored. Nevertheless, once the static requirements are met, the foundations of heavy equipment are to be checked for dynamic forces in the same manner as other main and auxiliary machinery.

(3) In selecting fittings from various standards or vendors, the method of hull attachment is to be carefully considered. Simplified, less expensive fittings may require more elaborate hull reinforcements. For example, some roller fairleads do not incorporate load bearing members between the end posts, which results in very high localized reaction loads on the deck.

(4) Fittings or equipment generally apply tension, compression and shear stresses to the deck structure. These stresses are to be added to the hull girder stresses that may exist while the ship is moored. The longitudinal deck stress may be assumed to correspond to the stress generated by the maximum allowable still water bending moment. For fittings in the bow and stern area, this stress may be ignored.

(5) Another consideration for equipment and fittings in the mid-body area is the stress-raising effect that any local reinforcements may have on longitudinal strength members. This particularly applied to deck plating and deck longitudinals of High Tensile Steel (HTS) where the ends of reinforcing members may generate fatigue cracking in the primary structure. For this reason, transverse reinforcing members are strongly preferred over longitudinal reinforcements. Where longitudinal reinforcements cannot be avoided, the ends of the reinforcing members are to be very gradually tapered.

(6) Tensile loadings (pull on deck plate) are the most difficult to accommodate. If the deck plating is thin in relation to the member on top and the reinforcement below, the heavy welding required could cause tearing of the deck plate. Furthermore, any misalignment between members above and below the deck would result in high deck bending stresses. For this reason, deck insert plates are recommended where the deck plate is thinner than the member welded to it.

(7) Special attention is to be paid to connections of fittings made from steel of higher strength than the hull steel. If local stresses are high and adequate compensation cannot be made using the original hull steel quality, then local installation of higher strength steel may be necessary.

(8) As far as practicable, mooring fittings and equipment are to be located on longitudinals, beams or girders to facilitate efficient distribution of the mooring load. Additional reinforcing members may also be required to spread the load. The arrangement of foundations and supporting structure beneath such fittings is to be designed to accommodate the design loads discussed in Appendix B, considering any possible variation in the direction of the forces acting through the connection to the fitting. Supporting structure includes that part of the ship's structure that is directly subjected to the forces exerted on the fitting.

(9) While this Appendix gives practical guidance on the design of structure reinforcements, the requirements of the Common Structure Rules (CSR) for Double Hull Oil Tankers, CSR for Bulk Carriers, the Classification Society Rules for other ship types and IACS Unified Requirement A2, including required corrosion margins, are also to be followed in applicable cases.

1.2 Mooring winches

(1) Mooring winches are normally bolted to foundations that are welded to the ship's deck. A built-up foundation is to be designed so that all parts are accessible and hold-down bolts can be fitted from below. Vertical members are required to be suitably supported by tripping brackets. These brackets are to be positioned close to bolt holes and generally span the under-deck longitudinals or beams.

(2) Adequate drain holes are to be provided to avoid any entrapment of water that could lead to corrosion damage.

(3) As an alternative to a built-up foundation, the mooring winches can be installed directly on to the deck. This foundation is easy to maintain as there is no obstructing structure above the deck and, owing to the lower height, there is no need to provide raised operating platforms. The deck plate below the winch is reinforced by increased thickness and adequate carlings below deck.

(4) Steel chocks or pourable resin compound may be fitted between the foundation and the machinery bed plate. Resin chocks are to be of suitable and proven material with the composition properties, along with mixing and pouring procedures covering installation, being in accordance with Classification Society requirements.

(5) If steel chocks are used, an area on the foundation top plate may require machining.

(6) If resin chocks are fitted, the top plate is to be sized taking into account the necessity of fitting dams to retain the resin.

(7) The surfaces where resin chocks are to be used are to be cleaned and the hold-down bolt torque is not to exceed the resin chock supplier's recommendation.

(8) Brake anchors are to be designed to meet the design criteria provided in Appendix B. For loads in excess of about 100 tonnes (981 kN), the brake anchors are preferably to be carried through the deck. Alternatively, brake anchors can be welded to the foundation with adequate toe brackets in line with deck stiffeners. Welding is to be full penetration type. Local deck insert plates may also be necessary.

(9) An abutment or end stopper may be welded to the foundation, at points predetermined by the machinery manufacturer, to reduce the hold-down bolt's shear loading and to reduce the need for fitted bolts.

(10) Foundations of all winches of greater than 5 tonnes rated pull may require to have abutments fitted.

(11) An under deck support structure is to be provided in line with the foundation above the deck. For winches in the mid-body area, the support is preferably to be in a transverse direction and be of adequate size and span to distribute the load into existing deck longitudinals. Reinforcement of existing longitudinals is to be avoided, if at all possible, to prevent fatigue cracking at the ends of reinforcements.

(12) Where tension loads are applied to the deck, it may be necessary for welding above and below the deck to be of the full penetration type. Other type weld sizes are to be checked for adequacy. Where foundation members line up with existing deck structure, the standard weld size of deck longitudinals, beams or transverse webs may also have to be increased.

1.3 Chocks and fairleads

(1) Chocks and fairleads are often welded directly to the hull structure. The outer faces of chocks and fairleads located in the bow and stern areas are to butt directly onto the shell plating. If the shell plating is of insufficient thickness, an insert plate is to be used. In the mid-body area, any welding to the sheer strake or the rounded gunwale plate is to be avoided (as required by Class). A suitable connection can be achieved with a cantilevered foundation, as shown in Figure 1.3a, or with doublers, as shown in Figure 1.3b. The doublers are to be at least the same thickness as the rounded gunwale plate and the material is to be of the same grade as the deck material, where possible. Doubling plates are not well suited for taking tensile loads. Doublers of lower grade than the surrounding structure may be accepted on a case-by-case basis taking due account of size and location only when the loading is predominantly compressive. Where practical, the foundation is to be sized so that the two longitudinal members line up with deck longitudinals. Should this not be possible, additional transverse reinforcing members below the deck may be required to spread the load over additional deck and shell longitudinals. The corners of doublers are to be well-rounded with a minimum radius of 20 mm to reduce stress concentrations in the gunwale plate. The ends of longitudinal foundation members are to have well-radiused connections to reduce stress concentrations in the upper deck.

(2) The installation of some universal fairleads requires special attention, since the supporting structure must not only absorb the overall reactions from a mooring line load, but also the reactions of the two individual end frames. The preferred design is a fairlead with a substantial bottom member that connects the two end frames.

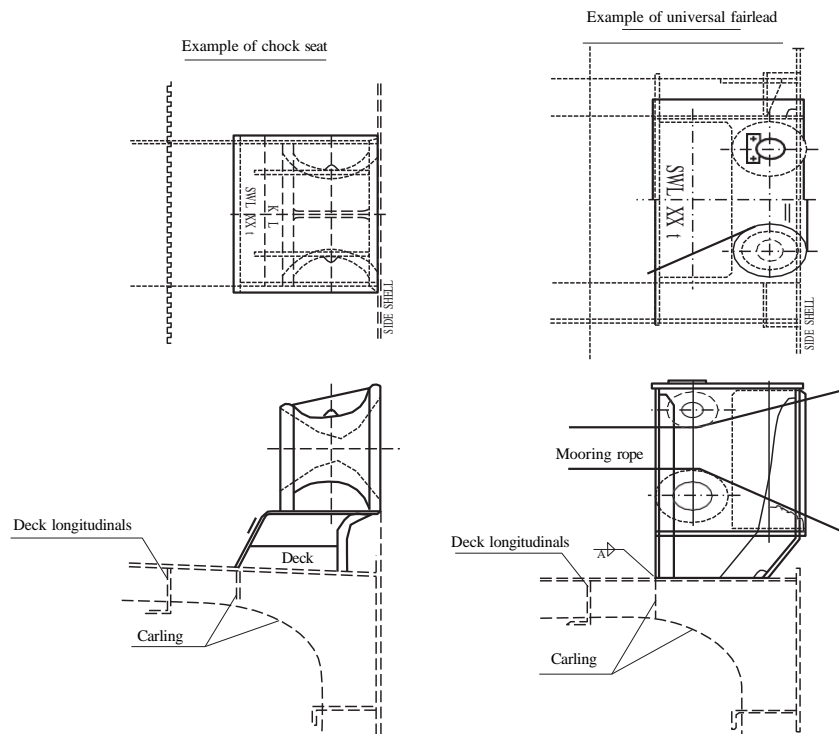


Figure 1.3a Typical cantilevered foundation in mid-body area

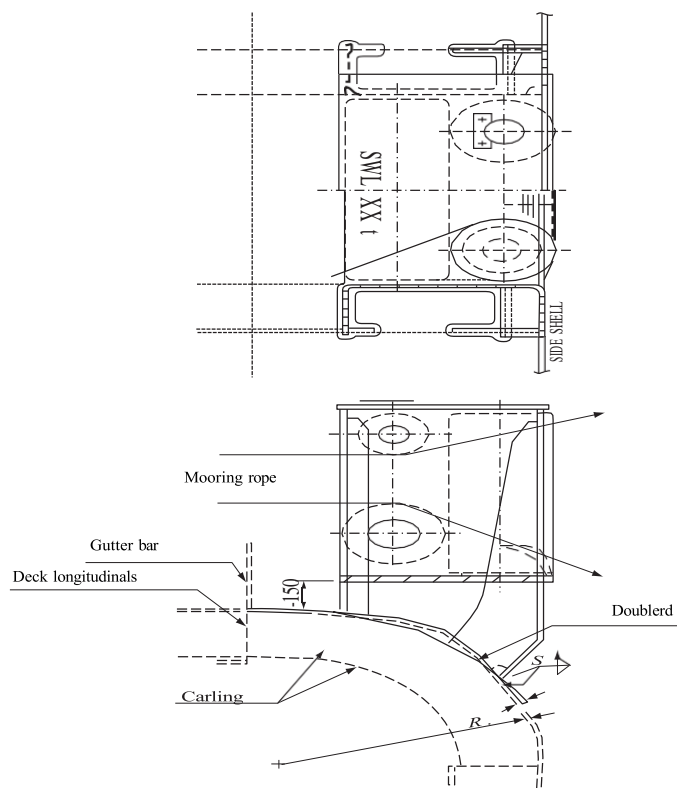


Figure 1.3b Installation of universal fairleads in rounded gunwale with doublers

1.4 Pedestal fairleads

- (1) The critical connections are the roller pin to pedestal and pedestal to deck attachments. Pedestal fairleads have failed more often in these areas than any other mooring fitting.
- (2) Most existing pedestals are of cylindrical or conical shape, making proper line-up with reinforcements below the deck difficult. For this reason, a rectangular section with rounded corners may be more appropriate in some cases.
- (3) Examples of good pin-to-pedestal connection and pedestal-to-deck connection are shown in Figure 1.8a and 1.8b.
- (4) The reinforcement below the deck is to be extended to adjacent strength members so as not to concentrate the stress on longitudinal girders and/or any other hull members over their allowable stress level as shown in Figure 1.8c.

1.5 Bitts

- (1) Bitts require deck strengthening members in line with all four sides of their base. The members below deck are to be of the same thickness as the base and their welding to the deck is to be equal to the weld size between bitt base and deck. Where bitts line up with existing structures, such as deck beams, girders, or transverse webs, the welding of these members to the deck may have to be increased.
- (2) For high freeboard ships such as LNG carriers, bitts recessed in the ship's side may be required. As far as is practical, recessed fittings are to be located in way of existing structures, such as longitudinals, stringers, and web frames. Additional reinforcing members of adequate size and span to distribute the load into the existing structure may also be required.
- (3) Special attention is to be given to the design of local reinforcements in fatigue sensitive areas of the side shell to minimize stress concentrations. For this reason, transverse reinforcing members are preferred, where practical, and reinforcement of existing longitudinals is to be avoided, if possible, to prevent fatigue cracking at the ends of reinforcements. If longitudinal reinforcements cannot be avoided, the ends of the reinforcing members are to be gradually tapered. Where recessed fittings line up with existing structures, the standard weld size of these members may also have to be increased.

1.6 SPM fittings and Smit brackets

- (1) Due to the high loading on these fittings, the method of connection to the hull structure is to be given due consideration. Each chain stopper or Smit bracket is to be welded directly to the deck of the ship or welded or bolted to a plate or pedestal structure which is in turn welded to the deck. The stopper or bracket is not to be bolted directly to the deck of the ship. A heavy deck insert plate may be required. In place of one centerline girder, two parallel girders with spacing equal to the distance between the cheek plates of the chain stopper or SPM bracket are recommended. Additional transverse members and pillars may be required to absorb the load. The SPM or towing fitting is to be located as close to the deck as possible. However, a small foundation will normally be required to achieve proper alignment between the fitting, the bow fairlead or chock, pedestal fairleads. The foundation must be provided with a thrust block capable of absorbing the chain load specified in Appendix B. Further guidance on SPM fittings is given in OCIMF Recommendation for equipment employed in the bow mooring of conventional tankers at single point moorings.

1.7 Tug push points

(1) With the advent of ever more powerful tugs, side shell reinforcement for tug pushing is to be carefully considered. Calculations are to consider the maximum expected tug pushing force and the contact area to determine the design pressure.

(2) At each push point, the vertical extent of reinforcement is to take into account the full range of drafts with sufficient longitudinal extent to minimize accidental contact outside the reinforced area. Typically, the extent of the load area is to extend vertically from the light waterline to the deck and transversely at least one frame space forward and aft of the marked push point. For high freeboard ships, such as LNG carriers, the vertical limit may be reduced, for example, from the light ballast waterline to the loaded waterline plus 4 m.

(3) As far as is practical, push points are to be located in way of existing transverse structure, such as bulkheads or web frames. Additional reinforcing members of adequate size and span to distribute the load into the existing longitudinal members will also be required. Special attention is to be given to the design of local reinforcements in fatigue sensitive areas of the side shell in order to minimize stress concentrations. For this reason, transverse reinforcing members are preferred and reinforcement of existing longitudinals is to be avoided, if possible, to prevent fatigue cracking at the ends of reinforcements. If longitudinal reinforcements cannot be avoided, the ends of the reinforcing members are to be gradually tapered. The location and extent of the reinforced areas are to be clearly marked on the side shell.

1.8 Special considerations

1.8.1 Rounded gunwale connection

(1) Many ships have a rounded connection between the upper deck and side shell in the mid-body area. The rounded plate is usually of Grade 'D' or 'E' steel to prevent propagation of major cracks in the hull envelope. Most Classification Societies place restrictions on the direct welding of mooring fittings to this plate. Since mooring chocks or fairleads in the mid-body area should be flush with the side shell to avoid line chafing on the rounded gunwale, either doublers or a cantilevered foundation will be required for all shipside mooring fittings, as shown in Figure 1.3b.

1.8.2 Doublers versus inserts

(1) Deck plating in way of mooring fittings may be reinforced by doublers or ideally by insert plates. Doublers are usually less expensive but cannot transmit large tensile loads and will be subject to specific Class Society requirements covering welding. This is because all loads to the deck are transmitted only through the fillet welds or plug welds of the doubler and these are seldom in line with stiffening below the deck. Doublers are more suitable for small fittings, such as eyes, since a small insert plate in a highly stressed upper deck may lead to crack initiation due to the additional locked-in stress created by the welding. For mooring outfits on the bow and stern where the deck's longitudinal stress is insignificant and the thickness is much less than midships, insert plates are to be used.

(2) Where doublers (or pads) are used, the width is to be small to prevent bending under tension loads. The following table provides details of typical pad widths and thickness, which may be used as a guide:

Typical pad width and thickness

Table 1.8.2

Leg Thickness of Fittings (mm)	Pad Width (mm) (max)	Pad Thickness (mm)
< 12	50	14
12-13	50	16
14-16	60	19
17-19	70	22
20 and above	75	25

Notes: a. Pad corners are to be provided with a minimum of 20 mm radius. The shape of pads is to be designed to suit that of legs of fittings.

b. A greater pad width causes failures (separation of the pad from the deck plate) at lower loads.

1.8.3 High strength steel fittings

Some mooring fittings may be built of High Tensile Steel (HTS) to reduce weight or to improve strength. Connections of such fittings, especially when the deck structure is of a lesser strength steel, are to be carefully calculated. Where the maximum stress occurs at the base of the fitting (such as the frame of a universal chock) and the deck is not of HTS or of a sufficient thickness, a deck insert plate of HTS may be required along with HTS strengthening members below the deck. Likewise, existing structures such as deck beams directly in line with HTS members above the deck may have to be locally replaced with HTS members. If the deck connection and reinforcing method are carefully considered before designing or selecting fittings for a ship, installation will be simplified and overall costs reduced.

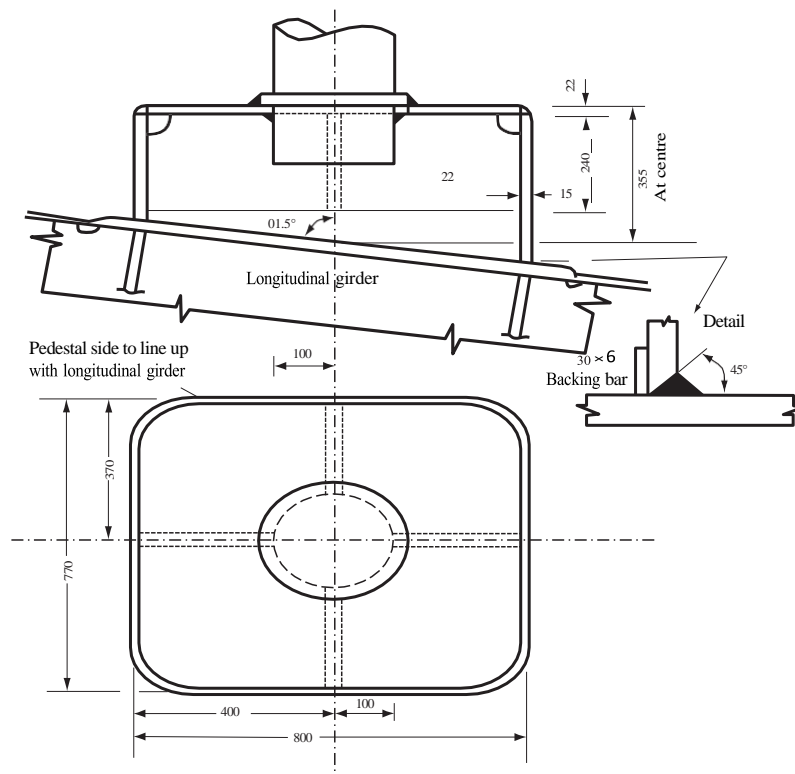


Figure 1.8a Typical foundation for pedestal fairlead

Appendix D Mooring Winches

1.1 Function and type

When in mooring, the winch is to be set in the manual mode.

1.2 Winch drums

- (1) The reason why split drums are used is that ISO Standard 3730, Annex A, recommends that synthetic ropes under tension should not be wound on a drum in more than one layer, otherwise a shorter life span will result. This can normally only be achieved by using split drums.
- (2) For either type of drum, the minimum drum diameter is to be 16 times the design wire rope's diameter. For conventional and high modulus fibre ropes, the manufacturer is to be consulted for information on the acceptable minimum bend radius for specific applications.
- (3) Split drums are to be wide enough to allow for 10 turns of the design wire rope on the tension section.
- (4) A minimum of 10 turns is also required when using unjacketed high modulus synthetic fibre ropes.
- (5) For conventional fibre ropes, a minimum of 5 or 6 turns are to be allowed for. When the number of turns is specified, counters are to be required.
- (6) Winch storage drums used to stow the pick-up rope are to be capable of lifting at least 15 tonnes and be of sufficient size to accommodate 150 m of 80 mm diameter rope. Use of winch drum ends (warping ends) to handle pick-up ropes is considered unsafe and is to be avoided.
- (7) Specifications are to be available on the winch drum to show the design holding capacity and the torque required on the hand wheel or lever to achieve this.

Note: If mooring lines are utilised that have a minimum breaking load in excess of that for which the winch was originally designed, the brakes are to be set to render at 60% of the minimum breaking load of the mooring line for which the winch was designed. A further consideration in such cases is that if the over-strength line is of a greater diameter than the mooring line for which the winch was designed, full stowage on the drum must be made and in the case of split-drum winches, must not result in excess layers on the tension part of the drum when in use.

1.3 Winch drives

- (1) The winch drive is to ideally allow for continuous variation in line speed permitting heaving and rendering at high speed when the load is small and developing high pull when the speed is low. The pull at stalled heave is not to exceed 50% of the mooring line's MBL.
- (2) Mooring winches in a gas hazardous area are to be hydraulically powered. In the case of electric drive, Ex 'd' rating is required.

Note: Most mooring winches will be outside gas hazardous areas and therefore will not require an 'Ex' rating. If not, there must be evidence available, either by a manufacturer's plate on the motor, or by documentation, that the motor is rated for use in a gas-hazardous area.

An Ex 'd' rating means that the equipment can withstand an internal explosion without igniting the outside atmosphere. Ex 'e' is an increased safety rating.

Glands at the point of entry of electric cables into junction boxes are to be checked.

(3) If mooring winches are electrically powered, insulation tests are to be carried out and the results to be recorded.

Note: Records are to be available of the testing of the insulation resistance, from the phases to earth, of motors. The resistance is to be above 1 MΩ. Falling insulation resistance indicates deterioration.

1.4 Winch brakes

(1) The design brake capability of winches is the percentage of a new line or wire's MBL, i.e. design load for the brake to skid. Generally, new equipment is to be designed to hold 80% of the line's MBL. The primary brake is to be set to hold 60% of the mooring line's MBL. Brake force may be expressed in 't' or percentage of MBL.

(2) Regardless of the brake type, periodic testing is essential to ensure safe mooring.

(3) The main purpose of brake testing is to verify that the brake will render at a load less than the design rope's MBL. New ships are normally supplied with a brake test kit of the simplified type. Each winch manufacturer will have their own test equipment and procedures which are to be followed by the operator.

(4) Each winch is to be tested individually and test is to be carried out prior to the ship's delivery and then every year thereafter following recommendations in ISGOTT. In addition, winches are to be individually tested after completion of any modification or repair involving the winch brakes, or upon any evidence of premature brake slippage or related malfunctions. Brakes are to be tested to prove they render at a load that is equivalent to 60% of the line's MBL.

(5) It is recommended that a complete set of test equipment is placed on board each ship properly stowed in an appropriate location. Alternatively the owner may elect to procure one or two sets of testing equipment for each type and size of winch and retain this equipment in a convenient central location for shipment to repair facilities.

(6) Specifications are to be available on the winch drum to show the design holding capacity and the torque required on the hand wheel or lever to achieve this.

Note: If mooring lines are utilised that have a minimum breaking load in excess of that for which the winch was originally designed, the brakes are to be set to render at 60% of the minimum breaking load of the mooring line for which the winch was designed. A further consideration in such cases is that if the over-strength line is of a greater diameter than the mooring line for which the winch was designed, full stowage on the drum must be made and in the case of split-drum winches, must not result in excess layers on the tension part of the drum when in use.

(7) A band brake is designed to work in one direction only, so the line must always be reeled correctly onto the drum. Each arrangement is to be assessed on a case-by-case basis with reference to the manufacturer's guidance. With lines correctly reeled, tension on the line is to be in a direction that causes the free end of the band to be forced towards the fixed end, thereby forcing the two halves of the band together.

(8) Winches are never to be left in gear with the mooring winch band brake on. Hydraulic or electric drives can suffer severe damage should the brake render. Mooring drums are always to be left disconnected from the winch drive whenever the mooring line is tensioned and the band brake is fully applied.

(9) The rated holding capacity is only achieved with one layer of line on the tension section of the drum. Operation with additional layers will decrease the brake holding capacity.

(10) Brake linings, drums and pins are to be in good order.

Notes: Defective brake gear is often evident, particularly on older vessels. Check the condition of cheek plates for wastage and distortion, the hinge pins and their retaining devices and the condition of the brake drum below the lining.

If there is significant wear on the brake linings, the brake adjustment screw may be at the limit of its travel and further tightening not possible.

1.5 Winch performance

Refer to ISO Standard 3730 for the principal performance particulars for winches.

(1) Rated pull

This is the pull that the mooring line can develop at the rated speed on the first layer. It is equivalent to 30% of the mooring line's MBL.

(2) Rated speed

The rated speed is the speed that can be maintained with the rated load applied to the mooring line.

(3) Light-line speed (also called no-load speed or slack-line speed)

This is the speed that can be achieved by the winch with negligible load on the line.

(4) Stall heaving capacity (also called stall pull)

This is the line pull the winch will exert when the control is in heave and the line is held stationary. It is never to exceed 50% of the mooring line's MBL.

(5) Drum capacity

Two capacities, 'normal' and 'high', are specified in ISO Standard 3730.

Winches with undivided drums could be more suitable for the 'normal' capacity. For undivided drums the total number of layers is not to exceed five normal capacity drums, and eight for high-capacity drums.

On split-drum winches, more layers may be stored and it is to be possible to store the total length of the mooring line on the storage part of the drum. An allowance for 1.5 extra layers is to be made when determining the flange diameter of 'normal' capacity drums storing wire ropes.

1.6 Strength requirements for winches

- (1) The strength of the mooring winch structure is to be based on the mooring line's MBL. The winch is to be clearly marked with the range of rope strengths for which it is designed.
- (2) Ship designers are to pay special attention to the support structure in way of the fixed end of band brakes.
- (3) Mooring winch foundations are to be in good order.

1.7 Winch testing

In addition to brake testing, the following tests are recommended by OCIMF, which are in general agreement with ISO Standard 3730, including: prototype test, delivery test, shipboard test and inspection.

1.8 Summary of recommendations

Recommendations for ship designers

- (1) All winches are to be controlled in the manual mode, including automatic-tensioning winches as presently designed.
- (2) In selecting drive systems, the speed-pull relationship for various types is to be considered.
- (3) Minimum rated winch pull is to be 30% of the design rope's MBL.
- (4) Minimum rated speed is to be selected on the basis of ship size, from minimum 0.13 m/sec for large ships and minimum 0.20 m/sec for small ones.
- (5) Minimum light line speed is to preferably be 0.75 m/sec, but will be dependent on the chosen drive system.
- (6) Maximum stall pull is not to exceed 50% MBL of the design rope.
- (7) New winch brakes are to be designed for holding 80% of the design rope's MBL. Operating load is to be set to 60% of the design rope's MBL.
- (8) Winch drums are to have a minimum diameter of 16 times the design wire rope's diameter.
- (9) The tension section of a split drum is to be wide enough for 10 turns of the design wire.
- (10) Winch brakes are to be of the fail-safe applied type.
- (11) Disc brakes are a good alternative for winch drums.
- (12) For optimum ease, security of operation and manpower reduction, single drum winches with full capacity 'fail-safe' input brakes are to be considered.

- (13) Winch brake testing provisions are to be incorporated into the winch design.
- (14) The strength of all structural winch components, including winch drum brakes and deck support, is to be based on the design rope's MBL. Special attention is to be given to the connection of the brake band anchor point to the ship's structure.
- (15) Winches are to be clearly marked with the rope MBL for which they are designed.