Rules for the Marine Operations related to the Sea Transport of Special Cargoes

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GENERAL CONDITIONS

Definitions:

"*Administration*" means the Government of the State whose flag the Ship is entitled to fly or under whose authority the Ship is authorised to operate in the specific case.

"IACS" means the International Association of Classification Societies.

"*Interested Party*" means the party, other than the Society, having an interest in or responsibility for the Ship, product, plant or system subject to classification or certification (such as the owner of the Ship and his representatives, the ship builder, the engine builder or the supplier of parts to be tested) who requests the Services or on whose behalf the Services are requested.

"*Owner*" means the registered owner, the ship owner, the manager or any other party with the responsibility, legally or contractually, to keep the ship seaworthy or in service, having particular regard to the provisions relating to the maintenance of class laid down in Part A, Chapter 2 of the Rules for the Classification of Ships or in the corresponding rules indicated in the specific Rules.

"Rules" in these General Conditions means the documents below issued by the Society:

(i) Rules for the Classification of Ships or other special units;
(ii) Complementary Rules containing the requirements for product, plant, system and other certification or containing the requirements for the assignment of additional class notations;
(iii) Rules for the application of statutory rules, containing the rules to perform the duties delegated by Administrations;
(iv) Guides to carry out particular activities connected with Services;
(v) Any other technical document, as for example rule variations or interpretations.

"*Services*" means the activities described in Article 1 below, rendered by the Society upon request made by or on behalf of the Interested Party.

"Ship" means ships, boats, craft and other special units, as for example offshore structures, floating units and underwater craft.

"*Society*" or *"TASNEEF"* means Tasneef and/or all the companies in the Tasneef Group which provide the Services.

"*Surveyor*" means technical staff acting on behalf of the Society in performing the Services.

Article 1

1.1. The purpose of the Society is, among others, the classification and certification of ships and the certification of their parts and components. In particular, the Society:
(i) sets forth and develops Rules;
(ii) publishes the Register of Ships;
(iii) issues certificates, statements and reports based on its survey activities.

1.2. The Society also takes part in the implementation of national and international rules and standards as delegated by various G overnments.

1.3. The Society carries out technical assistance activities on request and provides special services outside the scope of classification, which are regulated by these general conditions, unless expressly excluded in the particular contract.

Article 2

2.1. The Rules developed by the Society reflect the level of its technical knowledge at the time they are published. Therefore, the Society, although committed also through its research and development services to continuous updating of the Rules, does not guarantee the Rules meet state-of-the-art science and technology at the time of publication or that they meet the Society's or others' subsequent technical developments.

2.2. The Interested Party is required to know the Rules on the basis of which the Services are provided. With particular reference to Classification Services, special attention is to be given to the Rules concerning class suspension, withdrawal and reinstatemen t. In case of doubt or inaccuracy, the Interested Party is to promptly contact the Society for clarification.
The Rules for Classification of Ships are published on the Society's website: www.tasneef.ae.

2.3. The Society exercises due care and skill:
(i) in the selection of its Surveyors
(ii) in the performance of its Services, taking into account the level of its technical knowledge at the time the Services are performed.

2.4. Surveys conducted by the Society include, but are not limited to, visual inspection and non-destructive testing. Unless otherwise required, surveys are conducted through sampling techniques and do not consist of comprehensive verification or monitoring of the Ship or of the items subject to certification. The surveys and checks made by the Society on board ship do not necessarily require the constant and continuous presence of the Surveyor. The Society may also commission laboratory testing, underwater inspection and other checks carried out by and under the responsibility of qualified service suppliers. Survey practices and procedures are selected by the Society based on its experience and knowledge and according to generally accepted technical standards in the sector.

Article 3

3.1. The class assigned to a Ship, like the reports, statements, certificates or any other document or information issued by the Society, reflects the opinion of the Society concerning compliance, at the time the Service is provided, of the Ship or product subject to certification, with the applicable Rules (given the intended use and within the relevant time frame).
The Society is under no obligation to make statements or provide information about elements or facts which are not part of th e specific scope of the Service requested by the Interested Party or on its behalf.

3.2. No report, statement, notation on a plan, review, Certificate of Classification, document or information issued or given as p art of the Services provided by the Society shall have any legal effect or implication other than a representation that, on the basis of the checks made by the Society, the Ship, structure, materials, equipment, machinery or any other item covered by such document or information meet the Rules. Any such document is issued solely for the use of the Society, its committees and clients or other duly authorised bodies and for no other purpose. Therefore, the Society cannot be held liable for any act made or document issued by other parties on the basis of the statements or information given by the Society. The validity, application, meaning and interpretation of a Certificate of Classification, or any other document or information issued by the Society in connection with its Services, is governed by the Rules of the Society, which is the sole subject entitled to make such interpretation. Any disagreement on technical matters between the Interested Party and the Surveyor in the carrying out of his functions shall be raised in writing as soon as possible with the Society, which will settle any divergence of opinion or dispute.

3.3. The classification of a Ship, or the issuance of a certificate or other document connected with classification or certificati on and in general with the performance of Services by the Society shall have the validity conferred upon it by the Rules of the Society at the time of the assignment of class or issuance of the certificate; in no case shall it amount to a statement or warranty of seaw orthiness,

structural integrity, quality or fitness for a particular purpose or service of any Ship, structur e, material, equipment or machinery inspected or tested by the Society.

3.4. Any document issued by the Society in relation to its activities reflects the condition of the Ship or the subject of certifi cation or other activity at the time of the check.

3.5. The Rules, surveys and activities performed by the Society, reports, certificates and other documents issued by the Society are in no way intended to replace the duties and responsibilities of other parties such as Governments, designers, ship builders, manufacturers, repairers, suppliers, contractors or sub-contractors, Owners, operators, charterers, underwriters, sellers or intended buyers of a Ship or other product or system surveyed.

These documents and activities do not relieve such parties from any fulfilment, warranty, responsibility, duty or obligation (also of a contractual nature) expressed or implied or in any case incumbent on them, nor do they confer on such parties any right, claim or cause of action against the Society. With particular regard to the duties of the ship Owner, the Services undertaken by the Society do not relieve the Owner of his duty to ensure proper maintenance of the Ship and ensure seaworthiness at all times. Likewise, t he Rules, surveys performed, reports, certificates and other documents issued by the Society are intended neither to guarantee the buyers of the Ship, its components or any other surveyed or certified item, nor to relieve the seller of the duties arising out of the law or the contract, regarding the quality, commercial value or characteristics of the item which is the subject of transaction.

In no case, therefore, shall the Society assume the obligations incumbent upon the above-mentioned parties, even when it is consulted in connection with matters not covered by its Rules or other documents.

In consideration of the above, the Interested Party undertakes to relieve and hold harmless the Society from any third party claim, as well as from any liability in relation to the latter concerning the Services rendered.

Insofar as they are not expressly provided for in these General Conditions, the duties and responsibilities of the Owner and Interested Parties with respect to the services rendered by the Society are described in the Rules applicable to the specific Service rendered.

Article 4

4.1. Any request for the Society's Services shall be submitted in writing and signed by or on behalf of the Interested Party. Such a request will be considered irrevocable as soon as received by the Society and shall entail acceptance by the applicant of all relevant requirements of the Rules, including these General Conditions. Upon acceptance of the written request by the Society, a contract between the Society and the Interested Party is entered into, which is regulated by the present General Conditions.

4.2. In consideration of the Services rendered by the Society, the Interested Party and the person requesting the service shall be jointly liable for the payment of the relevant fees, even if the service is not concluded for any cause not pertaining to the Society. In the latter case, the Society shall not be held liable for non-fulfilment or partial fulfilment of the Services requested. In the event of late payment, interest at the legal current rate increased by 1.5% may be demanded.

4.3. The contract for the classification of a Ship or for other Services may be terminated and any certificates revoked at the request of one of the parties, subject to at least 30 days' notice to be given in writing. Failure to pay, even in part, the fees due for Services carried out by the Society will entitle the Society to immediately terminate the contract and suspend the Services.

For every termination of the contract, the fees for the activities performed until the time of the termination shall be owed to the Society as well as the expenses incurred in view of activities already programmed; this is without prejudice to the right to compensation due to the Society as a consequence of the termination.

With particular reference to Ship classification and certification, unless decided otherwise by the Society, termination of the contract implies that the assignment of class to a Ship is withheld or, if already assigned, that it is suspended or withdrawn; any st atutory certificates issued by the Society will be withdrawn in those cases where provided for by agreements between the Society and the flag State.

Article 5

5.1. In providing the Services, as well as other correlated information or advice, the Society, its Surveyors, servants or agents operate with due diligence for the proper execution of the activity. However, considering the nature of the activities performed (see art. 2.4), it is not possible to guarantee absolute accuracy, correctness and completeness of any information or advice supplied. Express and implied warranties are specifically disclaimed.

Therefore, except as provided for in paragraph 5.2 below, and also in the case of activities carried out by delegation of Governments, neither the Society nor any of its Surveyors will be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract, derived from carrying out the Services.

5.2. Notwithstanding the provisions in paragraph 5.1 above, should any user of the Society's Services prove that he has suffered a loss or damage due to any negligent act or omission of the Society, its Surveyors, servants or agents, then the Society will pay compensation to such person for his proved loss, up to, but not exceeding, five times the amount of the fees charged for the specific services, information or opinions from which the loss or damage derives or, if no fee has been charged, a maximum of AED5,000 (Arab Emirates Dirhams Five Thousand only). Where the fees charged are related to a number of Services, the amount of the fees will be apportioned for the purpose of the calculation of the maximum compensation, by reference to the estimated time involved in the performance of the Service from which the damage or loss derives. Any liability for indirect or consequential loss, damage or expense is specifically excluded. In any case, irrespective of the amount of the fees charged, the maximum damages payable by the Society will not be more than AED5,000,000 (Arab Emirates Dirhams Five Millions only). Payment of compensation under this paragraph will not entail any admission of responsibility and/or liability by the Society and will be made without prejudice to the disclaimer clause contained in paragraph 5.1 above.

5.3. Any claim for loss or damage of whatever nature by virtue of the provisions set forth herein shall be made to the Society in writing, within the shorter of the following periods: (i) THREE (3) MONTHS from the date on which the Services were performed, or (ii) THREE (3) MONTHS from the date on which the damage was discovered. Failure to comply with the above deadline will constitute an absolute bar to the pursuit of such a claim against the Society.

Article 6

6.1. These General Conditions shall be governed by and construed in accordance with United Arab Emirates (UAE) law, and any dispute arising from or in connection with the Rules or with the Services of the Society, including any issues concerning responsibility, liability or limitations of liability of the Society, shall be determined in accordance with UAE law. The courts of the Dubai International Financial Centre (DIFC) shall have exclusive jurisdiction in relation to any claim or dispute which may arise out of or in connection with the Rules or with the Services of the Society.

6.2. However,

(i) In cases where neither the claim nor any counterclaim exceeds the sum of AED300,000 (Arab Emirates Dirhams Three Hundred Thousand) the dispute shall be referred to the jurisdiction of the DIFC Small Claims Tribunal; and

(ii) for disputes concerning non-payment of the fees and/or expenses due to the Society for services, the Society shall have the

right to submit any claim to the jurisdiction of the Courts of the place where the registered or operating office of the Interested Party or of the applicant who requested the Service is located.

In the case of actions taken against the Society by a third party before a public Court, the Society shall also have the right to summon the Interested Party or the subject who requested the Service before that Court, in order to be relieved and held harmless according to art. 3.5 above.

Article 7

7.1. All plans, specifications, documents and information provided by, issued by, or made known to the Society, in connection with the performance of its Services, will be treated as confidential and will not be made available to any other party other than the Owner without authorisation of the Interested Party, except as provided for or required by any applicable international, European or domestic legislation, Charter or other IACS resolutions, or order from a competent authority. Information about the status and validity of class and statutory certificates, including transfers, changes, suspensions, withdrawals of class, recommendations/conditions of class, operating conditions or restrictions issued against classed ships and other related information, as may be required, may be published on the website or released by other means, without the prior consent of the Interested Party.

Information about the status and validity of other certificates and statements may also be published on the website or released by other means, without the prior consent of the Interested Party.

7.2. Notwithstanding the general duty of confidentiality owed by the Society to its clients in clause 7.1 above, the Society's clients hereby accept that the Society may participate in the IACS Early Warning System which requires each Classification Society to provide other involved Classification Societies with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and used to facilitate the proper working of the IACS Early Warning System. The Society will provide its clients with written details of such information sent to the involved Classification Societies.

7.3. In the event of transfer of class, addition of a second class or withdrawal from a double/dual class, the Interested Party undertakes to provide or to permit the Society to provide the other Classification Society with all building plans and drawings, certificates, documents and information relevant to the classed unit, including its history file, as the other Classification Society may require for the purpose of classification in compliance with the applicable legislation and relative IACS Procedure. It is the Owner's duty to ensure that, whenever required, the consent of the builder is obtained with regard to the provision of plans and drawings to the new Society, either by way of appropriate stipulation in the building contract or by other agreement.

In the event that the ownership of the ship, product or system subject to certification is transferred to a new subject, the latter shall have the right to access all pertinent drawings, specifications, documents or information issued by the Society or which has come to the knowledge of the Society while carrying out its Services, even if related to a period prior to transfer of ownership.

Article 8

8.1. Should any part of these General Conditions be declared invalid, this will not affect the validity of the remaining provisions.

PART A – INTRODUCTION

PART B - SPECIAL TRANSPORTS AND TOWING

PART C - LOADING AND UNLOADING OPERATIONS

CHAPTER 1 APPLICATION

1 Application

1.1 Marine operations

1.1.1 The marine operations addressed by these Rules are the activities performed in marine environment in order to move and transport special or exceptional cargoes, such as offshore jackets and topside modules, harbour cranes, plant modules and components, ship parts, etc.

1.1.2 Typical examples of marine operations are the following:

A. Load out from quay onto cargo barge or other floating units;

B. Sea transportation to the arrival location, including offshore installation sites;

C. Unloading from transportation unit to arrival location.

The quoted examples however do not exhaust the multiplicity of the operations linked to the naval and offshore activity that these Rules can be applied to.

1.2 Application and exclusions

1.2.1 Marine Operation are specific subject of Third Party Authority services, Marine Warranty Surveys or Classification of offshore platforms (ref. Tasneef Rules for the classification of steel fixed offshore platforms) and are to be supervised by Tasneef accordingly.

1.2.2 These Rules do not apply to non-safety-related components or systems and to those components which are not essential for global integrity.

1.2.3 As pertains:

- amendments to these Rules;
- observance of other rules;
- Tasneef responsibility,

and other general subjects, the pertinent dispositions of Section A of Tasneef "Rules for the Classification of ships" apply.

1.2.4 Novel technologies not covered by these Rules will be subjected to special considerations (e.g. through an ad-hoc Technology Qualification, according to the "Tasneef Guide for Technology Qualification Processes" 2014).

1.2.5 As the requirements of these Rules cover various types of operations, it is understood that the various provisions are to be applied when appropriate in relation to the type of operation concerned.

1.2.6 Special operations with uncommon features, procedures and solutions, other than those specified in these Rules, will be specially considered on a case-by-case basis.

1.3 Definitions

1.3.1 In these Rules general reference is made to terms and definitions reported in Clause 3 of ISO 19901-6:2009.

2 Regulatory framework

2.1 General

2.1.1 Marine operations are usually part of projects related to oil and gas exploration and production, installation of renewable energy plants, fabrication of marine facilities such as berthing terminals for ship loading and unloading. Such activities in given geographical regions (which can form all or part of the offshore waters of one or more countries) are governed by local legislation or National Acts, whose compliance is to be considered mandatory and under the responsibility of the project Owner, besides the provisions of these Rules or any mentioned reference International Standard.

2.1.2 The regulatory framework, including regulatory requirements or specific legislation to be applied, shall be considered of primary importance when covering similar technical or safety issues subject of provisions in these Rules.

Relevant provisions must be mentioned in the project documents to be submitted to Tasneef at the beginning of the required service.

In general, the project must define and take into account any additional requirements applicable to particular geographical regions, as well as regional environmental conditions and local design, construction and operating practices, that are not to be in conflict with the general safety target of these Rules (in case of conflict, the safest Rule should be followed).

2.1.3 Specifically to Europe, the European Community (EC) Countries and current members of the European Free Trade Association (EFTA) states have set bilateral agreements to be linked in the European Union's internal market, EEA (European Economic Area).

Common requirements are set by the EC, to be then implemented by each of the EC members through their own law making process. Under the EEA agreement, EFTA countries have agreed to meet the requirements of directives agreed upon by the EC, which are including directives relating to safety and relieving of trade barriers.

2.2 Reference standards

2.2.1 In addition to the provisions of these Rules, and as general reference, the marine operations are to be planned and executed according to the latest edition of:

- ISO 19901-1, Petroleum and natural gas industries — Specific requirements for offshore structures — Part 1: Metocean design and operating considerations;
- ISO 19901-6, Petroleum and natural gas industries — Specific requirements for offshore structures — Part 6: Marine operations.
- ISO 29400, Ships and marine technology — Offshore wind energy — Port and marine operations

2.2.2 For matters not expressly specified or modified by these Rules, the requirements of the relevant Chapters of the following Tasneef Rules (hereafter referred to simply as "Tasneef Rules" or "Rules"), are to be complied with, if applicable:

- "Rules for loading and unloading arrangements and for other lifting appliances on board ships" (which includes requirements for offshore units);
- "Rules for the Construction and Classification of Mobile Offshore Drilling Units and Other Similar Units";
- "Rules for the Classification of Ships".

2.2.3 Other Codes or Rules that mandatorily apply, or are suggested as general reference, are indicated under the paragraphs related to each type of Marine Operation.

2.3 Amendments to the rules

2.3.1 Since offshore technology is not only a complex technology but is rapidly evolving, these Rules will be subject to review and updating as deemed necessary based both on experience and on future development.

2.4 Governmental rules

2.4.1 Any Tasneef act and decision does not relieve the interested parties from their duty of complying with any additional and/or more stringent requirements issued by the competent Administration and the relevant provisions for this application.

2.5 Alternative design criteria

2.5.1 Tasneef reserves the right to accept design criteria alternative to those mentioned in this Rules, provided it is adequately documented that equivalent safety is achieved by such criteria.

2.6 Owner/contractor responsibility

2.6.1 These Rules are based on the assumption that the operation is designed and planned by qualified operators and performed by skilled personnel under the responsibility of the owner/contractor.

2.6.2 These Rules assume that the actual operating conditions do not differ substantially from the design values.

CHAPTER 2 General provisions

1 General

1.1 Documentation

1.1.1 Marine operations are to be carried out in accordance with approved procedures and under Tasneef supervision.

1.1.2 The procedures and the main supporting documents for the operation design and planning are to be included in the Marine Operation Manual and should be prepared and submitted for Tasneef review and approval sufficiently in advance prior to the start of the operations.

1.1.3 Details of the documents and information to be included in the Marine Operation Manual are reported under the paragraph of these Rules related to each type of operation.

1.2 Environmental actions

1.2.1 Characteristic parameters relating to the design environmental conditions for the start and the execution of each operation must be specified in the Marine Operation Manual and submitted for Tasneef review.

1.2.2 Environmental loads and effects during marine operations are to be determined in accordance with the applicable requirements from Clause 7 of ISO 19901-6:2009 (ISO 19901-7:2013 for mooring).

1.2.3 In order to cope with the uncertainty in both the monitoring and the forecasting of the environmental conditions, the weather forecast limitations to start the operations must be defined by applying a proper reduction factor to the design weather criteria.

1.3 Weight control

1.3.1 Most marine operations are particularly sensitive to the weight of the items to be handled. A careful activity of weight control is to be put in place, according to Clause 8 of ISO 19901-6:2009.

2 Hydrostatic stability

2.1 Stability criteria

2.1.1 Before the beginning of each marine operation, stability calculations are to be submitted to Tasneef showing that stability characteristics of the cargo barge or vessel comply with the recognized requirements applicable to the kind of unit and navigation in question and the additional requirements reported in the chapters of these Rules related to each type of marine operation.

2.2 Temporarily floated objects

2.2.1 The requirements of this paragraph apply to a floating system which is temporarily floated for transport or installation purposes, in different condition compared to the final operating one. Such system may consist of structural parts of offshore platform or ships, including temporary floaters or buoyancy tanks, if any.

2.2.2 Stability requirements for floating objects are to be determined in accordance with the requirements of Clause 9 of ISO 19901-6:2009.

2.2.3 The floating system is to have sufficient stability and reserve buoyancy during all stages of marine operations.

2.2.4 The following requirements are to be complied with:

a) the actual metacentric height of the system is to be at least 1 m;
b) the heel of the floating system due to the extreme wind which is compatible with the carrying out of operations is not to exceed 5 degrees;
c) the floating system is to be capable of withstanding accidental rapid increase in overturning actions during transfer of heavy loads.

2.2.5 The requirements of the above items a), b) and c) may be waived in special cases provided that adequate measures are taken which ensure the same degree of safety.

2.3 Stability test

2.3.1 Before starting any operation during which stability may be critical, a stability test may be required in accordance with procedures previously agreed with Tasneef

3 Vessel strength

3.1 Longitudinal strength

3.1.1 The distribution of bending moment and shear force along the hull beam are to be evaluated for each stage of the operation, and it is to be verified that the consequent stresses do not exceed the admissible ones.

3.2 Local strength

3.2.1 The local stress in the structural details of the cargo barge or vessel during the operations is to be verified according to the general principles explained in the chapters of these Rules related to each type of marine operation.

3.2.2 The deck of transport units shall be adequate to support the cargo weight and its dynamic effects in all the positions that it covers during loading, unloading and transport.

3.2.3 Where operations may cause the overloading of structural components, the effects of such overloading are to be monitored and controlled.

4 Equipment

4.1 Mooring systems

4.1.1 Mooring systems, used to maintain the vessels and cargo barges in the required position during the marine operations, are to be designed in compliance with the requirements given in Clause 13 of ISO 19901-6:2009.

4.1.2 Structures and relevant connection details, which are subject to forces from mooring lines of auxiliary or towing units are to be designed to withstand the breaking load of such lines.

4.1.3 Secondary structures such as fenders, gangway ladders, mooring rings, etc. are to be designed so that possible failure due to accidental overload will not result in damage to the main structure of the platform or injury to personnel.

4.2 Electrical and mechanical systems

4.2.1 Vessels and structures are to be equipped with all systems necessary to keep them under complete control during marine operations.

4.2.2 Depending on the nature and complexity of the operations, a separate study may be required for the purpose of selecting the most suitable system to ensure safe operation.

4.2.3 Systems are to be designed, constructed, tested, installed and maintained in compliance with the applicable requirements of Tasneef Rules and other recognised standards.

4.3 Instrumentation

4.3.1 To keep the vessels and structures under effective control during construction, adequate instrumentation may be required to monitor:

- loads and deformations;
- environmental conditions;
- ballast and stability conditions;
- heel, trim and draft.

4.3.2 All essential instruments are to be duplicated for redundancy.

4.3.3 All instruments used are to be tested and calibrated prior to the start of operation, to the satisfaction of Tasneef

4.4 Equipment for special operations

4.4.1 Systems and equipment used for special operations must be thoroughly specified so as to permit the proper carrying out of operations and the evaluation of loads imposed on the structures.

4.4.2 The following documentation is to be submitted to Tasneef

- description of the equipment;
- general arrangement and layout plans;
- strength calculations;
- material specifications;
- specifications for construction, testing and installation.

5 Decommissioning/Removal

5.1 General

5.1.1 The operations necessary for the decommissioning and removal of offshore structures should be planned and executed according to Clause 19 of ISO 19901-6:2009. Other applicable standards and codes may be accepted provided that their safety level is proved to be equivalent to the ISO standards.

CHAPTER 3 Marine Warranty Survey

1 General

1.1 Scope

1.1.1 The purpose of Marine Warranty Surveys is to ensure that marine operations are performed within defined risk levels, which should be tolerable to marine insurance and to the industry, as well as to the national and international Regulatory Bodies.

Such verification is carried out through:

1. examination and approval of project the documentation (drawings, specifications, manuals, etc.);
2. visits to be carried out before the operation;
3. attendance during its development.

1.1.2 The definition of the MWS Scope of Work takes into consideration the Joint Rig Committee document “Marine Warranty Surveyors Code of Practice and Scope of Work”.

1.1.3 The definition of the MWS Scope of Work, in terms of battery limits, reference rules and specific prescriptions, takes into consideration the relevant clauses from the insurance contract. Client provides MWS with such details during contract definition phase.

1.1.4 The certification is formalized through the release, in different phases of the project development, of Document Approval, Inspection Reports, Declarations of Conformity, Interim and Final Certificates, stating that the design, planning and execution of the operation itself were implemented in accordance with the prescriptions of these Rules and other agreed reference rules, and following the approved procedures.

1.1.5 At request of the involved parties, the "Declaration of Conformity" and the "Final Certificate" will be issued on the basis of documentation approved by a recognized Authority. In this case Tasneef action is limited to the assessment that the operation has been planned and carried out in the respect of the prescriptions reported in the approved documentation and this will be mentioned in the declaration and in the certificate released.

1.2 Involved parties

1.2.1 The different parties involved in the marine operation execution are:

A. Operator/Company: the party representing the owner(s).

B. Contractor(s): the parties performing the actual work.

C. Assured (may be the Operator/Company or the Contractor): the party who has obtained insurance cover for the marine operation and who engages the Warranty Surveyor in order to ensure that the terms of the warranty as laid down in his Insurance Policy are complied with.

D. Insurer: the party who is providing insurance cover for the marine operation.

E. Marine Warranty Surveyor (MWS): the independent third party ensuring that the terms of the Marine Insurance Warranty Clause are complied with.

F. Client: any party contracting the Marine Warranty Surveyor for the MWS service.

2 MWS activities

2.1 Surveys

2.1.1 As survey it is meant the action carried out by Tasneef to ensure that the marine operation has been designed, planned and performed in accordance with these Rules or other recognised standards, to be agreed with Client.

2.1.2 The survey is performed by means of the examination of documentation, the performance of a visit before the beginning of the operation and the attendance during its execution.

2.2 Document examination

2.2.1 For the correct execution of the Warranty Survey and relevant certification of a marine operation, Tasneef shall be supplied, with reasonable anticipation on the date of beginning of the operation, with the project documentation showing how the operation itself has been planned.

2.2.2 For general requirements relating to documentation see Clause 6.5 of ISO 19901-6:2009 (ISO 29001 for wind energy projects).

2.2.3 The project documentation, made up of drawings, procedures, specifications, analyses and calculations, shall contain all information that Tasneef considers as a necessary support for the approval, such as site survey and environmental reports, engineering analyses, calculations, etc.

Such documents are in general all enclosed in the installation manual.

2.2.4 The installation manual is a collection of plans, drawings, calculations procedures and other technical documents covering all the main aspects of the specific work to be performed and prepared in order to demonstrate that methods and equipment meet the prescriptions of the reference rules.

The documents to be included in the manual in general cover the following technical aspects:

- Reference rules and standards;
- Design basis and assumptions;
- General principles of analysis and planning;
- Limiting meteo conditions;
- Procedures for the main activities;
- Hydrostatic stability;
- Loads on structures and equipment;
- Structural and hydrodynamic analyses;
- Materials and welding;
- Tests and trials;
- Organization, responsibility, communication, monitoring, contingency, safety and alarm;
- Certificates and any other support documentation.

For more details, reference shall be made to the pertinent prescriptions of these Rules or other project standards.

2.3 Condition/suitability survey

2.3.1 Condition or Suitability Surveys are performed at vessel mobilization and are intended to verify that vessels to be employed for the Marine Operation are fully operational and provided with recognized Class Certificates in due course of validity, as well as any other applicable certificate for marine operation equipment like cranes, anchor winches, rigging, towing/mooring equipment, etc.

2.3.2 Surveys are performed on the basis of check list, specific for each kind of vessel, or, if necessary, defined for the specific project.

2.4 Visits preceding the beginning of the marine operation

2.4.1 Such visits include all the interventions aimed to verify that:

- what arranged and realized for the execution of the marine operation (equipment layout, sea-fastening, temporary aids, etc.) is in compliance with the documentation approved by Head Office and the common rules of good construction and execution practice;
- fabrication, welding, NDT (Non-Destructive Tests) and all other tests are planned and performed according to the manuals approved by Tasneef Approval Office, with satisfaction of Tasneef surveyor and according to the good practice;
- vessels to be employed are fully operational and provided with all applicable certificates in due course of validity, for Class requirements and for equipment specific for the marine operation;
- instrumentation and equipment, including lifting appliances, winches, trailers, laying tensioners, etc., are tested in compliance with the prescriptions of the applicable rules and with the relevant test documentation; they shall be also provided with valid and recognized certificates, whenever applicable;
- systems of communication, monitoring, data recording, emergency tracking, correspond to what is described in the approved documentation and perfectly working;
- limiting parameters defining the conditions established to begin the operation correspond to what agreed and approved.

2.5 Attendance during the execution of the marine operation

2.5.1 Such attendance has the purpose to verify that the operation is started, carried out and concluded as foreseen in the approved procedures and according to the agreed

limitations, at satisfaction of Tasneef surveyor and according to the good practice.

2.5.2 Tasneef surveyor may be involved, upon request, in meetings relevant to HAZOP/HAZID and contingency planning, before the operations and during their execution. This attendance in general is not deemed necessary for non-critical operations, such as common transportation of simple structures on towed barges.

3 Certificates and deliverables

3.1 Document approval

3.1.1 At the successful completion of the design appraisal phase, preferably before the beginning of the operations at sea, Tasneef provides formal approval of the examined manual. The approval may be issued together with comments and remarks that shall be strictly adhered to, for the execution of the Marine Operation.

Whenever required, upon provision of the necessary hardcopies, Tasneef may return one, or more, stamped copy of the manual.

3.2 Marine operation statement

3.2.1 At satisfying completion of the visit before the beginning of the marine operation, Tasneef surveyor releases a statement (or *declaration*) for compliance to the approved drawings and procedures.

3.2.2 For consecutive operations (i.e. load out, sea-fastening, transportation, launch, etc.), where the beginning of each phase depends on the completion of the previous one, in general several statements will be issued, each before the beginning of relevant phase.

3.2.3 The declaration may include reservations and remarks, if the procedures have not been followed thoroughly or some part of the work has not been executed as expected.

3.2.4 In case of repetitive operations, performed exactly in the same way, Tasneef may witness only an agreed percentage (10% at least) of the repetitive series. Tasneef statements issued at the start of a repetitive series of operations remains valid for the duration of the series under the condition that operations are prepared and performed in the same way, with identical vessels and equipment and based on the same design and procedures. Tasneef personnel may require occasional verifications or checks as required.

3.3 Final certificate

3.3.1 At the completion of the Marine Operation, carried out under the attendance of Tasneef surveyor and to his/her satisfaction, the final Certificate of Compliance is issued.

3.3.2 For consecutive operations, at request of the involved parties, a single Certificate can be issued, referred to all the operations, or several interim certificates relevant to each single phase.

3.3.3 Certificates may include reservations and remarks, if the procedures have not been followed thoroughly or some part of the work has not been executed as expected.

3.4 Breach of warranty

3.4.1 Whenever Tasneef while performing MWS scope of work and in any phase of the project, detects that marine operations are not planned, prepared or executed according to the reference standards and expected safety level, Tasneef can issue a Breach of Warranty letter to notify Company or Contractor that the insurance policy conditions could not be achieved unless proper corrective actions are implemented.

CHAPTER 1 General

1 Introduction

1.1 Application

1.1.1 This Part of the Rules applies to the carriage of special or exceptional cargoes, such as offshore jackets and topside modules, harbour cranes, ship parts, etc. by means of cargo barges (or pontoons), heavy transport vessels, offshore-support vessels, general cargo ships or similar units.

1.1.2 These Rules address also the sea towing of unmanned tows such as cargo barges, non-propelled units (pipe-laying barges, crane barges, semi-submersible platforms), damaged vessels and concrete or steel structures temporarily floated for transportation.

1.2 Definition of special transport

1.2.1 In general, sea transport is considered special or exceptional when:

- The loads induced by cargo and relevant sea-fastening on vessel structures exceed or are differently distributed in comparison with the allowable loads reported in the barge or vessel documents and certificates.
- Cargo weight and position are such that the stability condition is different from those reported in the vessel stability booklet.
- Cargo can be subject to wave impact loads.
- Other reasons for which the transport conditions can be deemed different from those expected in the regular vessel service, approved by her Classification Body.

1.2.2 For special or exceptional sea transport, the involved parties (Authorities, Insurance, etc.) commonly require a Declaration of Suitability as detailed in the following paragraphs.

1.3 Manned tow

1.3.1 Towing operations with people aboard the towed unit will be subject to special consideration in each instance, based on the stability and free board conditions, the safety, emergency rescue and fire-fighting equipment, together with the due presence on board of power generation equipment and accommodation.

1.3.2 The number of passengers allowed on board shall be limited, as far as possible, to the necessary crew only and will be reported on the final statement (see also IMO MSC/Circ.884 “Guidelines For Safe Ocean Towing”).

1.4 Marine Warranty Survey

1.4.1 The suitability declaration for transportation and/or towing (hereinafter referred to as “Declaration”) is intended to provide the independent technical verification that is commonly requested by Permitting Authorities (Coast Guard, etc.) to authorize transit in their competence area, or by Insurance Bodies to provide coverage against damage and loss that could occur during transport operations.

In the latter case, Tasneef acts as Marine Warranty Surveyor and the scope of work and requirements described in these rules may be modified based on a project specific agreement, to be defined at the contract award (See Pt. A Ch. 3 of these Rules).

1.5 Compliance with other Rules

1.5.1 Transport operations shall be planned and executed according to Clause 12 of ISO 19901-6:2009.

1.5.2 Ocean towing operations shall be planned and performed according to IMO MSC/Circ.884 “Guidelines For Safe Ocean Towing”.

1.5.3 “Rules for the classification of ships” (hereinafter indicated simply as “Rules”) or other Tasneef Rules are applicable, except as outlined below.

In particular, general requirements which are indicated in Part A, Ch 1, Sec 1 of the Rules are to be complied with.

2 Deliverables

2.1 General

2.1.1 These Rules define the requirements to be complied with in order to obtain Tasneef approval of the design and a suitability statement for the carriage of special or exceptional cargoes, as defined above.

2.2 Design appraisal

2.2.1 Upon successful completion of the design appraisal phase, Tasneef returns the engineering documents stamped with the applicable review status (Approved, Info, Noted) and the relevant comments or prescriptions, based on its independent judgement.

2.2.2 Upon request, Tasneef issues also a Certificate of Conformity stating the compliance of

the examined engineering documents with the project Rules and Standards agreed before starting the activity.

2.3 Declaration of suitability

2.3.1 Upon successful completion of the survey phase, Tasneef issues a suitability statement for the carriage of special or exceptional cargoes, as defined above.

2.3.2 The declaration is issued in Tasneef form (unless specifically agreed with all parties involved).

2.3.3 The declaration reports all remarks, prescriptions and limitations that Tasneef considers mandatory for the proper execution of the operation, based on its independent judgement.

2.3.4 The declaration may address the suitability of the towing arrangement, in the case of transport to be performed by towing.

2.3.5 The declaration may also address other operations related to the transport, such as load out, see part C of these Rules.

2.3.6 Compliance with these Rules, in order to obtain the aforesaid declaration, is apart from and does not exempt from the obligation of fulfilling the applicable laws, rules and requirements, possibly different and/or more stringent than those issued by Tasneef of the Administration of the country whose flag the vessel is flying, and possible different provisions.

3 Documentation

3.1 Engineering documents

3.1.1 The documentation indicated in Table 1 must be submitted to Tasneef for review and approval, where applicable. Documents must be clear and complete, with sufficient level of detail to enable Tasneef to perform the design review successfully.

3.1.2 Depending on the specific features of the transportation, Tasneef may require additional documents, whenever considered necessary for the proper description or verification of the transport arrangement.

3.1.3 Tasneef will accept reduced documentation whenever it is considered acceptable in respect of the particular features of the transport.

3.2 Weather restrictions

3.2.1 Whenever the voyage is subject to weather and favourable sea conditions, maximum allowable wind speed and significant wave height shall be specified. The proposed values will be reviewed by Tasneef in order to evaluate their compatibility with the chosen routes and seasonal period.

These restrictions shall be noted in the Declaration of Suitability.

Table 1: Documentation to be submitted

No.	I/A (1)	Document	Document details
1	I	Structural Analysis and Sea-fastening Design	a) load definition (see Chapter 2 and Ch 4, [1.3.2]); b) longitudinal strength calculations (see Ch 4, [1.2]); c) structural analysis d) structural checks of grillage and sea-fastening; e) structural checks of vessel structures (see Ch 4, [1.3]).
2	I	Naval Analysis and Stability Checks	a) determination of the position of the global centre of gravity of vessel and cargo with the correction due to possible tree surface of liquid in tanks and/or suspended load; b) righting moment and wind heeling moment curves (see Chapter 3); c) seakeeping analysis and definition of design acceleration; d) stability checks; e) evaluation of maximum towing pull.
3	I	Transportation Procedure	Including at least: a) vessel description and certificates; b) route, refuge harbours (if any) and relevant distance; c) seasonal period and weather limitations (if any); d) estimated voyage duration; e) sea-fastening fabrication (welding/NDT procedures, personnel qualification, etc.).
4	A	Transportation layout and general arrangement	Drawings showing position of masses on board, including: a) cargo weight, distribution, C.o.G. position; b) ballast plan; c) position of crane jibs or other mobile devices; d) weight and position of possible secondary items; e) wind exposed area.
5	A	Grillage and Sea-fastening General Arrangement	Drawings showing grillage and sea-fastening position in relation to deck/hull structures.
6	A	Sea-fastening Details	Construction drawings showing: a) structural members and joints; b) materials; c) standard items (i.e. beams, bolts. etc.); d) lashing items (i.e. ropes, shackles, pad-eyes, chains, tensioners. etc.).
7	A	Barge structure modification (if any)	Construction drawings relevant to: a) structural modification; b) selected materials; c) welding procedures and electrodes used.
8	A	Towing Plan	Towing line draft showing the position of each component (i.e. ropes, shackles, chains, triple plate. etc.) and relevant identification code and certified capacity (MBL, SWL, etc.).
9	I/A	Any other document	Any other document considered necessary for the proper description or verification of the transport arrangement, depending on the specific features of the operation.

(1) A = to be submitted for approval
I = to be submitted for information or review

CHAPTER 2 Loads

1 Loads

1.1 Load classification

1.1.1 Because of the purpose and applicability limits of the present Rules, in this Chapter only loads induced by cargoes acting on vessel structures during carriage are taken into account.

1.1.2 These loads may be divided into gravitational and environmental loads. The environmental loads considered here are those due to the wind action on the exposed areas of the cargoes or the seafastening, to the inertia forces due to vessel motion induced by waves and to possible wave impact against cargo parts.

1.2 Gravity loads

1.2.1 Permanent gravity loads consist of the weight of the cargoes and relevant grillage/sea-fastening arrangements.

1.2.2 Variable gravity loads, such as weight overload due to ice and/or snow accumulation shall be taken into account, according to the routes followed, the seasonal periods and the morphological characteristics of the cargoes.

1.3 Wind action

1.3.1 Loads induced by the wind on the cargo and on grillage/sea-fastening features shall be evaluated according to the relevant Articles of Pt E, Ch 4, Sect 2 and Sec 3 of the Rules for the Classification of Floating Offshore Units at Fixed Locations and Mobile Offshore Drilling Units.

1.3.2 Wind forces shall be considered from any direction in order to obtain, combined with other kinds of loads, the maximum load effects.

1.3.3 In general, a wind velocity of 51,5 m/s (100 knots) shall be used. Where transport is dependent on favourable sea and weather conditions, the value specified in the design documentation shall be taken into account; this value, however, shall be deemed acceptable by Tasneef

1.4 Slamming

Possible wave slamming against cargo elements protruding beyond sides, bow or stern of the pontoon and consequent impulsive loads, shall be taken into account. Relative wave surface speed must be evaluated and suitable slamming coefficients must be considered.

Similarly, the possible occurrence of green sea impacts in heavy storms must be investigated and, in such a case, the sea-fastening elements must be able to resist green sea forces generated by the water impact pressure acting on the cargo and sea-fastenings.

In the absence of specific studies, the pressure due to slamming and green sea is to be taken not less than 200 kN/m^2.

1.5 Inertia forces due to vessel motion

1.5.1 Inertia forces acting on cargo items shall be calculated by multiplying cargo mass, including proper contingency, by the dynamic acceleration which their Centre of Gravity is subjected to, due to the vessel movements induced by waves.

In general, the three translational acceleration components in the longitudinal, transverse and vertical directions relevant to the vessel shall be taken into account.

1.5.2 When cargo dimensions are particularly big, the following analysis refinements can be necessary:

a) to consider also the rotational components of the dynamic acceleration;

b) to apply inertia forces in different points, other than cargo C.o.G., in order to model the actual internal mass distribution;

c) to evaluate the vessel deflection response to waves (hogging & sagging) and to apply the relevant imposed displacements (differential settlements) to cargo supports, properly combined with inertia accelerations.

.

1.5.3 The contribution due to gravity acceleration because of pitch and roll heel angles of the vessel shall be taken into account, evaluating longitudinal and transverse acceleration.

1.5.4 Dynamic accelerations can be evaluated by seakeeping calculations, taking into account hydrostatic, geometrical and inertia characteristics of vessel and cargo.

Theories and parameters defining design sea states, other hypotheses and software used for analyses shall be agreed with Tasneef

1.5.5 Motion response criteria from Clause 12.2.5 of ISO 19901-6:2009 are recommended.

1.5.6 An accepted simplified method for general cargo ships is provided by the IMO Code of Safe Practice for Cargo Stowage and Securing.

1.5.7 The results of realistic model tests, performed by recognized laboratories, can be accepted.

2 Acceleration formulas for cargo barges

2.1 General

2.1.1 For carriage in the Mediterranean Sea, without any seasonal or route limitations, should difficulties arise in finding reliable data relevant to the sea state concerned and/or theoretical or experimental evaluation of dynamic acceleration, the formulas given in the following paragraphs can be used.

2.1.2 These formulas are applicable to cargo barges with the following characteristics:

$$50 \le L \le 150$$

$$0,2 \le B/L \le 0,4$$

$$5 \le B/T \le 10$$

$$1 \le z_G/T \le 4$$

$$0,3 \le R_P/B \le 0,6$$

where:

z_G = distance, in m, of the global centre of gravity of the cargo-pontoon system from the waterplane;

and the other symbols are explained in the following paragraphs and in Figure 1.

2.1.3 The acceleration values obtained by the formulas reported in the following paragraphs are inclusive of the contribution of gravity acceleration due to pitch and roll angle.

2.1.4 It is worth to highlight that, in some peculiar cases, the longitudinal acceleration a_x/g obtained by the formulas can be overestimated compared to the values calculated by seakeeping analysis. The reason is that, depending on the hull features, there is a relatively wide range of sea periods where surge and pitch responses are nearly 180° out of phase. However, since this compensating effect is not general but appears only for some hulls under certain sea states, it is not caught by general formulas.

2.2 Longitudinal acceleration

$$A_x = [40+122\ B/L+(1-L/25)^2](14,8 \cdot K_x \cdot L)^{-1}$$

$K_x = 0,1\ B^{0,5}+2,4\ B/L$

g = gravity acceleration (m/s^2);

L = cargo barge length (m);

B = cargo barge width (m);

z = distance, in m, between the point where acceleration has been calculated and the waterplane;

$$a_x/g = A_x\ [1+K_x\ (z/T)^{1,5}\ (T/B)]+0,2$$

where:

a_x = dynamic longitudinal acceleration (m/s^2)

2.3 Transverse acceleration

$$a_y/g = A_y\ (1+K_y z/B)[1+0,2(x/L)^2]+0,15$$

where:

a_y = dynamic transverse acceleration (m/s^2)

$A_y = 1/280(0,3+ C_y^2)[21+(48 - B)\ C_y]$ for B≤48 m

$A_y = 0,075\ (0,3+ C_y^2)$ for B>48 m

$C_y = (1-0,054\ K_y)$;

C_y should never be less than 0,7

$K_y = B\ GM / R_p^2$

GM = actual transv. metacentric height (m);

R_p = polar inertia roll radius, in x direction, of the whole pontoon-cargo with dry hull (m);

T = average pontoon draft (m);

x = longitudinal distance between the point where acceleration has been calculated and midship (m).

2.4 Vertical acceleration

$$a_z/g = A_z\ [1+K_z(x/L)^2]^{0,5} + A_{zy}$$

where:

a_z = dynamic vertical acceleration (m/s^2);

$A_z = 16\ L^{-1}+0,24-0,5\ B/L$

$K_z = 7,1$

$A_{zy} = y\ (a_y/g-0,15) / (z+R_p^2/GM)$

y = transversal distance between the point where acceleration has been calculated and midship (m).

2.5 Weather limitations

Where carriage takes place in the Mediterranean Sea and is dependent on favourable sea and weather conditions, the values of accelerations reported by formulas (a_x/g, a_y/g, a_z/g) can be

reduced by a certain percentage, to be approved by Tasneef as specified here below.

2.5.1 When the transport conditions do not exceed moderate sea (significant wave height Hs not exceeding 3,0 m), a reduction of 30%, 20% and 40% respectively for longitudinal, transverse and vertical acceleration can be assumed.

2.5.2 When the transport conditions do not exceed smooth sea (H_s not exceeding 1,0 m) and the route is coastal, a further reduction of 50% can be applied to the reduced values at previous point.

2.5.3 For intermediate sea states, the reduction factor, applicable to unrestricted values, is reported in the following table.

Table 2: Acceleration reduction factors

Hs limit	a_x/g factor	a_y/g factor	a_z/g factor
1,0	0,35	0,40	0,30
1,5	0,48	0,54	0,40
2,0	0,57	0,65	0,47
2,5	0,65	0,74	0,54
3,.0	0,70	0,80	0,60

2.5.4 When transport takes place in sheltered water, such as transport from one quay to another inside the same harbour, the value of 0,1 g can be assumed for the two horizontal accelerations (i.e a_x/g, a_y/g) and a_z can be disregarded.

3 Fatigue

3.1 Calculation principles

3.1.1 When the transport is very long or seafastening structures are used for several trips, a fatigue assessment may be required, in order to evaluate the amount of damage due to cyclic loading on seafastening elements and relevant connections on cargo and on vessel deck. The same assessment can be extended to cargo structures, if deemed necessary, but this aspect is in general not related to transport safety but only to the cargo design, in particular if the cargo is a structural item subject to fatigue loading also after the transport phase (i.e. offshore structures, skids for vibrating equipment, etc.).

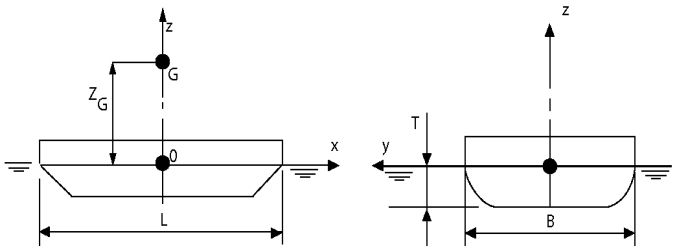
3.2 Analysis procedure

3.2.1 Several analysis criteria are acceptable, depending on the expected level of criticality.

In general, the main analysis steps should be:

a) Collect the scatter diagrams applicable for the various areas encountered along the route.

Figure 1



b) Calculate the ship response (RAOs).
c) Calculate local delta-stress in fatigue details due to single amplitude cyclic loading, including appropriate stress concentration factors.
d) Store stress results as hot spot stress transfer functions.
e) Calculate the sea spectra according to recognized formulas (Pierson-Moscovitz, Jonswap, etc.).
f) Calculate the stress response to each sea state encountered.
g) Choose appropriate S-N curves for each structural detail, to associate with each hot spot stress location.
h) Cumulate the fatigue damage using Miner's rule.
i) Apply a safety factor to the calculated fatigue damage and check against fatigue limit.

CHAPTER 3 Stability

1 Stability criteria

1.1 General

1.1.1 Before the beginning of each voyage, calculations, showing that stability characteristics of the vessel-cargo system comply with the statutory requirements applicable to the kind of unit and navigation and the additional requirements hereinafter reported, are to be submitted to Tasneef for review.

1.1.2 As an alternative to the additional stability calculations requested above, the results of experimental tests, performed by recognized Institutes or Organizations on representative models of the system may be accepted.

2 Additional stability criteria

2.1 Stability check

2.1.1 The ratio between the area under the righting moment curve, in the stability diagram, and the area under the transverse wind heeling curve shall be 1,4 or higher. These areas are limited to the range of heeling angles between origin and second intercept (between the two curves) or downflooding angle, whichever is less (Fig. 2).

2.2 Righting effect

2.2.1 The righting moment curve shall be calculated for a sufficient number of heel angles to define the curve, taking into account the liquid surface effects and suspended loads. The contribution given to the righting moment by the buoyancy of cargo parts which result immersed due to pontoon heeling shall be ignored.

2.3 Wind action

2.3.1 The wind heeling moment curve shall be calculated for a sufficient number of heel angles to define the curve.

2.3.2 Wind force on emerged parts of the vessel and on cargo shall be calculated according to Ch 2, [1.3]. Particular attention will be paid to the influence of horizontal surfaces which are exposed to the wind in heeled positions.

2.3.3 The lever of the wind heeling force shall be measured vertically from the centre of pressure of all surfaces exposed to the wind up to the centre of lateral resistance or to the geometrical centre of the projection of the underwater body of the pontoon, on a vertical plane.

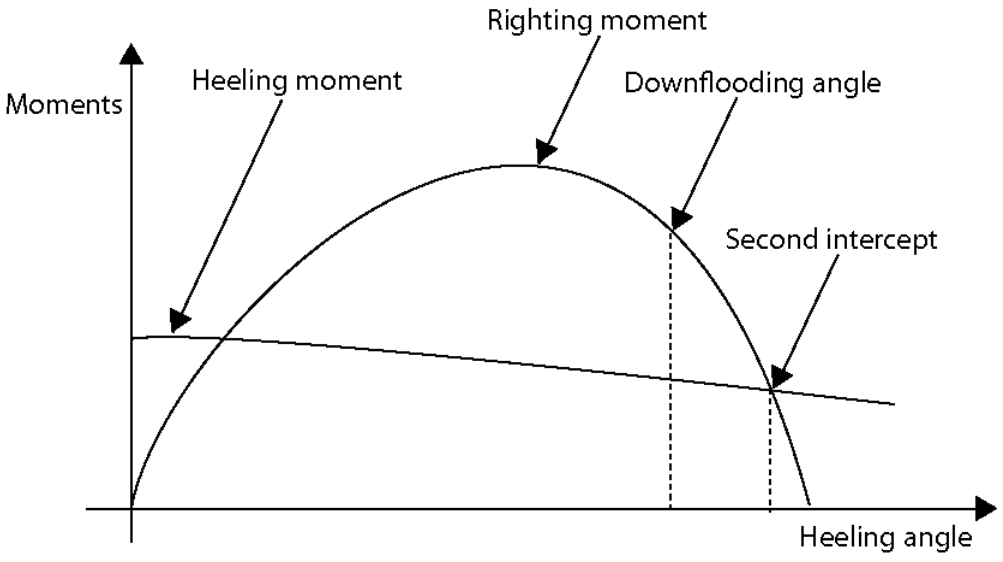


Figure 2

CHAPTER 4 Structural analysis

1 Principles of analysis

1.1 Load distribution

1.1.1 The arrangements for the carriage of cargo shall be designed so as to distribute static and dynamic loads induced on the vessel structures and to reduce still water and wave loads on pontoon hull beam.

1.1.2 Concentrated loads cannot be applied on areas of the weather deck which are not in correspondence with structural reinforced elements; gravitational and environmental loads should be transferred by sea-fastening features to vessel structural elements able to bear them efficaciously, like bulkheads, deck beams, girders, columns, sides.

1.1.3 Transmission of normal tensile stresses through thickness of doubling plates or plates welded along external contours are to be avoided.

1.1.4 When rubber tyre trailers (such as SPMTs) are intended to support the cargo, fully or partially, during transport, the stiffness of such support system must be improved by placing rigid blocks (e.g. wooden blocks with shims) under the trailer spine beam.

1.2 Vessel structure modification

1.2.1 Changes to vessel structural elements shall be carried out, if possible, without complex solutions and sudden section variations, which may induce dangerous stress concentrations.

1.2.2 The constructive solutions used shall be consistent, with regard to shape, functionality, materials and welding procedures, with existing pontoon structures.

2 Longitudinal strength

2.1 Loads

2.1.1 It is to be checked that loads acting on the hull beam while cargo is carried are lower than the design values.

2.2 Structural checks

2.2.1 The check should be carried out by calculating hull beam loads in still water for the vessel in transport condition and, on the basis of these, by calculating the required strength moduli and side shell thickness according to Pt B, Ch 6 of Tasneef Rules for the Classification of Ships.

2.2.2 These moduli and thicknesses shall be lower than those of different transverse sections of the vessel.

2.3 Load calculation

2.3.1 Where the condition established above has not been complied with, the Declaration can be issued only when the results of direct calculations can demonstrate, to Tasneef satisfaction, that wave loads, which are evaluated for the environmental conditions forecasted for transport, plus those calculated for still water condition do not induce stresses higher than the allowable ones reported in [4.5].

3 Local strength

3.1 General

3.1.1 The check of local strength of vessel structural elements is to be carried out by comparing working stresses, calculated according to this paragraph, with the allowable stresses reported in item [4.5].

3.1.2 Alternative methods will be subject to special consideration in each instance by Tasneef

3.2 Load effect determination

3.2.1 Determination of force, moments, stresses and strains shall be based on recognized criteria of static analysis, dynamic analysis and material strength.

3.2.2 Load effects evaluation shall be performed on the basis of the elasticity theory. Methods which are based on the plasticity theory will be considered by Tasneef in each instance.

3.3 Loads on vessel structures

3.3.1 The evaluation of load effects on the vessel structure shall be generally performed by taking into account the whole cargo/sea-fastening features subjected to the loads reported in Chapter 2.

3.3.2 In particular instances, whenever particular hypotheses on relative stiffness between cargo and vessel and on actual boundary conditions are verified, a simplified analysis may be accepted. An example is shown in Appendix 1 relevant to two typical cases.

3.4 Load cases

3.4.1 For every vessel structural element, the stress values due to each of the following load cases acting on the transported cargo shall be calculated:

a) gravitational loads;
b) wind action;
c) longitudinal acceleration;
d) transversal acceleration;
e) vertical acceleration.

3.4.2 These values shall be calculated according to the worst combination which may really exist for the single element, taking into account the statistical correlation of load cases. The stress combination methods will be subject to review by Tasneef

3.5 Load combination

3.5.1 Provided that a different request has not been made by Tasneef and when the loads relevant to load cases a) and b) (ref. par. [3.4.1] above) can be considered static and if the loads relevant to load cases c), d) and e) may be considered statistically independent, the combination of the single stress components shall be performed according to the following formula:

$S = S_a + S_b + (S_c^2 + S_d^2 + S_e^2)^{0,5}$

where:

S = work stress, normal or tangential, in the analysed structural component.

S_a, S_b, S_c, S_d, S_e = maximum stress value induced in this component respectively by load cases relevant to the aforesaid par. [3.4.1] a), b), c), d) and e).

3.5.2 Alternatively, the following eight load combinations should be considered:

$LC_{1,2,3,4} = F_a \pm (F_b + F_c) \pm F_e$

$LC_{5,6,7,8} = F_a \pm (F_b + F_d) \pm F_e$

where:

F_a, F_b, F_c, F_d, F_e = load cases relevant to the aforesaid par. [3.4.1] a), b), c), d) and e).

In the above combinations, the wind action F_b can be limited to its value in longitudinal direction for $LC_{1,2,3,4}$ and in transversal direction for $LC_{5,6,7,8}$.

3.6 Other loads

3.6.1 For the vessel structural elements which, in addition to the loads induced by the sea-fastening features, have to bear direct loads (hydrodynamic head, distributed load on deck, etc.), the relevant stresses must be added to the ones mentioned in the previous paragraph, considering the worst combination realistically possible for the considered element, of static and dynamic loads.

3.7 Load reduction

3.7.1 A reduction of loads may be accepted by Tasneef depending on the pontoon's navigational characteristics and/or on subordination of transport to established sea and weather conditions. See also Ch 2, par. 2.5.

3.8 Non-linear effects

3.8.1 Possible aspects of geometrical non linearity or lack of homogeneity in material which can have a significant influence on structure behaviour shall be carefully considered.

3.9 Deck girders

3.9.1 In the calculation of stresses due to the bending on ordinary girders of deck panels, the "effective width" evaluated according to Pt B, Ch 4 of Tasneef Rules for the Classification of Ships is to be considered.

4 Analysis methods

4.1 Elastic linear analysis

4.1.1 For vessel and sea-fastening structural components checked within linear elastic limits, the equivalent stress, evaluated according to the Von Mises criterion, stall not exceed the allowable values defined in [1.5].

4.1.2 Where criteria different from Von Mises' are chosen, they have to be agreed with Tasneef

4.2 Buckling analysis

4.2.1 This analysis method shall be used for those structural components for which buckling failure may occur.

4.2.2 Buckling analysis shall be performed using generally accepted methods and theories. Alternative criteria shall be approved by Tasneef

4.2.3 The effect of pre-strains due to geometrical and construction faults shall be taken into account when critical buckling stresses are evaluated.

4.3 Local crippling analysis

4.3.1 When high compressive loads are induced through areas which are limited by girder webs, local web crippling shall be analysed, checking that the following formula is verified:

$P / [s (c+2d)] \leq 1,15 \sigma_{amm}$

where:

σ_{amm} = allowable compressive stress of web material (see [1.5]), in N/mm2;

P = acting load, in N;

s = web thickness, in mm;

c = element width through which the load P is transmitted, in mm;

d = thickness of plate close to the web, in mm.

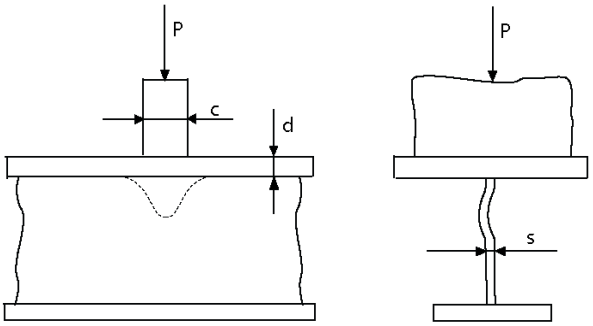


Figure 3: Local crippling

4.4 Sea-fastening

4.4.1 Grillage and sea-fastenings are not to be considered as an integral part of the pontoon structure and are generally removed at the end of each carriage.

4.4.2 The check of the sea-fastenings is to be carried out on the basis of the loads described in Chapter 2, according to general principles of analysis described in Chapter 4 and considering the allowable stresses stated in [1.5].

4.4.3 Sea-fastenings made of chains, ropes, shackles and tensioners should be avoided for heavy cargoes and replaced by rigid elements, such as welded braces and brackets.

4.4.4 Mixed sea-fastenings made of rigid elements together with chains and ropes should be avoided too, because the lower stiffness of flexible elements considerably reduces their contribution to the sea-fastening system (if the mixed solution is used, rigid sea-fastenings should be able to withstand all the design loads as if no flexible element were present).

4.4.5 When the sea-fastenings include chains, ropes, shackles and rods, the load to which they are submitted must not be higher than 1/3 of the rated breaking load and the connection elements (padeyes, D-rings, etc.) must be welded to the deck plating exactly in way of the webs or reinforcements such as beams, stringers, girders, etc. Moreover, the welding is to be carried out in way of the intersection of the reinforcement web symmetry plane with the deck plane.

4.5 ALLOWABLE STRESSES

4.6 Vessel Structures

4.6.1 For all vessel structural elements, the allowable stress σ_{amm}, in N/mm^2, with which equivalent working stresses have to be compared, is given by:

σ_{amm} = 177/k

where k is the coefficient related to the steel type (see the following par.). The equivalent working stresses are evaluated by the Von Mises criterion, taking into account, where necessary, hull beam stresses.

4.7 Material factor k

4.7.1 Unless otherwise specified, the material factor k has the values defined in Table 3, as a function of the minimum guaranteed yield stress R_{eH}.

Table 3: Material factor k

R_{eH} , in N/mm^2	k
235	1
315	0,78
355	0,72
390	0,68

4.7.2 For intermediate values of R_{eH}, factor k may be obtained by linear interpolation.
Steels with a yield stress lower than 235 N/mm^2 or greater than 390 N/mm^2 are considered by Tasneef on a case by case basis.

4.8 Grillage and sea-fastening structures

4.8.1 Allowable stresses from recognized “Working Stress Design” (ASD/WSD) codes for steel construction (AISC, etc.) are accepted. In consideration of the acting environmental load, an increase of 1,33 in allowable stress value may apply.

4.8.2 “Load and Resistance Factor” (LRFD) codes and relevant limit state checks are also accepted, provided that the structural analysis is performed in full compliance with all the factors prescribed by the selected code.

CHAPTER 5 Towing Arrangement

1 General

1.1 Application

1.1.1 This item covers towing operations intended for commercial and industrial purpose. Salvage or rescue towing services may be subject to special consideration.

1.2 General requirements

1.2.1 Towing operations shall be planned and executed according to the minimum requirements and criteria of this Chapter for the assessment of the adequacy of towing lines, based on design data and conditions such as tug pull, weather limitations, etc.

1.2.2 For towing operations where the distance between designated ports of refuge or safe anchoring requires more than 24 hours of navigation, guidelines can be found in IMO MSC/Circ.884.

1.2.3 For details and aspects not covered by these Rules, guidelines can be found in Clause 12 of ISO 19901-6:2009.

1.3 Definitions

1.3.1 The abbreviations used in this chapter have the following meaning:

BP: documented continuous bollard pull of tug

RBP: required bollard pull for the specific voyage

R_t: total resistance foreseen for the voyage

MBL: minimum breaking load

TL: Test load

SWL: safe working load

Hs: significant wave height, in m

1.4 Towing plan

1.4.1 The tug Master shall provide a towing plan drawing (see example in Appendix 2) showing position, identification and capacity (MBL or SWL or TL) of each component of the towing line (wires, chains, shackles, triple plate, etc.), including bridle legs and, at owner's request or for unrestricted operations, relevant connections to the tow. The towing plan must report also the value BP, RBP and the emergency line, where applicable.

1.4.2 The continuous bollard pull BP of the towing vessel(s) involved is to be sufficient to maintain station keeping of the tow in the design environmental conditions, therefore BP must not be lower than RBP.

1.4.3 All the elements in the towing plan must have adequate capacity with respect to BP except for oversized tug according to [2.5].

1.5 Calculation of required towing pull

1.5.1 The required pull RBP is to be calculated by means of recognized formulas, based on the design combination of wind, wave and current, considering zero forward speed.

1.5.2 For unrestricted operations, RBP must be related at least to the following environmental conditions acting in the same direction:

Wind speed: 20 m/s

Significant wave height: 5 m

Current speed: 0,5 m/s

1.5.3 For typical pontoons and barges with "box" shape and raked or spoon bow in deep and open water the following formula may be used for the calculation of RBP:

$RBP = R_t / h$

Where:

h: tug efficiency according to Table 4

$R_t = R_c + R_{wa} + R_{wi}$

Where:

R_c current resistance, to be calculated as follows:

$R_c = \rho \cdot (2{,}89/1000) \cdot (L \cdot B + 2 \cdot (L+B) \cdot T) \cdot V^2$

Where:

ρ: sea water density, to be taken as 1,025 t/m^3

$V = V_T + V_C$, in m/s

V_T: towing speed, in m/s

V_C: current speed, in m/s

R_{wa}: wave resistance, to be calculated as follows:

$R_{wa} = \rho \cdot g \cdot Hs^2 \cdot B/16$

R_{wi}: wind resistance, to be calculated as follows:

$R_{wi} = (A_C + 1{,}2 \cdot B \cdot (D-T) \cdot (V_w+V_T)^2)/1600$

Where:

D: depth of cargo barge is the distance, in m, measured vertically on the midship transverse section, from the moulded base line to the top of the deck beam at side

V_W: wind speed, in m/s

A_C: exposed frontal area of cargo, in m^2

Table 4: Estimation of tug efficiency

BP (kN)	Tug efficiency %		
	Calm	Hs = 2,0 m	Hs = 5,0 m
BP ≤ 300	80	50 + BP/10	BP/10
300 < BP ≤ 900	80	80	30 + 0,75 · (BP/10 – 30)
BP > 900	80	80	75

1.6 Emergency towing line

1.6.1 For unrestricted towing operations, the tow must be equipped with an emergency towing line sized according to the same criteria and safety factors applicable to the main line.

2 Towing equipment capacity

2.1 Towline Safety Factor

2.1.1 Each component in the towing line, including bridle legs and relevant connections to the tow, must have a documented MBL in excess of BP according to the safety factors reported in Table 5.

Table 5: Towing equipment safety factors

BP (KN)	Safety factor MBL / BP
BP ≤ 400	3,0
400 < BP ≤ 900	3,8 - BP/500
BP > 900	2,0

2.1.2 Components identified by SWL instead of MBL are acceptable if RBP does not exceed SWL, provided that SWL has been defined, by the manufacturer or certification body, considering a safety factor against breaking not lower that those reported in Table 5.

2.1.3 The capacity of cables and ropes with terminal connection forming eye or loopsplices adopting clamps or hand splicing are to be reduced by following correction coefficients:

- 0,90, for wire up to 10 mm
- 0,75, for wire equal to or greater than 40 mm
- for intermediate wire diameters, correction coefficients are to be derived by linear interpolation between 0,90 and 0,75.

2.2 Shackles and connections

2.2.1 All connecting items such as shackles, rings, etc., must have a documented MBL in excess of BP according to the safety factors reported in Table 5, increased by 10%.

2.2.2 All connecting items such as shackles, rings, etc., should have a documented at least 50% in excess of the towline documented ultimate capacity (i.e. MBL of the weakest element in the towline).

2.3 Pennant and weak link/fuse

2.3.1 Pennants must have a documented MBL in compliance with the safety factors reported in Table 5, reduced by factor 0,95.

2.3.2 Weak links or fuses must have a documented MBL in compliance with the safety factors reported in Table 5, reduced by factor 0,9.

2.4 Fibre ropes

2.4.1 If fibre rope elements are used, they must have a documented MBL in excess of BP according to the safety factors reported in Table 5, increased by factor 1,5.

2.4.2 For unrestricted operations, pennants fibre ropes should have a documented MBL in excess of the towline documented ultimate capacity (i.e. MBL of the weakest element in the towline) according to the safety factors reported in Table 6.

Table 6: Fibre rope safety factors

BP (KN)	Safety Factor $MBL_{fibrerope}$ / $MBL_{towline}$
BP ≤ 500	2,0
500 < BP ≤ 1000	2,5 - BP/1000
BP > 1000	1,5

2.5 Oversized tug

2.5.1 If the available towing vessel is oversized with regard to the specific needs of the towage to perform, in particular for weather restricted operations, then the towline capacity may be related to the calculated RBP instead of the available BP. Therefore, the towline safety margin can be assessed by replacing BP with RBP in Table 5.

2.5.2 In this case, the tug must be equipped with a suitable monitoring system (load cell on winch cable, weather forecast service, etc.) so that the Master can properly adjust route and speed in order to avoid any risk of exceeding RBP during the voyage.

2.6 Connecting items on the tow

2.6.1 The towline attachments on the towed object (fairleads, chain brackets, bollards, padeyes, etc.) are to be verified at owner's request or for unrestricted towing operation. They and their supporting structures are to be approved by a QSCS Classification Society (as defined by Tasneef Rules) for a SWL greater than BP for normal towing operation (harbour operation) or equal to the equivalent test loads of Table 8 for other towing operations.

If such approval is not documented, the capacity must be assessed by means of suitable structural calculations, according to Pt B, Ch 10, Sec 4, [3] of the Rules for Classification of Ships, as applicable.

2.7 Multiple towing

2.7.1 In case of multiple towing, in series (Figure 2) or parallel (Figure 3) in Appendix 2, the above criteria apply to each line of the tow, considering the whole BP for each line.

2.8 Limited towing operation

2.8.1 Ring or shackles may be accepted instead of triple plate only for limited towing operation. (e.g. when the distance from a safe anchoring along the route can be covered in less than 6 hours of navigation in the weather conditions expected for the towing operation) or when the towing operation are limited to favourable weather condition (e.g. sea state not more than 3 of Douglas scale, wind not more than 3 of Beaufort scale).

3 Towing equipment testing

3.1 Load test certificates

3.1.1 Each component in the towing line not provided with a MBL certificate should be provided with a test certificate in compliance with the test loads reported in the following tables.

Table 7: Test load for steel wires

BP (KN)	Test load
BP ≤ 400	1,52 · BP
400 < BP ≤ 900	(1,728 - 0,00052 · BP) · BP
BP > 900	1,26 · BP

Table 8: Test load for link elements (chains, triangular plates, etc.)

BP (KN)	Test load
BP≤ 400	1,53 · BP
400 < BP ≤ 800	(1,77 - 0,0006 · BP) · BP
BP > 800	1,29 · BP

Table 9: Test load for shackles

BP (KN)	Test load
BP ≤ 400	1,59 · BP
400 < BP ≤ 900	(1,87 - 0,0007 · BP) · BP
BP > 900	1,24 · BP

Table 10: Test load for weak links/fuses

BP (KN)	Test load
BP ≤ 400	1,59 · BP
400 < BP ≤ 900	(1,87 - 0,0007 · BP) · BP
BP > 900	1,24 · BP

CHAPTER 6 Surveys

1 Vessel survey

1.1 General

1.1.1 All units involved in the transportation must be in good condition and provided with Class Certificates in due course of validity, along with all other applicable certificates required for the intended service.

1.1.2 Tasneef surveyor shall take note of the fore and aft draught, to be reported in the Declaration. These values must be in compliance with the visaed drawings, where applicable.

1.2 Condition survey

1.2.1 Upon request, Tasneef performs a condition survey based on dedicated check list, in order to assess the general conditions of the vessel, the safety and functionality of main equipment and the suitability for the planned operations.

2 Sea-fastening survey

2.1 Visual and dimensional survey

2.1.1 The loaded, sea-fastened and ballasted unit in transport condition must be surveyed by Tasneef

2.1.2 If the transport features are not particularly challenging or exceptional, in the opinion of Tasneef the suitability of the transport arrangement, including the stability condition, can be assessed directly by the Tasneef Surveyor, during the survey.

2.2 Material

2.2.1 Sea-fastening material must be provided with manufacturer certificates confirming the mechanical properties assumed for the design and reported on the approved drawings.

2.2.2 If sea-fastening material is high strength steel (tensile stress greater than 410 N/mm^2), or whenever specifically requested, sea-fastening samples shall be subject to laboratory tests in order to verify the mechanical properties, according to recognized testing procedures (Tasneef EN, etc.).

2.3 Welding and NDT

2.3.1 Welders to be used for welded joints with manual process are to be approved by Tasneef

2.3.2 Specific welding processes are allowed if approved for types that are appropriate to the joint categories, in compliance with Tasneef requirements.

2.3.3 Sea-fastening welds must be visually inspected on 100% of their length and, in general, they shall be NDT tested according to the following scheme:

Table 11: Percent extent of NDT

Type of joint	UT	MT/PT
Full penetration in-line butt weld	30	10
Full penetration T-butt weld	20	20
Partial penetration welds with penetration depth greater than 12 mm	5	20
Other partial penetration welds and all fillet welds	0	20

When high fatigue utilization is expected, for example for re-used sea-fastening elements or for very long routes, the values in the table above must be increased properly, referring to recognized standards, such as EN1090-2.

For transports under restricted weather limitation and for welds where the calculated (quasi-)static stress do not exceed 50% of the weld tensile or shear capacity, the values in the table above can be reduced by ½ but not less than 5%.

2.3.4 If unacceptable defects are highlighted, welds must be repaired and NDT test percentage increased to Tasneef surveyor satisfaction.

2.4 Re-used sea-fastening

2.4.1 If sea-fastening structures are made from second-hand steel, the original material certificates must be available. Otherwise, coupon testing will be performed in order to verify that the mechanical properties are in compliance with the design assumptions.

2.4.2 NDT must be performed in critical areas, such as old welds and nearby cuttings, in order to demonstrate the absence of possible defects and cracks.

3 Towing plan verification

3.1 Visual and dimensional survey

3.1.1 All towing line components must be in good condition. No piece of towline equipment should be used if:

- the reduction in cross sectional area due to wear, abrasion, corrosion and broken wires exceeds 10%;
- there is severe kinking, crushing or other damage resulting in distortion of the rope structure;
- end sockets, thimbles or other rope terminations are damaged, deformed or significantly corroded.

3.2 Equipment certificates

3.2.1 The towing equipment on-board tug and cargo barge (or other towed unit) must have a certified capacity not lower than the one assumed on the approved towing plan.

3.2.2 Such capacity should be tested and certified by Tasneef or other recognised Third Party organization (e.g. IACS Classification Societies). In particular case the Manufacturer certificates may be accepted in lieu of the above, provided that:

- the Manufacturer has a solid and recognised reputation in the towing component construction field of activity, directly experienced and documented by Tasneef and:
- the Manufacturer is ISO:9001 certified, and:
- the components have a certificate type 3.1 at least.

3.3 Emergency line

3.3.1 The tow must be equipped with an emergency towing line secured on board.

3.4 Towing line length

3.4.1 The towline must have an appropriate length determined using established criteria for the specific towage. As a general rule, in unrestricted operations, the main towline length should be at least:

$$L\ (m) = (BP/BL) \cdot 1800$$

where BL is the documented breaking load of the towline, i.e. the minimum breaking load (MBL) of its weakest element.

3.4.2 The main towline should never be shorter than 500 m plus the minimum length that needs to remain always on the winch drum.

3.4.3 It is the Master's responsibility to deploy an adequate towing wire length, depending on the tow characteristics and weather conditions.

CHAPTER 1 General

1 Introduction

1.1 Application

1.1.1 This Part of the Rules applies to loading and unloading operations, often referred to as Load Out and Load In, of heavy cargo items to/from the transportation unit. Such operations, necessary to move the cargo or to change its supporting condition, may be performed by means of:

- Self-propelled modular trailers (SPMTs);
- Crane lift;
- Skidding by hydraulic push or pull;
- Winch skidding;
- Ballast variations (float off, float over);
- Launch.

1.1.2 The regulations given in the following articles do not take into account the functionality of the concerned operations but have the only aim of ensuring the standard safety level, mainly depending on structural strength and hydrostatic stability.

1.2 Compliance with other Rules

1.2.1 Loading and unloading operations shall be planned and executed according to the applicable clauses of ISO 19901-6:2009 or ISO 29400, as applicable.

1.2.2 Tasneef "Rules for the classification of ships" or other Rules are applicable for specific aspects.

1.2.3 Other applicable standards and codes may be accepted provided that their safety level is proven to be equivalent to the standards quoted in the previous paragraphs. In any case their application must be submitted to Tasneef for approval.

1.2.4 Compliance with these Rules is apart from and does not exempt from the obligation of fulfilling the applicable laws, rules and requirements, possibly different and/or more stringent than those issued by Tasneef of the Administration of the country whose flag the vessel is flying, and possible different provisions.

2 Deliverables

2.1 General

2.1.1 These Rules define the requirements to be complied with in order to obtain Tasneef design approval and suitability statements for the arrangement intended for cargo loading and unloading operations, as defined above.

2.1.2 Statements are issued in Tasneef form, unless specifically agreed with all parties involved.

2.2 Design appraisal

2.2.1 Upon successful completion of the design appraisal phase, Tasneef returns the engineering documents stamped with the applicable review status (Approved, Info, Noted) and the relevant comments or prescriptions, based on its independent judgement.

2.2.2 Upon request, Tasneef issues also a Certificate of Conformity stating the compliance of the examined engineering documents with the project Rules and Standards agreed before starting the activity.

2.3 Declaration of suitability

2.3.1 Upon successful completion of the survey performed before the operation, Tasneef issues a statement for the correct preparation of the loading or unloading operation according to the approved documents and reference Rules.

2.3.2 The statement contains all the remarks, prescriptions and limitations that Tasneef considers necessary, based on its independent judgement, to be taken into account to carry out the operation.

2.4 Attendance report

2.4.1 Upon request, at successful completion of operations, Tasneef issues an inspection report stating that the operation has been performed smoothly and without apparent damage. In general this statement is included in the Declaration of Suitability for the transport mentioned in Part B of these Rules.

3 Documentation

3.1 Manual

3.1.1 For each loading or unloading operation envisaged, a specific manual will be provided for Tasneef review, including at least the information listed in Table 1.

3.1.2 In addition to the above, the manual shall address the topics mentioned by these Rules, under the chapters related to each specific type of operation.

3.1.3 Depending on the specific features of the operation, Tasneef may require additional documents or may waive the requirement of information, which can be superfluous in relation to the characteristics of the cargo, vessel and equipment.

3.2 Contingency measures

3.2.1 Documentation must include a description of possible hazards and relevant contingency measures, possibly based on dedicated Risk Analysis or HAZID/HAZOP sessions.

3.2.2 Operation planning and equipment selection must take into consideration the possible hazards and emergency conditions identified.

3.3 Weight control

3.3.1 Loading and unloading operations are particularly sensitive to the weight of the items to be moved. A careful activity of weight control must be put in place, according to recognized standards such as Clause 8 of ISO 19901-6:2009.

3.3.2 The weight control reports must be available for Tasneef review, including the physical weighing certificates.

3.3.3 The physical weighing of the items to be moved is in general mandatory for the operations under subject. The weighing can be avoided only in particularly simple cases, where there is complete confidence in the weight control performed. This option must be anyway always agreed with Tasneef

3.3.4 Based on the weight control data available, proper weight contingency factors shall be considered in the operation design, when their application leads to more conservative design conditions.

Table 1 : Documentation to be submitted

No.	I/A (1)	Document	Document details
1	A	Load-out/in Procedure	a) description and main data of the items to be loaded/unloaded; b) description, main data and certificates of cargo barge or vessel, including description of any modification or upgrading; c) procedure describing every step of the operation and their expected duration; d) description of materials, equipment, transfer system on the quay and on the barge and relevant strength/capacity check; e) procedures, certification and qualification records for fabrication processes, where applicable f) organization and responsibility chart; g) operation preparation and preliminary checks; h) ballasting system description; i) tide tables and bathymetric charts of the operational area; j) weather window and limitations (if any) i.e. any maximum allowable values of wind velocity, wave height and current speed which allow the operation to begin; k) risk management, HSE, safety measures and contingency plans.
2	I	Structural Analysis	a) load definition; b) capacity check of SPMTs (structural stress and stability); c) capacity check of winches or hydraulic push-pull systems; d) capacity check of cranes, rigging, loose gear; e) longitudinal strength and local checks of vessel structures a) structural checks of supports, skid ways, skid shoes; b) bearing capacity checks of the quay; c) check of link beam/bridge between quay and barge; d) site specific assessment for jack-up operations.
3	I	Mooring Analysis	a) load definition, according to design weather limitations; b) capacity check of mooring equipment (ropes, bollards, winches, etc.).
4	I	Ballast Sequence Calculation	The operation is subdivided into a sufficient number of steps, for each of them the calculation provides: a) ballast plan changes, i.e. amount of water added/discharged for each tank; b) tide level variation and checks of the seabed clearance; c) foreseen duration of each step and check of available pumping capacity; d) global centre of gravity of vessel and cargo with the correction due to possible tree surface effect in tanks; e) righting moment and wind heeling moment curves (see Chapter 3); f) checks relevant to stability and longitudinal strength.
5	A	Drawings	a) sequence drawings with yard and vessel layout at the main steps of operation; b) cargo weight, distribution, C.o.G. position (including secondary items); c) mooring plan and wind exposed area; d) ballast plan; e) support structures on barge/vessel and their position in relation to deck/hull structures f) rigging arrangement and spreader bars; g) equipment structural details and materials.
6	A	Barge structure modification (if any)	Construction drawings relevant to: a) structural modification; b) selected materials; c) welding procedures and electrodes used.
7	I/A	Any other document	Any other document considered necessary for the proper description or verification of the arrangement, depending on the specific features of the operation.

(1) A = to be submitted for approval
I = to be submitted for information or review

CHAPTER 2 Design criteria

1 Equipment

1.1 General

1.1.1 The item to be moved and all the equipment used for the operation must be properly designed and verified against the loads foreseen during operations, considering also accidental loads in emergency conditions. Where applicable, equipment must be provided with suitable certificates.

1.1.2 Checks of steel components based on recognized “Working Stress Design” (WSD/ASD) codes for steel construction (AISC, etc.) are accepted.

1.1.3 “Load and Resistance Factor” (LRFD) codes and relevant limit state checks are also accepted, provided that the structural analysis is performed in full compliance with all the factors prescribed by the selected code.

1.1.4 For FEM analysis, the equivalent stress evaluated according to the Von Mises criterion, shall not exceed the minimum guaranteed yield stress. Where criteria different from Von Mises' are chosen, they have to be agreed with Tasneef

1.1.5 Where the operations may cause the overloading of structural components, the effects of such overloading are to be monitored and controlled.

1.1.6 As regards the general requirements for the instrumentation, the general provisions in Part A of these Rules apply. The instrumentation used for the control of the loading or unloading operation may include devices suitable for measurement of draft, levelling, inclination, ballast levels and parameters relating to environmental conditions.

1.2 Environmental actions

1.2.1 Stresses induced by environmental conditions are to be included in the structural checks, according to the weather limits assumed for the operations and stated in the manual.

1.3 Ballast operations

1.3.1 The ballast steps must be planned so that there is always enough tank capacity (in charging and discharging) to allow the ballasting sequence to be thoroughly followed.

1.3.2 Ballast pumps must be properly sized in order to have adequate pumping capacity to finalize the operation in adequate time and, when applicable, to compensate the tidal variations, also in case of emergency (such as unexpected stand-by).

1.3.3 For operations where the barge grounding is not foreseen, the under-keel clearance, i.e. minimum distance between barge bottom and sea bed, shall be at least 1,0 m during all the loading/unloading steps. Reduction to 0,5 m is acceptable, provided that the confidence against the grounding risk is improved, for example by using recent and accurate bathymetry measurements, divers’ monitoring, etc.

1.4 Mooring equipment

1.4.1 Mooring equipment must be properly sized, according to Ch. 13 of ISO 19901-6:2009 and based on the weather limits assumed for the operations and stated in the manual.

2 Vessel stability

2.1 General

2.1.1 The vessel shall have adequate stability and buoyancy reserve for all operations of loading and unloading, including possible phases of stand-by on weather or temporary mooring.

2.2 Metacentric height

2.2.1 During all the operations, the actual metacentric height of the vessel is to be at least 1 m.

3 Vessel strength

3.1 Longitudinal strength

3.1.1 The distribution of bending moment and shear force in still water along the hull beam are to be evaluated for each stage of the operation, and it is to be verified that the consequent stresses do not exceed the allowable values.

3.2 Load distribution

3.2.1 The arrangements for the loading and unloading of cargo shall be designed to properly distribute static and dynamic loads induced on the vessel structures and to reduce still water and wave loads on pontoon hull beam.

3.2.2 Concentrated loads should always be applied on areas of the weather deck which are in correspondence with structural reinforced elements.

3.2.3 The levelling and tolerances on supports, skid-ways, etc. are to be defined in order to avoid

over-stress on structures due to ineffective restraint conditions, during all stages of the operation.

3.3 Immersion and grounding

3.3.1 It is to be checked that the bottom and side structures of the cargo barge or vessel are able to withstand the hydrostatic pressures corresponding to the drafts which are reached.

3.3.2 If grounding is required (e.g. float-off), it is to be checked that the bottom structures of the barge are able to withstand the operational loads (ground pressure). Grounding option must be approved by the vessel Class.

3.3.3 For operations where the barge needs to be grounded, the selected site is to be subject to detailed bathymetry measurements in the period preceding the operation. The measured water depth is to be in line with the assumptions in the manual and engineering documentation.

3.3.4 The selected grounding site is to be precisely identified, in particular for offshore operations, by means of geographic coordinates and signalling buoys. The operation location and scheduling are to be submitted to local Authorities to obtain the necessary permits and navigation restrictions.

3.4 Vessel structure modification

3.4.1 Changes to vessel structural elements shall be carried out, if possible, without complex solutions and sudden section variations, which may induce dangerous stress concentrations.

3.4.2 The constructive solutions used shall be consistent, with regard to shape, functionality, materials and welding procedures, with existing pontoon structures.

4 Local structural analysis

4.1 Analysis principles

4.1.1 The local structural analysis of the cargo barge or vessel during the operations of loading and unloading is to be carried out according to the general principles explained in Part B, Ch 4 of Tasneef Rules for the Classification of Ships.

4.2 Load effect determination

4.2.1 Determination of force, moments, stresses and strains shall be based on recognized criteria of static analysis, dynamic analysis and material strength.

4.2.2 Load effects evaluation shall be performed on the basis of the elasticity theory. Methods which are based on the plasticity theory will be considered by Tasneef in each instance.

4.3 Non-linear effects

4.3.1 Possible aspects of geometrical non linearity or lack of homogeneity in material which can have a significant influence on structure behaviour shall be carefully considered.

4.4 Deck levelling

4.4.1 Analyses and checks must take into account that, due to tolerances in ground levelling and in the alinement between the quay plane and the vessel deck, the cargo weight may be distributed on a number of supports which is lower than the envisaged one.

4.5 Deck strength

4.5.1 The deck of the transport unit shall be adequate to support the cargo weight in all the positions that it covers during the movement.

4.5.2 The change in cargo weight distribution, caused for example by ballast operation where the barge experiences big rotations or where the cargo is partially immersed, is to be carefully evaluated and the maximum loads are to be calculated. Deck structures and relevant support beams (grillage) are to be checked accordingly.

4.5.3 Point loads, such as wheel loads, must be carefully considered and the weakest deck structure (plate, girder, etc.) where such loads apply must be verified.

4.5.4 The possibility of loss of support, due to imperfect alinement or levelling, must be taken into consideration.

4.5.5 In the calculation of stresses due to the bending on ordinary girders of deck panels, the “effective width” evaluated according to to Pt B, Ch 4 of Tasneef Rules for the Classification of Ships is to be considered.

5 Analysis methods

5.1 Elastic linear analysis

5.1.1 For vessel structural details checked within linear elastic limits, the equivalent stress, evaluated according to the Von Mises criterion, stall not exceed the allowable values defined in Pt. B, Ch. 4, par. 4.5 of these Rules.

5.1.2 Where criteria different from Von Mises' are chosen, they have to be agreed with Tasneef

5.2 Buckling analysis

5.2.1 This analysis method shall be used for those structural components for which buckling failure may occur.

5.2.2 Buckling analysis shall be performed using generally accepted methods and theories. Alternative criteria shall be approved by Tasneef

5.2.3 The effect of pre-strains due to geometrical and construction faults shall be taken into account when critical buckling stresses are evaluated.

5.3 Plating subject to wheel load

5.3.1 The net thickness of plate panels subjected to wheeled loads is to be not less than the value obtained, in mm, from the following formula:

$$t = C_{WL} (n P_0 k)^{0,5} - t_C$$

where:

$C_{WL} = 2,15 – 0,05 \ell/s + 0,02 (4 - \ell/s) \alpha^{0,5} - 1,7\alpha^{0,25}$

ℓ : length, in m, of plate longer side

S : length, in m, of plate shorter side

ℓ/s is to be taken not greater than 3

$$\alpha = \frac{A_T}{\ell s}$$ with ℓ not greater than 5s

A_T : print area, in m^2 of tyre or group of tyres, in case of double or triple wheels.

n : number of wheels on the plate panel, taken equal to:

- 1 in the case of a single wheel;
- the number of wheels in a group of wheels, in case of double or triple wheels.

P_0 : wheeled force, in kN (the static value is in general acceptable, unless any dynamic effect is envisaged).

k : material factor, see par. 7 below.

t_C : corrosion allowance, in mm.

5.3.2 When the tyre print area is not known, it may be taken equal to:

$$A_T = 9,81 \frac{n Q_A}{n_W p_T}$$

where:

n : number of wheels on the plate panel, as defined in the previous par.

Q_A : axle load, in t

n_W : number of wheels for the axle considered

p_T : tyre pressure, in kN/m^2. When the tyre pressure is not known, it may be taken as defined in Tab. 2.

Table 2: p_T for different kinds of vehicles

Vehicle type	Tyre pressure p_T, in kN/m^2	
	Pneumatic tyres	Solid rubber tyres
Private cars	250	Not applicable
Vans	600	Not applicable
Trucks and trailers	800	Not applicable
Handling machines	1100	1600

5.3.3 When four wheels of one axle are located on a plate panel, as shown in Fig. 1, the net thickness of deck plating is to be not less than the greater of the values obtained, in mm, from the following formulas:

$t = t_1$

$t = t_2 (1 + \beta_2 + \beta_3 + \beta_4)^{0,5}$

where:

t1 : net thickness obtained from [5.3.1] for n = 2, considering one group of two wheels located on the panel;

t2 : net thickness obtained from [5.3.1] for n = 1, considering one wheel located on the panel;

$\beta_2, \beta_3, \beta_4$: coefficients obtained from the following formula, by replacing i by 2, 3 and 4, respectively (see Fig. 6.4.3):

- for $\alpha_i < 2$

  $\beta_i = 0,8 (1,2 - 2,02\alpha_i + 1,17\alpha_i^2 - 0,23\alpha_i^3)$

- for $\alpha_i \geq 2$

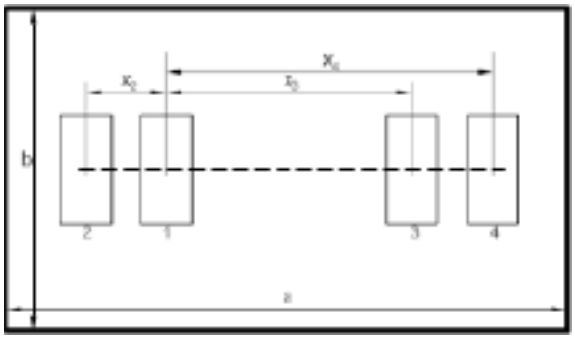
  $\beta_i = 0$

x_i : Distance, in m, from the wheel considered to the reference wheel (see Fig. 1).

b : Dimension, in m, of the panel side perpendicular to the axle

α_i : x_i/b

Figure 1 : Four-wheel axle on a panel



CHAPTER 3 Typical operations

1 Load out by SPMT or skidding

1.1 General requirements

1.1.1 This item covers the operations necessary to move a structure from one supporting condition to another by means of Self Propelled Modular Trailers (SPMT) trailers or by skidding.

1.1.2 Load out operations shall be planned and executed according to Clause 11 of ISO 19901-6:2009 or ISO 29400, as applicable. For possible alternative criteria see the prescriptions at Pt. A of these Rules.

1.2 Barge stability and strength

1.2.1 The barge longitudinal strength and stability is to be verified for a sufficient number of cargo positions included between the beginning and the end of trailer operations, taking into account the necessary step-by-step ballast variation.

1.3 Point loads

1.3.1 Point loads, such as wheel loads, must be carefully considered and the weakest deck structure (plate, girder, etc.) where wheels pass must be verified against the relevant static (or dynamic, if applicable) load.

1.3.2 Bridge plates or similar structures subject to concentrated loads, such as wheels loads, must be verified against the relevant static load (unless particular dynamic effects are foreseen).

1.3.3 The trailer path shall be adequately prepared prior to trailer movement, pot holes filled and compacted, debris and obstructions removed.

1.3.4 Guidelines for the check of structural details subject to point load are available at Pt. B, Ch. 4 of these Rules.

2 Lifting

2.1 General requirements

2.1.1 This item covers the operations necessary to move a heavy item from one supporting condition to another by lifting.

2.1.2 Lifting operations shall be planned and executed according to Clause 18 of ISO 19901-6:2009 or ISO 29400, as applicable. For possible alternative criteria see the prescriptions at Pt. A of these Rules.

2.1.3 It is to be verified that the structures to be lifted and the relevant lifting points have sufficient structural strength for the operation. Special attention is to be paid to the evaluation of the physical aspects that have impact on the load amplitude and distribution, such as

- Dynamic effect;
- Tolerance on rigging length (skew effect);
- Weight inaccuracy and contingency;
- Tolerance on C.o.G. position.

2.1.4 The weight control process, including physical weighing, shall be demonstrated to have been properly managed, so that the weight and centre of gravity data are reliable enough to avoid unexpected overload or tilt during the operation. See also at Pt. C, Ch. 1, Par. 3.3 of these Rules.

2.1.5 For all lifting operations, the effectiveness and the structural strength of the equipment used are to be considered. Such equipment include crane and rigging arrangement (shackles, slings, grommets, etc.).

2.1.6 When the crane is operating from a jack-up vessels, site-specific assessment and soil bearing verification shall be performed, to ensure the crane vessel stability under the specific spud support conditions.

2.2 Rigging equipment

2.2.1 Crane rigging equipment must be properly sized, according to the dynamic effects expected, with reference to the weather limits assumed for the operations and stated in the manual.

2.2.2 Rigging equipment and lifting points must be sized according to Ch. 18 of ISO 19901-6:2009. For cable laid slings and grommets reference shall be made to IMCA M179.

2.2.3 Spreader bars and lifting beams must be designed and verified according to EN 13155. The omission of the load test is possible provided that the relevant design and check procedure in EN 13155 is followed.

2.3 Clearances

2.3.1 Adequate clearances must be foreseen and maintained during movement of lifted objects, depending on the nature of the lifted objects and nearby obstacles, the limiting weather conditions, the motion characteristics of the involved vessels.

2.3.2 In general, 3 m clearance at least is always required around the lifted object against any other object, unless specific guides and bumpers are used.

2.3.3 Clearances around vessels, mooring lines and anchors must be in compliance with Par. 18.7 of ISO 19901-6:2009.

2.4 Installation guides and bumpers

2.4.1 Stabbing guides and cones, installed to ensure a smooth gradual placing of lifted parts,

are to have adequate strength and be so built that accidental overloads do not lead to damage to primary structures of the lifted item.

2.4.2 Guides and cones, used as bumpers and subject to accidental impact, should be sized to resist, a design impact event which shall be defined realistically in terms of velocity and direction. The verification should be based on consideration on energy absorption and deformation pattern.

2.4.3 As a guideline, the design impact force can be defined as a percentage (recommended 10%) of the lifted weight in the worst possible direction. In this case an elastic analysis is acceptable.

2.4.4 Guidance for bumper and guide verification can be found at Par. 18.8 of ISO 19901-6:2009.

2.4.5 The structural parts where stabbing guides and cones are mounted shall be able to resist at least 1,3 times the force coming from the bumper when subject to its design load.

2.5 Free floating

2.5.1 When the lifting is followed by a free floating phase, reference shall be made to the applicable prescriptions from the following paragraph 3.

3 Launching

3.1 Stability

3.1.1 During the launching operation in open sea, and for the subsequent free floating phase, the stability of both cargo unit and launched object is to be carefully considered in relation to the dynamic type of operation and to the environmental influence.

3.1.2 The object prepared for launching or free floating is to be provided with sufficient buoyancy reserve (recommended 5%) to compensate possible inaccuracies in the calculation of weights and buoyancy.

3.1.3 It is to be verified that the object will behave in a stable manner during and after launching and upending phases, and that sufficient bottom clearance is ensured to prevent impacts and grounding.

3.2 Longitudinal strength

3.2.1 The longitudinal strength of the barge is to be verified for a sufficient number of positions included between the beginning of trim variation obtained by means of ballasting and the completion of cargo launching, taking into account the dynamic characteristics of the operation.

3.2.2 The position of the cargo centre of gravity on the vertical of the launching rocker arm pin is to be given special consideration.

3.3 Launching devices

3.3.1 Where items such as platform jackets are to be launched from a barge, the barge is to be provided with suitable arrangements for launching operations. Launch ways and rocker-arm arrangements are to be checked with regard to their suitability and structural strength.

3.3.2 Special consideration shall be given to the stresses of the structures to which the rocker arm or similar devices are connected.

3.3.3 The launching design is to be such that the stresses imposed on the launched object (e.g. platform jacket) will not exceed the allowable limits at any time.

3.3.4 Installation accessories (buoyancy tanks, supports, etc.) are to have adequate structural strength to withstand forces imposed during launching operations.

3.4 Buoyancy tanks

3.4.1 Buoyancy tanks, used for launching operation or simply to guarantee effective free floating conditions, must be designed for the hydrostatic pressure related to the maximum depth they are expected to reach.

3.4.2 Buoyancy tanks are to be properly inspected (immediately before the operation) and leak tested (1,1 times the hydrostatic pressure at the maximum expected depth) to detect possible flaws or damages which might jeopardize their water tightness.

4 Float Over

4.1 General requirements

4.1.1 Float over operations shall be planned and executed according to Clause 15 of ISO 19901-6:2009.

5 Float Off

5.1 General

5.1.1 Float off operations are generally executed by ballasting the cargo barge or vessel until the deck is submersed and the transported unit remains floating. In some cases, this operation is done by grounding the cargo barge or vessel, usually touching the seabed only at one end (bow or stern) of the hull.

5.2 Stability

5.2.1 The transported unit is to have sufficient buoyancy and stability to remain safely afloat and to be removed from the transport position at completion of the ballast operations.

5.2.2 The stability of the system is to be ensured along the whole operations. Stability calculation can take advantage from the contribution from the cargo immersed parts and from the ground reaction, at the stages where such phenomena occur.

5.3 Cargo securing

5.3.1 The cargo stability on board is to be granted at all stages of the operation. Seafastening elements are necessary if the friction effect is not demonstrated to be sufficient. Particular care is to be taken when operation require big rotations of the system.

5.3.2 Seafastening elements are not to interfere with the removal of the cargo unit, once afloat. To this aim, seafastening can be designed to be removable or foldable, under external intervention or under the action of their self-weight.

5.3.3 The vessel rotation and the cargo immersion occurring during ballast operations can modify the cargo weight distribution on its supports. This effect is to be carefully evaluated and the maximum loads are to be calculated, in order to check the structural adequacy of grillage and deck structures.

CHAPTER 4 Surveys

1 Vessel survey

1.1 General

1.1.1 All units involved in the loading/unloading operations must be in good condition and provided with Class Certificates in due course of validity, along with all other applicable certificates required for their service.

1.1.2 Vessel draught, trim and ballast pattern prior to operations must be in compliance with the approved procedure and drawings.

1.1.3 Pumping equipment for ballast adjustment, including portable pumps, if any, must be fully functional and tested.

1.2 Condition survey

Upon request, Tasneef performs a condition survey based on dedicated check list, in order to assess the general conditions of the vessel, the safety and functionality of main equipment and the suitability for the planned operations.

2 Load out preparation

2.1 General provisions

2.1.1 The actual arrangement at yard must be in compliance with the requirements from the approved documents and procedure.

2.1.2 Items to be moved must be arranged according to the approved procedure and their Weight Control data, possibly from physical weighing, must be checked to ensure that their weight and C.o.G. position are in compliance with those reported in the approved documents.

2.1.3 Conditions and preparation of quay or jetty must be checked, including certificates of ground load test.

2.1.4 Bridging elements (ramps, plates or beams acting as bridge between quay and vessel) must be in compliance with the drawings, concerning structural dimensions and layout.

2.2 Environmental conditions

2.2.1 Surveyor, with the support of yard personnel, reviews the weather forecast and the availability of proper weather window prior to operations.

2.2.2 Similarly, surveyor reviews tidal variations of the previous week and tide level at commencement and checks the bathymetric survey reports.

2.3 Trailer operations

2.3.1 Fabrication site must be adequately prepared in way of trailer wheel path and roll on stage markings should be placed along ramp and vessel deck.

2.3.2 Trailer number and arrangement must be in compliance with the approved procedure.

2.3.3 Trailer certificates, capacity, hydraulic system and prime mover must be checked.

2.4 Crane operations

2.4.1 Cranes, rigging equipment (shackles, slings, spreader bars/frames, etc.) and lifting points on the cargo items must be visually inspected. They must be in good condition and provided with valid certificates, where applicable.

2.4.2 Load test can be performed if foreseen by procedure or agreed to improve the operation safety level. Such tests must be performed according to applicable standards.

2.5 Skidding operations

2.5.1 Skid beams preparation and on stage marking must be visually checked.

2.5.2 Skid beams and all other supporting structures stressed by pulling must be fabricated according to the approved drawings, as well as padeyes and trunnions used for the pull.

2.5.3 Pushing or pulling equipment such as wires, winches, hydraulic jacks, sheaves, shackles must be in good conditions and provided with certificates ensuring that their capacity is in compliance with the approved procedure.

2.6 Mooring

2.6.1 Vessel mooring arrangement must be in compliance with the approved plans.

2.6.2 The conditions and certificates (where applicable) of mooring equipment must be checked, including ropes, bollards (on shore arid on board), fairleads, winches, sheaves, shackles.

2.7 Welding and NDT

2.7.1 Welders to be used for welded joints with manual process are to be approved by Tasneef

2.7.2 Specific welding processes are allowed if approved for types that are appropriate to the joint

categories, in compliance with Tasneef requirements.

2.7.3 Welds performed to build structures or fasten equipment used during operations must be visually inspected on 100% of their length and NDT tested according to agreed methods and percentage of length.

2.7.4 If unacceptable defects are highlighted, welds must be repaired and NDT test percentage increased to Tasneef surveyor satisfaction.

APPENDIX 1 Simplified strength analysis method for some typical cases

1 Introduction

The check of the local resistance of the structural components, carried out considering the global system of cargo – sea-fastening – barge, requires a rather complicated analysis.

However, in many practical cases, when it is possible to consider the pontoon as a substantially rigid support for the cargo and the boundary conditions may be outlined according to a limited number of supports symmetrically arranged, the check may be divided into two separate parts, whose treatment is thus made easier:

a) calculation of the stresses acting upon a single boundary formed by one sea-fastening;
b) check of the local structures of the pontoons, to which the above stresses are transmitted.

To give an example, it is explained below how the analysis can be simplified for two cases, which are frequent in the field of offshore carriage.

2 Platform jacket fastened to the barge deck by means of rigid sea-fastenings

With reference to Fig 1 only the assembly, which is symmetric to the symmetric longitudinal plan, is taken into consideration while the vertical component of the wind force due to the roll inclination, may be ignored due to the particular tubular structure of the cargo.

Attention is focused on support n°1 and the following parameters are considered:

P = own weight of the jacket;

G = centre of gravity of the jacket;

P_1 = P fraction weighing on support n°1;

G’ = centre of gravity of the jacket part weighing on supports 1 and 2:

F_V = resultant of the transversal wind loads on the jacket;

F_x, F_y and F_z = longitudinal, transversal and vertical forces transmitted by the jacket on support n° 1.

The forces transmitted by the cargo to support n°1 are indicated below in Tab 1 (see Ch 4, [1.3.4]).

Table 1

Condition	Cause	F_x	F_y	F_z
(a)	Own weight	-	-	P_1
(b)	Transversal wind	-	$\frac{F_v}{4}$	$\frac{F_v}{2} \cdot \frac{z_v}{d}$
(c)	Longitudinal acceleration	$\frac{P}{4} \cdot \frac{a_x}{g}$	-	$\frac{P}{2} \cdot \frac{a_x}{g} \cdot \frac{z_G}{b}$
(d)	Transversal acceleration	-	$P_1 \cdot \frac{a_y}{g}$	$2P_1 \cdot \frac{a_y}{g} \cdot \frac{z'_G}{d}$
(e)	Vertical acceleration	-	-	$P_1 \cdot \frac{a_z}{g}$

where:

g = gravity acceleration, in m/s’;

a_x = longitudinal dynamic acceleration calculated in way of the global centre of gravity of the jackets, in m/s^2.

a_y. a_z = vertical and transversal dynamic acceleration, calculated in way of centre of gravity G ' of the jacket part weighing on supports 1 and 2, in m/s^2.

The stresses S_a, S_b, S_c, S_d and S_e acting on each lashing component can be determined by subjecting a structural model of the lashing corresponding to support n° 1 to the above-mentioned loading conditions.

These stresses are composed into the two resultant stresses S' and S” on the basis of which the pontoon structures involved are checked by means of the following formula:

$$S' = S_a + S_b + (S_c^2 + S_d^2 + S_e^2)^{0,5}$$

$$S'' = S_a - S_b - (S_c^2 + S_d^2 + S_e^2)^{0,5}$$

Figure 1

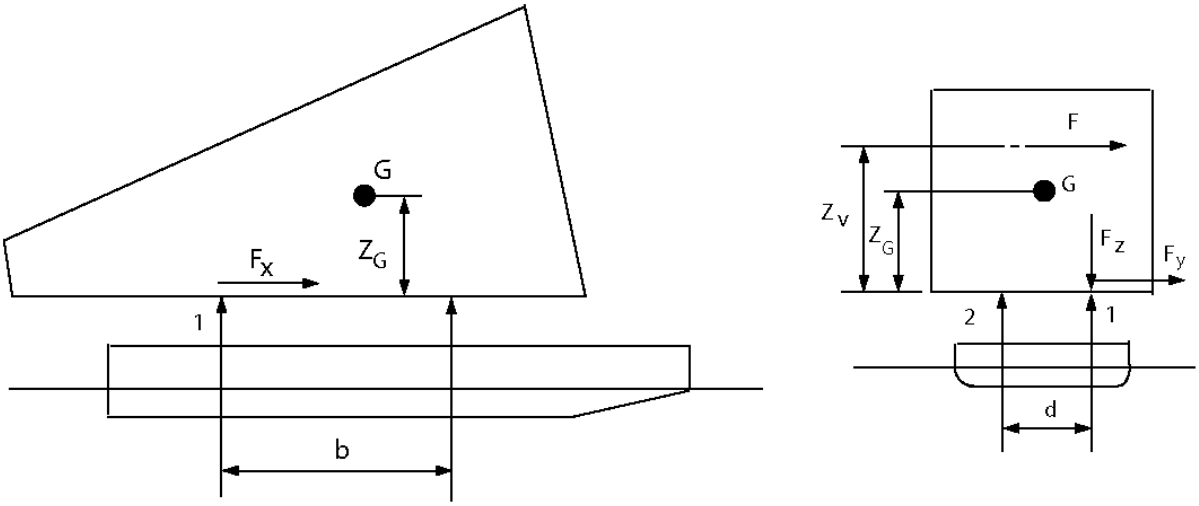
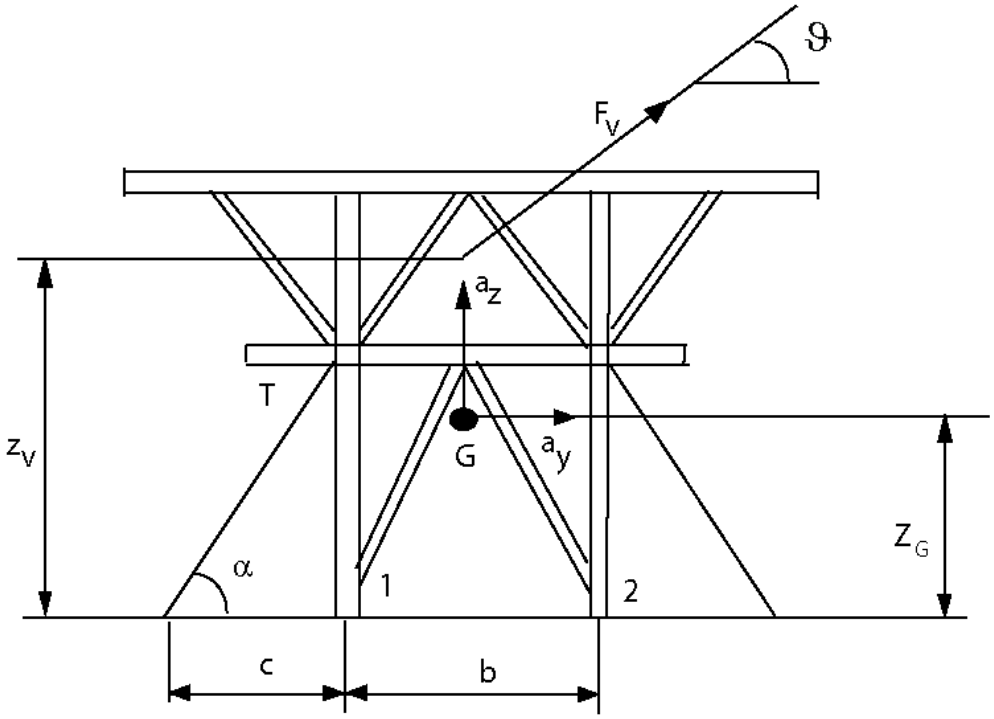


Figure 2



3 Platform deck laid on the barge deck and lashed by means of ropes

With reference to Fig 2, considering in the first instance the problem only on the transversal plane and assuming that the deck has a double symmetry and that the rope pretension may be ignored, it is necessary to consider the two conditions explained in the following paragraphs.

Condition 1

$$\frac{F_V \cos\theta\,(z_V/z_G) + (P/g)a_Y}{P - (P/g)a_z - F_V \sin\theta} \leq \frac{b}{2z_G}$$

where θ is the calculated roll angle, P ts the deck weight and the other parameters are those defined in par. [2].

In this condition, the rope is not stressed to avoid capsizing of the deck. The reactions on the most stressed support are calculated in the same way as in par. [2] above, unless the friction between the support and the deck is insufficient to ensure the required horizontal reaction; in this case it will be necessary to have recourse to different solutions. The effect of the wind in the horizontal areas as a consequence of the inclination of the whole cannot in this case be ignored.

Condition 2

$$\frac{F_V \cos\theta\,(z_V/z_G) + (P/g)a_Y}{P - (P/g)a_z - F_V \sin\theta} \geq \frac{b}{2z_G}$$

In this condition, one support is unloaded and the adjacent rope is stressed to avoid capsizing; they are therefore calculated in a different way. As they originate from two different situations:

- the maximum tensile load on the rope T;
- the maximum vertical and horizontal reactions on the most stressed support.

a) Calculation of the maximum load T on the rope

For this calculation the effect of the wind force and of the vertical and transversal accelerations, directed as indicated in Fig 2, are combined by means of the following formula:

$$T = T_P + T_V + (T_Z^2 + T_y^2)^{0,5}$$

Where:

T_P = load due to the structure's own weight (which tends to release the rope stress), given by;

$$T_P = -P/2 \frac{b}{(b+c)\sin\alpha}$$

T_V = load due to the transversal wind, given by:

$$T_V = F_V \frac{z_V \cos\theta + (b/2)\sin\theta}{(b+c)\sin\alpha}$$

T_Z = load due to the vertical acceleration, given by:

$$T_Z = P \frac{a_z}{g} \frac{b}{b+c} \frac{1}{2\sin\alpha}$$

T_y = load due to the transversal acceleration, given by;

$$T_y = P \frac{a_y}{g} \frac{z_G}{(b+c)\sin\alpha}$$

b) Calculation of the maximum vertical and horizontal reactions on the most stressed support (support 2 in the example of Fig 2).

These reactions occur when the vertical acceleration is directed in the opposite direction to the one indicated in Fig 2.

The maximum vertical reaction C_{max} is obtained by the following formula:

$$C_{max} = C_P + C_V + (C_Z^2 + C_Y^2)^{0,5}$$

where:

C_P = force due to the structure's own weight, given by:

$$C_P = (c + b/2) \frac{P}{b+c}$$

C_V = force due to the transversal wind, given by:

$$C_V = F_V \frac{z_V \cos\theta - (c + b/2)\sin\theta}{(b+c)}$$

C_Z = force due to the vertical acceleration, given by:

$$C_Z = P \frac{a_z}{g} \frac{2c + b}{2(b + c)}$$

C_y = force due to the transversal acceleration, given by:

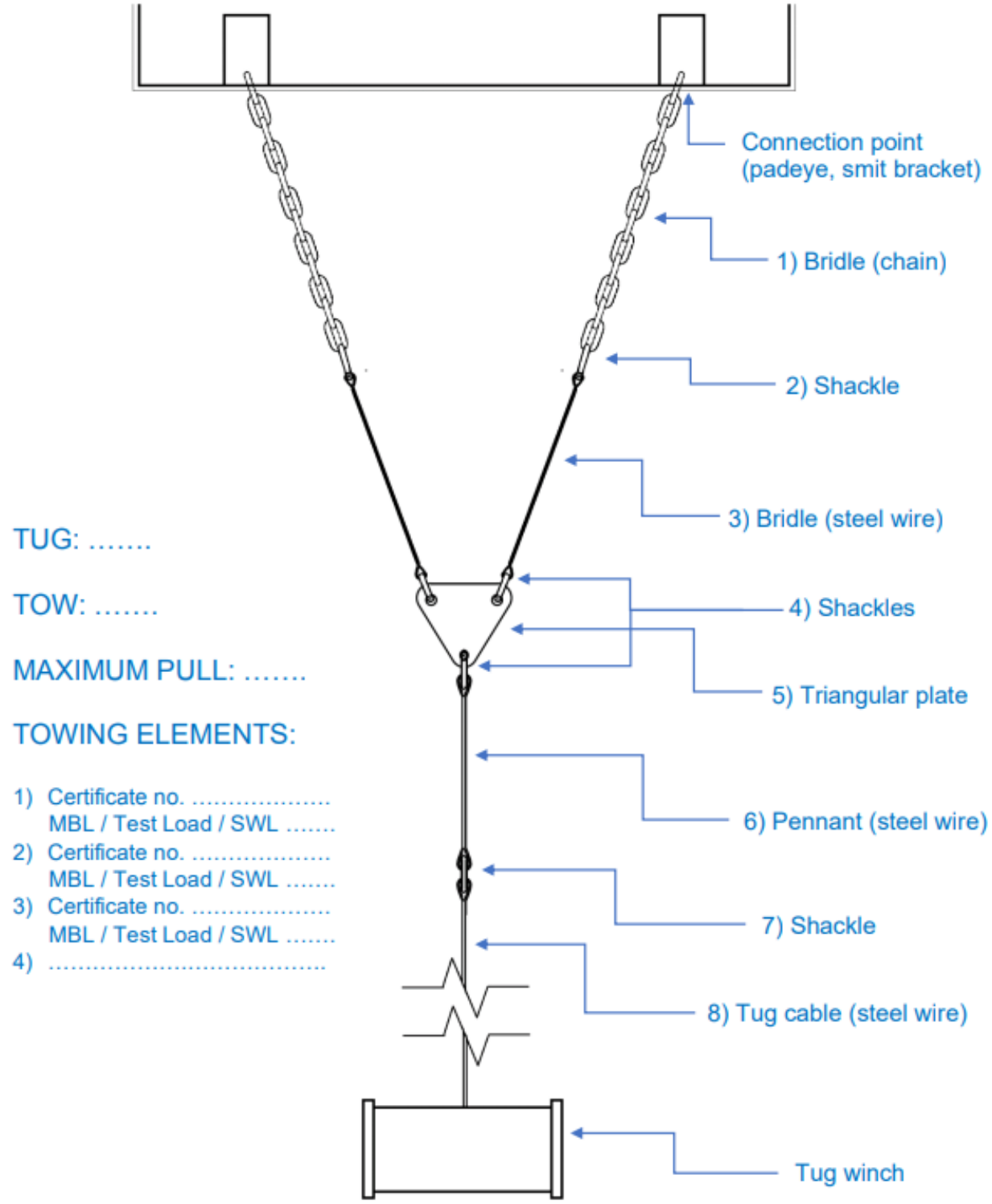
$$C_y = P \frac{a_y}{g} \frac{z_G}{b+c}$$

It will also be necessary to verify that the maximum transversal reaction on the compressed support, calculated in a similar way to the one explained above, may be transmitted by the friction. Otherwise, and in the case of a lack of proper constraints, a new suitable model shall be adopted.

To take into account the effects of the longitudinal acceleration, in connection with longitudinal sea-fastening features, similar considerations can be made.

APPENDIX 2 - TOWING PLAN EXAMPLE

Figure 1



APPENDIX 2 Towing plan example

Figure 2

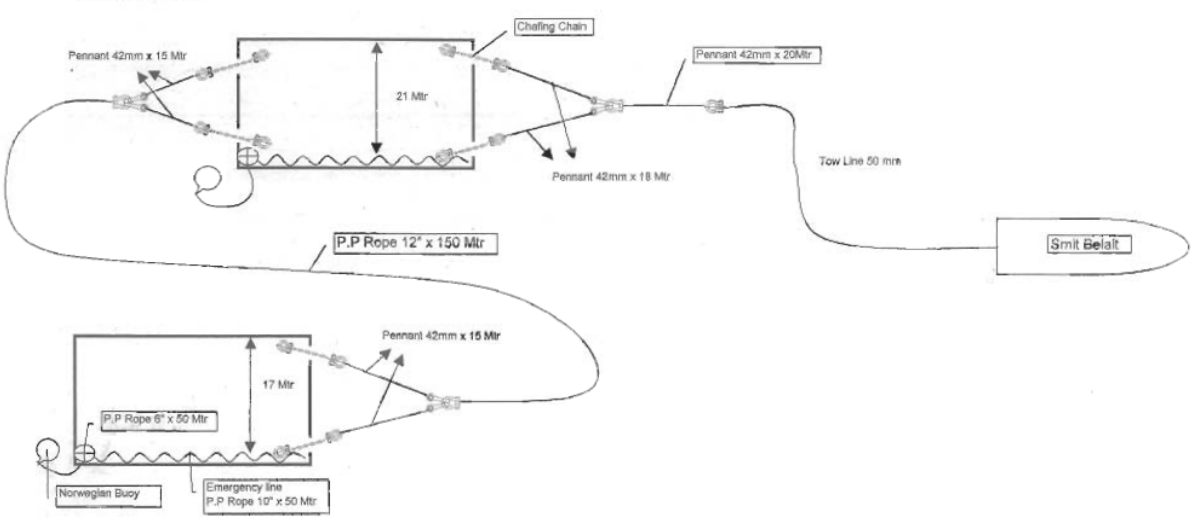


Figure 3