



**BUREAU
VERITAS**

Rules for the Classification of Offshore Loading and Offloading Buoys

May 2006

**Rule Note
NR 494 DT R02 E**



BUREAU
VERITAS

MARINE DIVISION

GENERAL CONDITIONS

ARTICLE 1

1.1. - BUREAU VERITAS is a Society the purpose of whose Marine Division (the "Society") is the classification ("Classification") of any ship or vessel or structure of any type or part of it or system therein collectively hereinafter referred to as a "Unit" whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

The Society:

- prepares and publishes Rules for classification, Guidance Notes and other documents ("Rules");
- issues Certificates, Attestations and Reports following its interventions ("Certificates");
- publishes Registers.

1.2. - The Society also participates in the application of National and International Regulations or Standards, in particular by delegation from different Governments. Those activities are hereinafter collectively referred to as "Certification".

1.3. - The Society can also provide services related to Classification and Certification such as ship and company safety management certification; ship and port security certification, training activities; all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board.

1.4. - The interventions mentioned in 1.1., 1.2. and 1.3. are referred to as "Services". The party and/or its representative requesting the services is hereinafter referred to as the "Client". **The Services are prepared and carried out on the assumption that the Clients are aware of the International Maritime and/or Offshore Industry (the "Industry") practices.**

1.5. - The Society is neither and may not be considered as an Underwriter, Broker in ship's sale or chartering, Expert in Unit's valuation, Consulting Engineer, Controller, Naval Architect, Manufacturer, Shipbuilder, Repair yard, Charterer or Shipowner who are not relieved of any of their expressed or implied obligations by the interventions of the Society.

ARTICLE 2

2.1. - Classification is the appraisement given by the Society for its Client, at a certain date, following surveys by its Surveyors along the lines specified in Articles 3 and 4 hereafter on the level of compliance of a Unit to its Rules or part of them. This appraisement is represented by a class entered on the Certificates and periodically transcribed in the Society's Register.

2.2. - Certification is carried out by the Society along the same lines as set out in Articles 3 and 4 hereafter and with reference to the applicable National and International Regulations or Standards.

2.3. - **It is incumbent upon the Client to maintain the condition of the Unit after surveys, to present the Unit for surveys and to inform the Society without delay of circumstances which may affect the given appraisement or cause to modify its scope.**

2.4. - The Client is to give to the Society all access and information necessary for the performance of the requested Services.

ARTICLE 3

3.1. - The Rules, procedures and instructions of the Society take into account at the date of their preparation the state of currently available and proven technical knowledge of the Industry. They are not a code of construction neither a guide for maintenance or a safety handbook.

Committees consisting of personalities from the Industry contribute to the development of those documents.

3.2. - **The Society only is qualified to apply its Rules and to interpret them. Any reference to them has no effect unless it involves the Society's intervention.**

3.3. - The Services of the Society are carried out by professional Surveyors according to the Code of Ethics of the Members of the International Association of Classification Societies (IACS).

3.4. - **The operations of the Society in providing its Services are exclusively conducted by way of random inspections and do not in any circumstances involve monitoring or exhaustive verification.**

ARTICLE 4

4.1. - The Society, acting by reference to its Rules:

- reviews the construction arrangements of the Units as shown on the documents presented by the Client;
- conducts surveys at the place of their construction;
- classes Units and enters their class in its Register;
- surveys periodically the Units in service to note that the requirements for the maintenance of class are met.

The Client is to inform the Society without delay of circumstances which may cause the date or the extent of the surveys to be changed.

ARTICLE 5

5.1. - The Society acts as a provider of services. This cannot be construed as an obligation bearing on the Society to obtain a result or as a warranty.

5.2. - The certificates issued by the Society pursuant to 5.1. here above are a statement on the level of compliance of the Unit to its Rules or to the documents of reference for the Services provided for.

In particular, the Society does not engage in any work relating to the design, building, production or repair checks, neither in the operation of the Units or in their trade, neither in any advisory services, and cannot be held liable on those accounts. Its certificates cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

5.3. - The Society does not declare the acceptance or commissioning of a Unit, nor of its construction in conformity with its design, that being the exclusive responsibility of its owner or builder, respectively.

5.4. - The Services of the Society cannot create any obligation bearing on the Society or constitute any warranty of proper operation, beyond any representation set forth in the Rules, of any Unit, equipment or machinery, computer software of any sort or other comparable concepts that has been subject to any survey by the Society.

ARTICLE 6

6.1. - The Society accepts no responsibility for the use of information related to its Services which was not provided for the purpose by the Society or with its assistance.

6.2. - **If the Services of the Society cause to the Client a damage which is proved to be the direct and reasonably foreseeable consequence of an error or omission of the Society, its liability towards the Client is limited to ten times the amount of fee paid for the Service having caused the damage, provided however that this limit shall be subject to a minimum of eight thousand (8,000) Euro, and to a maximum which is the greater of eight hundred thousand (800,000) Euro and one and a half times the above mentioned fee.**

The Society bears no liability for indirect or consequential loss such as e.g. loss of revenue, loss of profit, loss of production, loss relative to other contracts and indemnities for termination of other agreements.

6.3. - All claims are to be presented to the Society in writing within three months of the date when the Services were supplied or (if later) the date when the events which are relied on were first known to the Client, and any claim which is not so presented shall be deemed waived and absolutely barred.

ARTICLE 7

7.1. - Requests for Services are to be in writing.

7.2. - **Either the Client or the Society can terminate as of right the requested Services after giving the other party thirty days' written notice, for convenience, and without prejudice to the provisions in Article 8 hereunder.**

7.3. - The class granted to the concerned Units and the previously issued certificates remain valid until the date of effect of the notice issued according to 7.2. hereabove subject to compliance with 2.3. hereabove and Article 8 hereunder.

ARTICLE 8

8.1. - The Services of the Society, whether completed or not, involve the payment of fee upon receipt of the invoice and the reimbursement of the expenses incurred.

8.2. - **Overdue amounts are increased as of right by interest in accordance with the applicable legislation.**

8.3. - **The class of a Unit may be suspended in the event of non-payment of fee after a first unfruitful notification to pay.**

ARTICLE 9

9.1. - The documents and data provided to or prepared by the Society for its Services, and the information available to the Society, are treated as confidential. However:

- Clients have access to the data they have provided to the Society and, during the period of classification of the Unit for them, to the **classification file** consisting of survey reports and certificates which have been prepared at any time by the Society for the classification of the Unit;
- copy of the documents made available for the classification of the Unit and of available survey reports can be handed over to another Classification Society Member of the International Association of Classification Societies (IACS) in case of the Unit's transfer of class;
- the data relative to the evolution of the Register, to the class suspension and to the survey status of the Units are passed on to IACS according to the association working rules;
- the certificates, documents and information relative to the Units classed with the Society may be reviewed during IACS audits and are disclosed upon order of the concerned governmental or inter-governmental authorities or of a Court having jurisdiction.

The documents and data are subject to a file management plan.

ARTICLE 10

10.1. - Any delay or shortcoming in the performance of its Services by the Society arising from an event not reasonably foreseeable by or beyond the control of the Society shall be deemed not to be a breach of contract.

ARTICLE 11

11.1. - In case of diverging opinions during surveys between the Client and the Society's surveyor, the Society may designate another of its surveyors at the request of the Client.

11.2. - Disagreements of a technical nature between the Client and the Society can be submitted by the Society to the advice of its Marine Advisory Committee.

ARTICLE 12

12.1. - Disputes over the Services carried out by delegation of Governments are assessed within the framework of the applicable agreements with the States, international Conventions and national rules.

12.2. - Disputes arising out of the payment of the Society's invoices by the Client are submitted to the Court of Nanterre, France.

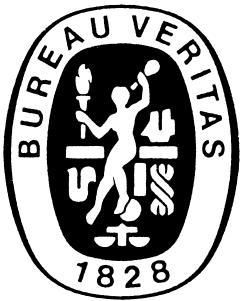
12.3. - **Other disputes over the present General Conditions or over the Services of the Society are exclusively submitted to arbitration, by three arbitrators, in London according to the Arbitration Act 1996 or any statutory modification or re-enactment thereof. The contract between the Society and the Client shall be governed by English law.**

ARTICLE 13

13.1. - These General Conditions constitute the sole contractual obligations binding together the Society and the Client, to the exclusion of all other representation, statements, terms, conditions whether express or implied. They may be varied in writing by mutual agreement.

13.2. - The invalidity of one or more stipulations of the present General Conditions does not affect the validity of the remaining provisions.

13.3. - The definitions herein take precedence over any definitions serving the same purpose which may appear in other documents issued by the Society.



RULE NOTE NR 494

Rules for the Classification of Offshore Loading and Offloading Buoys

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SECTION 1

GENERAL

1 General

1.1

1.1.1 Application

The requirements of the present Rule Note apply to oil loading and offloading buoys, as defined in [1.2].

An offshore buoy with service notation “**oil-loading**” or “**oil-offloading**” is considered as a permanent installation as defined in Part A, Chapter 1, Sec 1 [4.5] of the Rules for the Classification of Offshore Units.

Particular provisions of the present Rule Note are complementary to provisions of the following Rules and Rules Note, which remain applicable, except where otherwise specified:

- Parts A, B and C of the “Rules for the Classification of Offshore Units”
- NR 216 “Material and Welding”
- NR 426 “Construction Survey of Steel Structures of Offshore Units and Installations”.

Buoys used as a permanent mooring system will be given special consideration based on the present document.

1.1.2 National Authorities Requirements

Attention is drawn to special legal provisions enacted by National Authorities which units may have to comply with according to their flag, structural type, size, operational site and intended service, as well as other particulars and details.

1.1.3 Classification and National requirements

Compliance with statutory requirements mentioned in [1.1.2] is not included in classification scope but, in case of conflict between the Rules and these requirements, the latter ones are to take precedence over the requirements of the Rules, as stated in Part A, Chapter 1, Sec 1 of the Rules for the Classification of Offshore Units.

1.2 Definitions

1.2.1 Buoy

A buoy is a floating body, not normally manned, generally of a cylindrical shape and fitted with mooring equipment as necessary to perform the mooring of a vessel and ensuring fluid transfer between production and/or storage unit or onshore installation and the moored vessel.

It is composed of the following main parts:

- a hull providing buoyancy and stability
- a rotating part to which the vessel is moored and allowing weathervaning

- a fixed part to which the mooring lines and underbuoy pipes are connected.

Note 1: The hull may be either the rotating part or the fixed part.

1.2.2 Fluid transfer lines

To ensure fluid transfer, a buoy is connected to the following types of fluid transfer lines:

- floating hoses
- underbuoy pipes.

A floating hose is a fluid transfer line connected between the moored vessel and the buoy.

An underbuoy pipe may be:

- a riser: a fluid transfer line located between the sea bottom (e. g. from a pipe line end manifold) and the buoy,
- an export line: a fluid transfer line located between the production and/or storage unit and the buoy.

1.2.3 Loading

For the purpose of the present Rule Note, loading means facilities, in a near-shore location, for fluid transfer (either ways) between a moored vessel and on-shore facilities for processing, storage or distribution.

1.2.4 Offloading

For the purpose of the present Rule Note, offloading means facilities to transfer hydrocarbons from an offshore installation to the moored vessel.

1.2.5 Loading and offloading buoy

Loading and offloading buoys are installations that include:

- the buoy
- the equipment for vessel mooring to the buoy
- the equipment for fluid transfer
- related handling/storage equipment.

1.2.6 Splash zone

The splash zone is the zone of the buoy which is alternatively in and out of water due to wind, wave, tide and motions. Surfaces which are wetted only during major storms are excluded from the splash zone.

1.3 Structural type and service notation

1.3.1 In accordance with Part A, Chapter 1, Sec 2 [4.2] of the Rules for The Classification of Offshore Units, the units covered by the present Rule Note will receive, according to their type and service, one structural type and one service notation among the following:

- **Offshore Buoy / oil loading**
- **Offshore Buoy / oil offloading**

1.4 Site notation

1.4.1 Site notation is granted in accordance with provisions of Part A, Chapter 1, Sec 2 [5.3] of the Rules for the Classification of Offshore Units.

Note 1: A navigation notation is generally not applicable.

1.5 Additional class notation

1.5.1 RIPRO

RIPRO additional class notation may be assigned to buoys fitted with underbuoy pipes meeting the corresponding requirements of Sec 8, [2].

1.6 Additional service feature

1.6.1 POSA

The additional service feature **POSA** is to be assigned for permanent offshore buoys installation.

The anchoring system of the buoy is to comply with the requirements of NI 493 "Classification of Mooring Systems for Permanent Offshore Units" applicable for granting the additional class notation **POSA**, in addition to those of the present Rule Note.

Note 1: See also Sec 4, [6].

2 Design conditions

2.1 General

2.1.1 In accordance with the provisions of Part A, Chapter 1 and Part B, Chapter 2 of the "Rules for the Classification of Offshore Units", the party applying for classification is to provide the Society with the classification data and assumptions.

Relevant information will be entered in the Design Criteria Statement (refer to Part A, Chapter 1, Sec 1 [1.6] of the "Rules for the Classification of Offshore Units").

2.2 Site data

2.2.1 As specified for permanent installations in Part A, Chapter 1 1 and Part B, Chapter 2 of the "Rules for the Classification of Offshore Units", the party applying for classification is to specify the site at which the unit will operate and is to provide relevant design data and background information.

2.3 Operating conditions and loads

2.3.1 The data on unit operation are to include the information required in [2.3.2] to [2.3.5].

2.3.2 General information

The characteristics of hydrocarbons intended to be loaded and offloaded are to be specified.

2.3.3 Environmental conditions

The following environmental conditions are to be considered:

- extreme environmental conditions with no moored vessel (survival condition)
- most severe environmental conditions during loading and offloading conditions with a moored vessel
- limiting conditions before the disconnection of the moored vessel.

2.3.4 Moored vessel

The range of vessel sizes is to be specified. The range of loading conditions of these vessels is to be also specified.

2.3.5 Loads

The following loads are to be considered, in all relevant conditions detailed in [2.3.3]:

- mooring loads
- hawser line loads
- underbuoy pipe loads
- wave static head loads
- loads induced by other equipment
- loads in bearings.

3 Documentation to be submitted

3.1

3.1.1 Submitted documentation is to include the following information, in addition to what is specified in Part A, Chapter 1 of the "Rules for the Classification of Offshore Units":

- Design criteria and data, as defined in [2]
- General drawings:
 - arrangement of watertight subdivision, including the location, type and disposition of watertight and weathertight closures
 - structural arrangement showing shell, bottom and deck platings and bulkheads
 - location of equipment
 - general arrangement of underbuoy pipes, underbuoy pipes supports and transfer lines (including the swivel)
 - general arrangement of the mooring system
 - general arrangement of hazardous areas
 - arrangement of the rotating structure
 - general arrangement of boat landing area.
- Structural drawings, specifications and supporting documents:
 - mooring systems foundations (fairleads, stoppers, winches, bollards, etc.) as applicable
 - rotating part and fixed part structural and mechanical drawings
 - buoyancy part structural drawings
 - underbuoy pipes supports

- specification of coatings and drawings of cathodic protection, including outside hull and inside of tanks, with drawings of anode securing devices.
- d) Piping drawings:
 - diagrammatic drawings of vent systems
 - connections to underbuoy pipes
 - diagrammatic drawings of crude oil and/or gas piping systems
 - specification of pumps, valves, expansion joints and other crude oil and/or gas piping fittings
 - bilge and drainage systems
 - remote control of crude oil and/or gas transfer system (if any)
 - drawings of product swivels
 - drawings of electrical swivels (if any)
 - emergency shut down system (if any)
- e) Safety plans:
 - drawing and specification of fire and gas detection systems (if any)
 - fire extinguishing equipment layout and specifications.
- f) Electrical drawings:
 - instrumentation
 - energy supply system
 - controls systems
 - navigation aid systems.
- g) Others:
 - documents relevant to contemplated additional notations, as specified in the Rules.

SECTION 2

MAINTENANCE OF CLASS

1 General principles of surveys

1.1 General

1.1.1 The general principles of surveys are given in Part A, Chapter 2, Sec 1 of the "Rules for the Classification of Offshore Units".

1.2 Survey types

1.2.1 Classed buoys are submitted to surveys for the maintenance of class. These surveys include the class renewal survey, intermediate and annual survey. Such surveys are carried out under the conditions laid down in the present Section. In addition to the above periodical surveys, buoys are to be submitted to occasional surveys whenever deemed appropriate by the Society.

2 Annual survey

2.1 General

2.1.1 At every annual survey, the buoy is to be generally examined afloat. The survey will include visual examination and tests to show that the buoy is in satisfactory conditions.

Note 1: It is reminded that, according to Part A, Chapter 2, Sec 1 [5.5] of the "Rules for the Classification of Offshore Units", every modification of the unit or its equipment, affecting the classification are to be brought to the knowledge of the Society.

2.1.2 The extent of the survey depends also on the condition of the buoy and its equipment. If any doubt arises as to the maintenance or condition of the buoy or its equipment, then further examination and testing may be conducted as considered necessary by the Surveyor.

2.1.3 Any specific equipment or arrangement covered by service notation or an additional class notation for which annual survey is not detailed in the present Rules or in another publication of the Society is to be submitted to a programme of survey determined with the agreement of the Society.

2.1.4 The Owner or his representative is to declare to the attending Surveyor that no changes have been made to the buoy that may affect the classification.

2.2 Survey of structure and related equipment

2.2.1 The survey includes the following:

- Examination of the buoy structure and its closing appliances so far as can be seen:
- side shell plating above the waterline, with special attention to plating damages due to wave slam or bumping and/or due to boat impacts

- buoy body deck
- internal parts of buoy body (with particular attention to the watertight bulkheads and bulkhead penetrations, bottom structure and centre well)
- structure in the vicinity of main bearing, hawser supports and other major load carrying structures
- structure in the vicinity of major openings or discontinuities
- turret or turntable as applicable
- hatches, hatch coamings and closing appliances
- bulwarks, guard rails and freeing ports
- air pipes, overflow pipes and closing arrangements
- Examination of anchoring and mooring equipment covered by class, as far as practicable, including housing, supporting equipment and connections to the buoy's structure.
- Structural areas of the buoy exposed to corrosion, including spaces used for water ballast (if any) and spaces used as surge tanks (if any), as accessible. If deemed necessary, thickness measurements may be required.
- Examination of the corrosion protection system (as applicable: condition of the sacrificial anodes, protective coating ...).
- Confirmation that the main bearing is maintained according to Manufacturer's program. Results of grease analysis may be required.

Note 1: When considered necessary by the Surveyor, thickness measurement is to be carried out and if the results of these thickness measurements indicate that substantial corrosion is found, the extent of thickness measurements is to be increased at his satisfaction.

Note 2: Extent of surveys of hatches, hatch coamings and their closing appliances, if any, is specified in the "Rules for the Classification of Steel Ships".

2.2.2 Other areas:

- Verification of protection of personnel (guard rails, access ladders, boat landing).
- Verification of loading guidance and stability data as applicable including verification of draft and trim of the buoy.

2.3 Piping and pressure containing equipment

2.3.1 For piping and pressure containing equipment, the survey includes the following:

- Bilge pumping system.
- Cargo/product lines with their equipment and apparatus (including supports, seals, remote control and shut down devices, instrumentation).
- Swivel and seals.

2.4 Safety equipment

2.4.1 For safety equipment, the survey includes the following:

- Confirmation that portable fire extinguishers are in their stowed positions, checking for evidence of proper maintenance and servicing.
- As applicable, confirmation that other safety systems such as the alarm and communication systems are in working order.

2.5 Electrical equipment

2.5.1 For electrical equipment, the survey includes the following:

- Navigation aids (signal lights, sound signal and radar deflector).
- Sources of power (including batteries, solar panels, wind generators as applicable).

2.6 Hazardous areas

2.6.1 For hazardous areas, the survey includes the following:

- Confirmation that there is no potential sources of ignition in or near the cargo lines and swivel.
- Examination of hazardous areas including their closures and boundaries.
- Gas detection and associated arrangements (if any).
- Electrical and mechanical safe equipment.

2.7 Mooring system

2.7.1 Refer to Part A, Chapter 2, Sec 8 of the "Rules for the Classification of Offshore Units".

3 Intermediate survey

3.1 General

3.1.1 The intermediate survey includes the following:

- Underwater surveys are to be carried out by one or more qualified divers under survey of the Society.

The following areas are to be surveyed according to an agreed program:

- Buoy bottom (external part).
- Mooring lines supports (as applicable).
- Examination of the corrosion protection system (condition of the sacrificial anodes, if any, which are to be less than 50% depleted; protective coating...).
- For buoys where internal spaces of the buoy body are used as ballast tanks or surge tanks, the intermediate survey consists of an internal examination of ballast tanks and surge tanks, as deemed necessary by the Surveyor.
- Electrical equipment in hazardous areas will be examined and tested, with particular attention to:
 - Protective earthing.

- Condition of increased safety equipment.
- Condition of cabling (damage to outer sheath, corrosion of metal braiding).
- Operation of pressurised equipment and functioning of alarms.

3.2 Ballast tank / surge tank surveys

3.2.1 Application

This applies to buoys where internal spaces of the buoy body are used as ballast tanks or surge tanks. In this case the intermediate survey consists of an internal examination of ballast tanks and surge tanks, as deemed necessary by the Surveyor.

3.2.2 Buoys of less than 10 years of age

For buoys of less than 10 years of age, in addition to the requirements of [3.1], an internal examination of representative salt water ballast tanks is to be carried out. The same applies to surge tanks.

- Where such examination reveals no visible structural defects, the examination may be limited to the verification that the protective coating remains efficient, and that the sacrificial anodes, if any, are less than 50% depleted.
- Where poor coating condition, corrosion or other defects are found in salt water ballast spaces or where a protective coating was not applied from the time of construction, or where sacrificial anodes, if any, are found to be more than 50% depleted, the examination will be extended to other ballast spaces of the same type.
- For salt water ballast spaces, where a protective coating is found in poor condition and is not renewed, where a soft coating has been applied or where a protective coating was not applied from the time of construction, maintenance of class will be subject to the tanks in question being internally examined and thickness measurements carried out as considered necessary at annual intervals.

3.2.3 Buoys of 10 years of age and over

For buoys of 10 years of age and over, in addition to the requirements of [3.1], an internal examination of all salt water ballast tanks is to be carried out. The same applies to surge tanks.

- Where such examination reveals no visible structural defects, the examination may be limited to the verification that the protective coating remains efficient.
- For salt water ballast spaces, where a protective coating is found in poor condition and is not renewed, where a soft coating has been applied or where a protective coating was not applied from the time of construction, maintenance of class will be subject to the tanks in question being internally examined and thickness measurements carried out as considered necessary at annual intervals.
- When substantial corrosion is found, thickness measurements may be required at this time.

4 Class renewal survey

4.1 General

4.1.1 Survey programme

A specific survey programme is to be worked out in advance of the class renewal survey by the Owner in co-operation with the Society.

4.1.2 General scope of survey

- a) As part of the preparation for the class renewal survey, the programmes of thickness measurements and surveys are to be dealt with, in advance of the class renewal survey. Thickness measurements are to be carried out not earlier than the last annual survey.
- b) The class renewal survey includes, in addition to the requirements of the annual survey, examination, tests and checks of sufficient extent to consider that the structure and related piping are in an acceptable condition and that the new class period can be assigned, subject to proper maintenance and operation and to periodical surveys being carried out at the due dates.
- c) Unless otherwise specified, the programmes are to include requirements of [4.2] to [4.6] which are applicable at every class renewal survey.

In addition to the surveys detailed in [4.2] to [4.6], a general examination, as detailed in [2] for the annual survey of the structure, piping and pressure containment equipment, electrical and safety equipment will be carried out.

4.1.3 Additional survey

Any specific arrangement or equipment covered by a service notation or an additional class notation for which class renewal survey is not detailed in the present Rule Note or in another publication of the Society is to be submitted to a programme of survey determined with the agreement of the Society.

4.1.4 Survey of underwater parts

An examination of the underwater parts, such as buoy bottom, side shell below water line, centre well below water line, mooring lines supports..., is to be carried out in dry condition unless, as per Part A, Chapter 2, Sec 1 [4.3] of the "Rules for the Classification of Offshore Units", underwater surveys have been accepted by the Society in lieu of dry-docking, for specific cases of operation.

Underwater surveys will be performed according to an agreed program under survey of the Society.

4.2 Class renewal survey of structure and related equipment

4.2.1 Buoy body

Internal spaces of the buoy body (including salt water ballast tanks, cofferdams, surge tanks...), internal spaces of the turntable (if applicable), internal spaces of the turret (if applicable) will be examined in order to discover substan-

tial corrosion, significant deformation, fractures, damages or other deterioration impairing structural integrity; this examination is to be supplemented by thickness measurement and testing as deemed necessary.

Where provided, the condition of coating or corrosion protection system of the buoy body internal spaces will be examined. The condition of the external corrosion protection system will also be examined.

For salt water ballast spaces and surge tanks where a protective coating is found in poor condition and is not renewed, where a soft coating has been applied or where a protective coating was not applied from the time of construction, maintenance of class will be subject to the tanks in question being internally examined and thickness measurements carried out as considered necessary at annual intervals.

Thickness measurement is to be carried out as considered necessary.

4.2.2 Buoy particular structural areas

Buoy particular structural areas, as defined in Sec 4 are to be examined in order to discover substantial corrosion, significant deformation, fractures, damages or other deterioration impairing structural integrity; this examination is to be supplemented by thickness measurement and testing as deemed necessary.

Particular attention is given to high stress areas, particularly to areas of stress concentrations such as bearing support, hawsers supports and more generally, openings, changes in sections and/or shapes, structural connections and other structural discontinuities. Examination is also made of the connections of equipment and attachments to load carrying structural elements.

Anchoring and mooring equipments are examined as per Part A, Chapter 2, Sec 8 [1.2] of the "Rules for the Classification of Offshore Units".

The requirements for thickness measurements at class renewal survey are given in Tab 1.

The surveyor may further extend the thickness measurements as deemed necessary.

For areas in tanks where coating are found to be in a good condition, the extent of thickness measurements according to Tab 1 may be specially considered by the Society.

The location of measurements and the acceptance criteria for thickness measurements are defined in App 1.

4.2.4 Main bearing

The main bearing (including sealing and greasing systems) is to be externally inspected.

In case of doubt during survey, repairs or dismantling of the main bearing may be requested and/or rotation tests with torque measurements.

Table 1 : Requirements for thickness measurements for class renewal survey

| Age of the buoy (years) | | | |
|--|--|--|--|
| age ≤ 5 | 5 < age ≤ 10 | 10 < age ≤ 15 | age > 15 |
| Suspect areas after survey required in [4.2.1] and [4.2.2] | 1. Buoy body <ul style="list-style-type: none"> a) Selected strakes in the splash zone (1), including side shell and centre well. b) Selected strakes and stiffeners in salt water ballast tanks and/or surge tanks. | 1. Buoy body <ul style="list-style-type: none"> a) Selected strakes and stiffeners of side shell and centre well (with particular attention for the splash zone (1)) b) Selected strakes and stiffeners of radial bulkheads and inner bulkheads (with particular attention in salt water ballast tanks and/or surge tanks) c) Selected strakes and stiffeners of deck d) Selected strakes and stiffeners of bottom | 1. Buoy body Thickness measurements for the application of App 1 |
| | 2. Turret (if applicable) Selected strakes and stiffeners in the splash zone (1). | 2. Turret (if applicable) Selected strakes and stiffeners (with particular attention to the splash zone) | 2. Turret (if applicable) Strakes and stiffeners to be measured following the same principle applied for the buoy body |
| | 3. Suspect areas after survey required in [4.2.1] and [4.2.2]. | 3. Selected items (plates, stiffeners, ...) of buoy particular structural areas | 3. Buoy particular structural areas: <ul style="list-style-type: none"> a) main bearing area if not already covered by 1 b) mooring lines supports and hawser supports: as deemed necessary, following an agreed program |
| | | 4. Suspect areas after survey required in [4.2.1] and [4.2.2] | |

(1) The definition of the splash zone is given in Sec 1, [1.2.6].

4.3 Piping and pressure containing equipment

4.3.1 General

Piping systems and pressure containing equipment (e.g. swivel) will be examined for tightness and satisfactory condition.

Dismantling and/or thickness measurements may be required. In case of doubt, repairs or dismantling on crude oil or ballast piping are to be performed and a hydraulic or hydro-pneumatic test is to be carried out. It is to be verified that crude oil piping are electrically bonded to the hull.

4.3.2 Cargo transfer

Swivel assembly (including seals) and associated piping are to be externally examined. Swivels and piping conveying erosive or corrosive fluids are to be dismantled for internal visual inspection.

Thickness measurements may be required.

Upon completion of the survey, the swivel assembly is to be hydraulic or hydro-pneumatic tested to design pressure.

The swivel assembly is also to undergo a rotation test (at least at maximum operating pressure). At least one complete rotation is to be performed. The measured leakage is not to exceed design values.

All safety valves on crude oil piping and product swivel are dismantled for examination, adjusted and, as applicable, resealed.

4.3.3 Other

Crude oil, ballast and stripping pumps are internally examined and prime movers are checked. A working test is carried out.

Venting systems and flame screens are to be opened up for examination as deemed necessary.

When level gauging in tank is fitted, function test is to be made.

4.4 Safety equipment

4.4.1 In addition to the annual survey requirements, the safety equipment covered by classification as per Sec 6 are to be tested at the satisfaction of the attending Surveyor.

4.5 Electrical equipment

4.5.1 The program of the annual survey is to be performed.

4.6 Hazardous areas

4.6.1 In addition to the annual and intermediate surveys programs, a general examination of the electrical equipment and cables in dangerous zones, such as areas adjacent to the swivel, is to be carried out for defective explosion-

proof equipment, improperly installed wiring, non-approved equipment and dead ended wiring.

An insulation test of circuits is carried out. In case where a proper record of testing is maintained, consideration will be given to accept recent readings by the Operator. If any of the readings is not within acceptable criteria, or if the condition of the cables, fixtures or equipment appears defective in any way, verification measurements may be required. These measurements are not to be attempted until the unit is in a gas-free or inerted condition and are to be carried out within an acceptable period of time.

SECTION 3

GENERAL ARRANGEMENT AND STABILITY

1 General arrangement

1.1 Floating structure

1.1.1 Locking system

A locking device is to be provided for locking the rotating part in any selected position during installation, maintenance or repair operations.

1.1.2 Buoy fendering

The hull is to be fitted below the waterline with a skirt around the hull to protect against tanker impact and with fenders at the top of the buoy to protect against service boat impact.

1.1.3 Draught marks

Draught marks are to be fitted on the side shell of the buoy. For deep water applications, the draught marks are to be fitted at four locations on the side shell of the buoy.

1.2 Rotating part

1.2.1 Centre of gravity

The centre of gravity of the rotating part is to be on the vertical axis of the buoy.

The rotating part is to be equipped with sealed ballast boxes of sufficient capacity and located such as to allow the adjustment of the rotating part centre of gravity.

1.3 Protection

1.3.1 A protective cage is to be fitted around the hawser line connecting plate on the mooring arm. Cage dimensions and height are to be such as the connecting plate or any other adjacent part will not come in contact with the frame at any time when the tanker is moored.

1.3.2 A tubular frame protective cage is to cover the deck or at least the rotating part so that the hawser line is not caught in projecting parts of the buoy, such as valves and piping, winches and handling gear or navigational aids.

1.4 Access

1.4.1 Boat landing

The boat landing area is to be located as far as practicable at the opposite side of the floating hose piping connection to the buoy.

1.4.2 Walkways, ladders and handrails

Walkways, ladders and handrails are to be fitted to all raised areas of the buoy requiring access for maintenance and operation personnel.

1.5 Inspection

1.5.1 Means are to be provided to facilitate inspection and efficient maintenance of the structure and associated equipment.

Each buoy watertight compartment is to be accessible by a watertight manhole. The minimum clear opening for vertical access is not to be less than 600 mm by 800 mm, unless otherwise authorized by the Society.

1.5.2 The buoy is to be equipped with installations to help divers for connection and disconnection of the floating hose lines and for current maintenance operations.

2 Stability

2.1 Intact stability

2.1.1 The intact stability of the buoy is to be examined under the following conditions:

- In still water, without mooring lines, hawser line and underbuoy pipes.
- In still water, with mooring lines but without hawser line and underbuoy pipes.
- Under tow, if necessary.
- During installation.
- In operating conditions with all mooring lines and submitted to the hawser line and the underbuoy pipe loads.

The following loads are to be considered in the hawser line, based on the breaking strength BS of the hawser line:

- Single line system (see Sec 4, [5.2]):
The breaking strength of the hawser line.
- Twin-line system:
 - a total load of 1,6 BS with not more than BS on one line
 - a load equal to BS on one line (with no load on the other one).
- After breakage of one anchoring line in the conditions described in e).

2.2 Damage stability

2.2.1 The buoy is to have enough reserve buoyancy to stay afloat with one flooded compartment while connected to a vessel. The loads to be considered in the hawser line are those defined in [2.1], e).

2.2.2 In case of deep water offshore application, the buoy is to have enough reserve buoyancy to stay afloat with two adjacent flooded compartments but without being connected to a vessel.

2.2.3 For the purpose of the damage cases described in [2.2.1] and [2.2.2], a transverse penetration of 1.5 m, normal to the shell, is to be considered.

2.2.4 In case arrangements are made inside the watertight compartments to maintain buoyancy in case of damage, this will be given special consideration by the Society.

The system shall not prevent access for inspection of critical areas.

Where foam is used for that purpose, it will have to be type approved by the Society.

SECTION 4

STRUCTURE AND LOAD BEARING COMPONENTS

Symbols

| | |
|----------|---|
| C | : Depth of the buoy, in m, measured vertically from the moulded base line to the top of the deck at side |
| D | : Diameter (length) of the buoy, in m, defined as the distance from external side to the external side of the floating structure |
| T | : Scantling draught, in m |
| s_0 | : Standard stiffener spacing, in m, to be taken equal to: |
| | $s_0 = 0,48 + \frac{D}{200}$ |
| R_{eH} | : Minimum guaranteed yield stress of the material considered, in N/mm ² |
| E | : Young modulus of the material considered, in N/mm ² |
| v | : Poisson ratio of the material considered |
| k | : Material factor for steel, as defined in [1.3.2] |
| c | : Material factor, to be taken equal to: <ul style="list-style-type: none"> • 1,0 for steel • 0,9 for stainless steel |
| r_p | : Coefficient for plate scantling: $r_p = c k^{1/2}$ |
| r_s | : Coefficient for stiffener scantling: $r_s = c k$ |
| H_m | : Design wave static height, in m. H_m may be taken equal to H_{max100} , the maximum wave height with a return period of 100 years, unless more accurate evaluation is available |
| α | : Coefficient to be derived from hydrodynamic calculations or model tests in basin. α may be taken equal to 0,75 unless more accurate evaluation is available |
| d | : Distance from the load point to the deck, in m |
| t | : Thickness of plating, in mm |
| h_w | : Web height, in mm |
| t_w | : Web thickness, in mm |
| b_f | : Face plate width, in mm |
| t_f | : Face plate thickness, in mm |
| w | : Section modulus, in cm ³ , of stiffener with attached plating |
| ℓ | : Span of stiffener, in m |
| s | : Spacing of stiffener, in m |
| p | : Pressure, in kN/m ² |
| z | : Vertical distance from the keel line, in m |

μ : Aspect ratio coefficient for plates:

$$\mu = 1 \quad \text{for } \ell \geq 3s$$

$$\mu = 1 - 0,675 \left(1 - \frac{\ell}{3s} \right)^2 \quad \text{for } \ell < 3s$$

with μ not being taken less than 0,7.

1 General

1.1 General requirements

1.1.1 The requirements of the present Section are complementary to the provisions of Part B of the "Rules for the Classification of Offshore Units", which remain applicable, except where otherwise specified.

1.2 Corrosion protection

1.2.1 Attention is drawn to the provisions of Part B, Chapter 3, Sec 5 of the "Rules for the Classification of Offshore Units" concerning corrosion protection of the structure.

1.2.2 An overall plan for the corrosion protection of the structure is to be prepared and submitted to the Society.

This plan is to cover all external and internal areas of the structure and is to take into account the intended duration of operations, conditions of maintenance and the particular conditions in each area.

1.3 Materials

1.3.1 Application

Steel structures are considered in the present Section. Structures made of aluminium or other materials are considered by the Society on a case by case basis.

Material grades are to be in accordance with the provisions of Part B, Chapter 3, Sec 2 of the "Rules for the Classification of Offshore Units".

1.3.2 Material factor

Unless otherwise specified, the material factor k has the values defined in Tab 1, as a function of the minimum guaranteed yield stress R_{eH} .

For intermediate values of R_{eH} , k may be obtained by linear interpolation.

Steels with a yield stress lower than 235 N/mm² or greater than 390 N/mm² are considered by the Society on a case by case basis.

Table 1 : Material factor k

| R_{eH} (N/mm ²) | k |
|-------------------------------|------|
| 235 | 1 |
| 315 | 0,78 |
| 355 | 0,72 |
| 390 | 0,68 |

1.4 Loads

1.4.1 The structural design is to consider all relevant loads described in Sec 1, [2.3.5].

1.5 Structural design

1.5.1 In the structural design, particular attention is to be given to the continuity with adjacent structure and the capacity of such structure to carry heavy loads.

1.6 Fatigue

1.6.1 Structural elements for which fatigue is a probable mode of failure are to be adequately designed to resist the effects of cumulative damage caused by repeated application of fluctuating stresses.

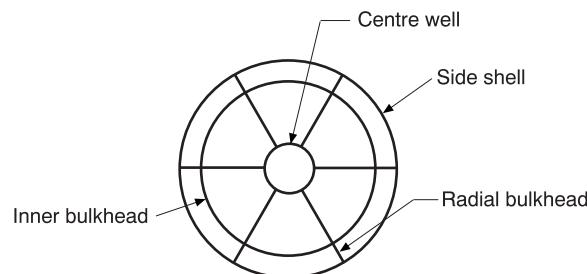
1.7 Finite element analysis

1.7.1 The Society reserves its right to require finite element calculation wherever deemed appropriate.

2 Buoy body

2.1 Definitions

2.1.1 The different structural elements of buoy body are identified in Fig 1.

Figure 1 : Identification of structural elements

2.2 Plating

2.2.1 General

The requirements for the plating are applicable to substantially stiffened platings.

Non substantially stiffened platings are to be examined on a case by case basis by the Society (see also [2.2.4]).

2.2.2 Minimum thickness

The thickness of the plating is to be not less than the values given in Tab 2.

Table 2 : Minimum thickness of plating

| Plating | Minimum thickness, in mm |
|-----------------|--|
| Side shell | $[5 + 0,1 D k^{1/2} + 5 (s - s_0)]$ |
| Bottom | $[6 + 0,1 D k^{1/2} + 5 (s - s_0)]$ |
| Deck | $[4 + 0,1 D k^{1/2} + 5 (s - s_0)]$ |
| Radial bulkhead | $[4 + 0,08 D k^{1/2} + 5 (s - s_0)]$ |
| Inner bulkhead | |

2.2.3 Scantlings

The thickness of the plating is to be not less than the values given in Tab 3.

Table 3 : Thickness of plating subjected to lateral loads

| Structure | Pressure, in kN/m ² | Thickness of plating, in mm |
|---------------------|--|--------------------------------|
| Side shell (1) | $p = 10 \left(T + \alpha \frac{H_m}{2} \right)$ not to be taken less than 17,5 T | $t = 1,3 r_p \mu s p^{1/2}$ |
| Bottom | | |
| Deck | $p = 10 \left(T + \alpha \frac{H_m}{2} - C \right)$ not to be taken less than 15 | $t = 1,25 \mu s (k p)^{1/2}$ |
| Radial bulkhead | | |
| Inner bulkhead | $p = 10 d$ not to be taken less than 10 | $t = 1,25 \mu s (k p)^{1/2}$ |
| Radial bulkhead (2) | $p = 10 d$ not to be taken less than 10 | $t = 1,3 r_p \mu s p^{1/2}$ |
| Inner bulkhead (2) | | |

(1) According to the environmental load condition on which the structural design of the buoy is based, another side shell load distribution may be considered by the Society.
(2) In case where liquid storage is provided in the buoy.

2.2.4 Centre well

a) If the stiffeners are arranged continuously around the centre well, the thickness of the plating of the centre well is to be not less than the values given in Tab 2 and Tab 3 for side shell.

b) If the stiffeners are not arranged continuously around the centre well, the scantlings of the center well are to be examined on a case by case basis by the Society.

In this case the thickness, in mm, of the centre well is to be not less than:

$$t = 5 + 0,1 D$$

2.2.5 Radial bulkhead buckling check

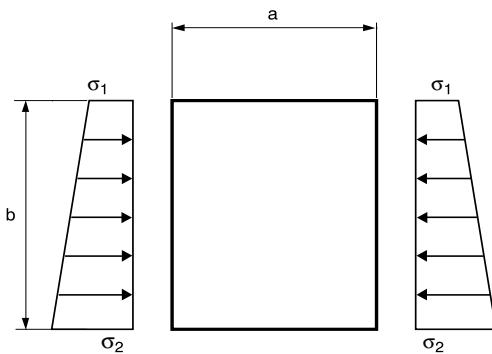
The plate panel of radial bulkhead subjected to in-plane compression stresses may be examined under buckling criteria.

In this case, rectangular plate panels are considered as being simply supported. For specific designs, other boundary conditions may be considered at the Society's discretion, provided that the necessary information is submitted for review.

For plate panels subjected to compression along one side, as shown in Fig 2, side "b" is to be taken as the loaded side. In such case, the compression stress varies linearly from σ_2 to $\sigma_1 = \psi \sigma_2$ ($\psi \leq 1$) along edge "b".

Note 1: As a general rule, $\sigma_1 = \sigma_2$ except when Note 1 of Tab 3 is applied.

Figure 2 : Buckling of a simply supported plate panel subjected to compression



The critical buckling stress is to be obtained, in N/mm², from the following formulae:

$$\sigma_c = \sigma_E \quad \text{for } \sigma_E \leq \frac{R_{eH}}{2}$$

$$\sigma_c = R_{eH} \left(1 - \frac{R_{eH}}{4\sigma_E} \right) \quad \text{for } \sigma_E > \frac{R_{eH}}{2}$$

Where:

R_{eH} : Minimum yield stress, in N/mm², of the radial bulkhead plate panel

σ_E : Euler buckling stress, to be obtained, in N/mm², from the following formula:

$$\sigma_E = \frac{\pi^2 E}{12(1-\nu^2)} \left(\frac{t}{b} \right)^2 K_1 \epsilon 10^{-6}$$

With

E : Young's modulus, in N/mm², of the radial bulkhead plate panel

ν : Poisson's ratio of the radial bulkhead plate panel. Unless otherwise specified, a value of 0,3 is to be taken.

t : Thickness, in mm, of the radial bulkhead plate panel

b : Length, in m, of side "b" as shown on Fig 2

K_1 : Buckling factor defined in Tab 4

ϵ : Coefficient to be taken equal to:

- $\epsilon = 1$ for $\alpha \geq 1$

- $\epsilon = 1,05$ for $\alpha < 1$ and side "b" stiffened by flat bar
- $\epsilon = 1,10$ for $\alpha < 1$ and side "b" stiffened by bulb section
- $\epsilon = 1,21$ for $\alpha < 1$ and side "b" stiffened by angle or T-section
- $\epsilon = 1,30$ for $\alpha < 1$ and side "b" stiffened by primary supporting members.

with $\alpha = a / b$.

Table 4 : Buckling factor K_1

| Aspect ratio $\alpha = a/b$ | Buckling factor K_1 |
|-----------------------------------|---|
| $\alpha \geq 1$ | $\frac{8,4}{\psi + 1,1}$ |
| $\alpha < 1$ | $\left(\alpha + \frac{1}{\alpha} \right)^2 \frac{2,1}{\psi + 1,1}$ |
| With $\Psi = \sigma_1 / \sigma_2$ | |

2.2.6 Connections

Special attention is to be paid to the connection between the stiffeners of the side shell / centre well / inner bulkhead and the radial bulkheads.

2.3 Ordinary stiffeners

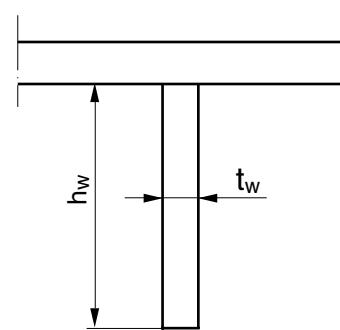
2.3.1 Dimensions of ordinary stiffeners

a) Flat bars

The dimensions of a flat bar ordinary stiffener (see Fig 3) are to comply with the following requirements:

$$\frac{h_w}{t_w} \leq 18 \sqrt{k}$$

Figure 3 : Dimensions of a flat bar



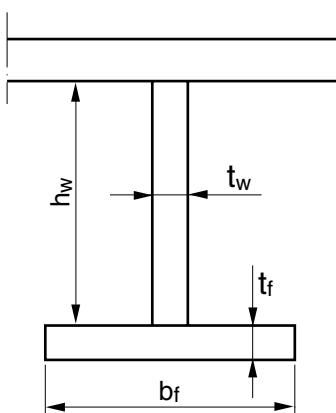
b) T-section

The dimensions of a T-section ordinary stiffener (see Fig 4) are to comply with the following requirements:

$$\frac{h_w}{t_w} \leq 50 \sqrt{k}$$

$$\frac{b_f}{t_f} \leq 30 \sqrt{k}$$

$$b_f t_f \geq \frac{h_w t_w}{6}$$

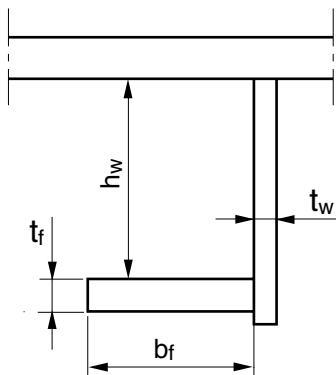
Figure 4 : Dimensions of a T-section**c) Angle**

The dimensions of an angle ordinary stiffener (see Fig 5) are to comply with the following requirements:

$$\frac{h_w}{t_w} \leq 50\sqrt{k}$$

$$\frac{b_f}{t_f} \leq 15\sqrt{k}$$

$$b_f t_f \geq \frac{h_w t_w}{6}$$

Figure 5 : Dimensions of an angle**2.3.2 Minimum thickness**

As a rule, the minimum web or flange thickness of ordinary stiffeners is not to be less than:

- $5 + 0,04 D k^{1/2}$
- the thickness of the attached plating

whichever is the lesser.

2.3.3 Scantlings

The section modulus of ordinary stiffeners subjected to lateral loads is to be not less than the values given in Tab 5.

2.3.4 Centre well

- a) When the stiffeners are arranged continuously around the centre well, they are to comply with the require-

ments of [2.3.1] to [2.3.3] and are to be not less than the values given in Tab 5 for side shell.

- b) When the stiffeners are not arranged continuously around the centre well, their scantlings are to be examined on a case by case basis by the Society.

Table 5 : Section modulus of ordinary stiffeners subjected to lateral loads

| Structure | Pressure, in kN/m ² | Section modulus of ordinary stiffeners, in cm ³ |
|---------------------|---|--|
| Side shell (1) | $p = 10\left(T + \alpha \frac{H_m}{2}\right)$ | |
| Bottom | not to be taken less than 17,5 T | |
| Deck | $p = 10\left(T + \alpha \frac{H_m}{2} - C\right)$ | |
| Inner bulkhead | $p = 10 d$ | |
| Radial bulkhead | not to be taken less than 10 | $w = 0,42 r_s p s \ell^2$ |
| Inner bulkhead (2) | $p = 10 d$ | |
| Radial bulkhead (2) | not to be taken less than 10 | $w = 0,56 r_s p s \ell^2$ |

(1) According to the environmental load condition on which the structural design of the buoy is based, another side shell load distribution may be considered by the Society.
(2) In case where liquid storage is provided in the buoy.

2.4 Primary supporting members**2.4.1 Scantling of primary supporting members**

The section modulus and sectional area of primary supporting members subjected to lateral loads are to be determined taking into account:

- the lateral pressure given in Tab 5
- the allowable stress σ_a given in Part B, Chapter 3, Sec 3 [5] of the "Rules for the Classification of Offshore Units".

3 Buoy particular structural areas**3.1 General**

3.1.1 The present article includes particular requirements on bearings, bearings supporting structure, mooring attachments and hawser line attachments.

3.1.2 The allowable stresses are given in Part B, Chapter 3, Sec 3 of the "Rules for the Classification of Offshore Units".

3.2 Bearings supports

3.2.1 Design of bearing supports

Bearing supporting structure areas are to be designed considering the loads transferred by the bearing in all relevant conditions of loading.

Particular attention is to be given to the interactions between the deformations of the bearings supporting structure and the bearings design and performance.

Justifications by finite element calculations may be requested by the Society where deemed appropriate.

3.3 Hawser line attachment structure

3.3.1 Hawser line loads

For the design of the hawser line attachment structure, the following loads are to be considered, based on the breaking strength BS of the hawser line (see [5]):

- a) Single line system (see [5.2]):

The breaking strength of the hawser line.

- b) Twin-line system:

- a total load of 1,6 BS with not more than BS on one line
- a load equal to BS on one line (with no load on the other one).

These conditions are to be considered as accidental cases (refer to the Part B, Chapter 2, Sec 3 of the "Rules for the Classification of Offshore Units").

3.4 Mooring line attachment structure

3.4.1 General requirements

In addition to the loads mentioned in [1.4], the structure is to be designed for the loads induced by the mooring system with particular attention to:

- load components induced by unit's rotational motions
- buoyancy and hydrodynamic loads acting on the structure itself, when submerged.

3.4.2 Load cases

The load cases to be considered for the design of the mooring line attachment structure subjected to the loads of one mooring line shall include the following cases (as defined in Part B, Chapter 2, Sec 3 of the "Rules for the Classification of Offshore Units"):

- design load case: the load applied in the mooring line is the maximum tension corresponding to the damage case of the mooring system (one line broken)
- accidental load case: the load applied in the mooring line is the minimum breaking strength of the line.

For mooring line attachment structures that may be subject to loads from several adjacent lines, design loads are to be in accordance with the App 3 of the NI 493 "Classification of Mooring Systems for Permanent Offshore Units".

4 Bearings

4.1 Design of bearings

4.1.1 The design of bearings is to be performed in accordance with suitable recognized standards, with due consideration to:

- loads to be transferred, in all relevant conditions of loading
- design life
- inspection and maintenance requirements
- interaction with deformation of supporting structure (see [3.4.1])
- anticipated travel distance over design life (see [4.1.2]).

4.1.2 An evaluation of the anticipated travel distance is to take into account the rotational motions induced by the moored vessel, under the combination of :

- daily weather variation (e.g. current or wind reversals)
- slow drift motion of the moored vessel
- wave frequency oscillation induced by the moored vessel yaw and buoy angular motions.

Note 1: Slow drift and wave frequency terms acting together are better combined using a rainflow counting method.

4.1.3 Justifications by finite element calculations may be requested by the Society where deemed appropriate.

4.2 Roller bearings

4.2.1 Roller bearings are to be designed, manufactured and tested according to recognised standards.

4.2.2 Roller bearings shall be protected against the ingress of sea water.

4.3 Plain bearings and pads

4.3.1 Metallic or synthetic plain bearings and pads are to be of a material suitable for working in marine/sea water environment and type approved by the Society.

5 Vessel mooring system (Hawsers)

5.1 Definitions

5.1.1 Hawser assembly

The hawser assembly means the whole assembly of one hawser line with its associated buoyancy elements and pick up line.

5.1.2 Hawser line

Hawser line means the load bearing components of the hawser assembly.

5.1.3 Hawser

Hawser means the fibre rope segment of the hawser line.

5.2 Arrangement

5.2.1 Generally, the tanker mooring system is to include two hawser lines in parallel, as specified in the OCIMF document "Recommendation for equipment employed in the mooring of ships at single point moorings".

5.2.2 Arrangement with a single hawser line is to be considered when requested by the Owner.

5.2.3 The safe working load of the hawser line is not to exceed, in principle, the safe working load of the stoppers onboard the moored vessel.

Note 1: Following OCIMF, stopper safe working load is generally 1960 kN (200 t), and is 2450 kN (250 t) for vessels over 350 000 t deadweight.

5.2.4 Attachment to the buoy may include a quick release hook or a weak link with a capacity not smaller, in principle, than the safe working load of the line, and in any case not exceeding 1,1 the safe working load of the line.

5.2.5 The arrangement and the design of each hawser line is to be in accordance with the OCIMF document quoted in [5.2.1].

Note 1: Hawsers do not need to be designed for the whole design life of the buoy as it is generally accepted that hawsers are renewable items.

5.2.6 Other components of the hawser assembly are not covered by Classification and are assumed to be in accordance with the OCIMF document quoted in [5.2.1].

5.2.7 The hawser line length is to be not less than 30 meters.

5.3 Design load and strength

5.3.1 Design tension

The design tension in line is to be obtained from the design tension in mooring analysis, in accordance with the provisions of NI 493 "Classification of Mooring Systems for Permanent Offshore Units" and is to be taken equal to:

- for a single line system:

$$T_{hD} = T_D$$

- for a twin-line arrangement (see [5.2.1]):

$$T_{hD} = 0,625 T_D$$

where:

T_{hD} : Design tension in the hawser line

T_D : Design tension in the equivalent single line in mooring analysis

5.3.2 Criteria

The design tension T_{hD} is not to exceed 1,1 the specified safe working load of the line.

The strength of each component of the hawser line is to be such that:

$$SF \cdot T_{hD} \leq BS$$

where:

SF : Safety factor given in Tab 6

BS : For chafe chain and other steel components: the guaranteed breaking strength

For hawsers: the wet breaking strength of hawser, to be obtained as in [5.3.3]

Table 6 : Safety factor

| | Chafe chain and other steel components | | Hawser |
|--------------------|--|-----|--------|
| | Q3 (1), QR3 | QR4 | |
| Twin-line system | 2,0 | 2,2 | 2,5 |
| Single line system | 2,5 | 2,7 | 3 |
| (1) See [5.3.4]. | | | |

5.3.3 Hawser strength

The wet breaking strength BS of the hawser is to be obtained from the certified breaking strength of the rope as:

$$BS = c_N \cdot NWBS \quad \text{or} \quad BS = c_N \cdot c_W \cdot NDBS$$

where:

$NDBS$: Certified New Dry Breaking Strength of the single leg hawser

$NWBS$: Certified New Wet Breaking Strength of the single leg hawser

c_N : Construction factor, to be taken equal to:

$c_N = 1,0$ for a single leg hawser,

$c_N = 1,7$ for a double leg hawser (grommet).

c_W : Material factor, equal to the ratio $NWBS/NDBS$.

$c_W = 1$ for polyester and other materials not sensitive to sea water,

c_W as derived from type tests in other cases, e.g. for polyamide (nylon).

5.3.4 Chafe chain

Unless otherwise specified by the Owner, the diameter of the chafe chain is to be in accordance with OCIMF, i.e. 76 mm.

Grade Q3 is not to be used in a mooring system for vessels exceeding 150 000 t deadweight, for a single line system, or exceeding 350 000 t deadweight, for a twin-line system.

5.4 Manufacturing and testing

5.4.1 Hawsers are to be designed, manufactured and tested in accordance with the OCIMF document "Guidelines for the purchasing and testing of single point mooring hawsers".

Hawsers are to be type approved by the Society and manufactured under survey of the Society.

5.4.2 The chains and steel components of the hawser line are to be in accordance with the relevant provisions of the Section 4 of NI 493 "Classification of Mooring Systems for Permanent Offshore Units", or for grade Q3, those of Ch 4, Sec 1, [2] of NR 216 "Materials and Welding".

The manufacturing is to be performed under survey by the Society.

6 Buoy mooring system

6.1

6.1.1 The mooring system of the buoy is to be in accordance with the NI 493 "Classification of Mooring Systems for Permanent Offshore Units".

6.1.2 The design of mooring system is to include the environmental conditions defined in Sec 1, [2.3.3], and is to cover the range of vessel situations as quoted in Sec 1, [2.3.4].

6.1.3 For buoys anchored in shallow or moderate water-depth, ORQ grade may be accepted for chain material.

7 Subsea tanks

7.1 Definition

7.1.1 The underbuoy pipes may not be connected directly to the buoy but to a buoyancy module with positive buoyancy located below the sea surface. This buoyancy module is referred as subsea tank in the present [7].

The transfer line located between the buoy and the subsea tank is referred as jumper hose in the present [7].

7.2 General arrangement

7.2.1 Watertight subdivisions

The subsea tank is to be divided into at least two watertight compartments. In case of flooding of one watertight compartment, the subsea tank is to have enough buoyancy to avoid damage of the export line or risers attached to it.

Other equivalent arrangement may be considered provided that the same level of safety is guaranteed.

7.2.2 Jumper hose

The jumper hose located between the buoy and the subsea tank is to be in compliance with applicable provisions of Sec 8.

7.3 Structure

7.3.1 The structure of the subsea tank is to be designed in accordance with the Appendix 2 of the NR 316 "Rules and Regulations for the Classification of Submersibles" dedicated to structures under external pressure.

SECTION 5

PIPING SYSTEMS

1 General

1.1 Application

1.1.1 The present Section deals with particular provisions applicable to piping systems installed onboard buoys.

1.1.2 Particular provisions of the present Section are complementary to provisions of the Part C, Chapter 1, Sec 7 of the "Rules for the Classification of Offshore Units" which remain applicable except otherwise justified.

1.2 Other provisions

1.2.1 Piping systems (such as bilge, hydraulic, pneumatic fuel, cargo etc.) and their accessories which may be installed on a buoy are to be designed, manufactured, surveyed and tested according to Part B, Chapter 1 of the "Rules for the Classification of Offshore Units".

2 Bilge - Drainage systems

2.1 Bilge arrangement

2.1.1 Buoys are to be provided with efficient means for pumping from and draining any watertight space (tank or void).

Pumping by means of a portable hand pump may be acceptable in lieu of a fixed bilge system.

2.2 Scupper arrangement

2.2.1 Scuppers or other arrangements are to be provided on the buoy to permit the drainage of water likely to accumulate on the buoy deck.

3 Sounding system

3.1

3.1.1 Each watertight space (tank or void) is to be provided with a sounding mean. Manual system is acceptable.

4 Venting system

4.1 General

4.1.1 Any tank that is filled or emptied through a fixed or external pumping system or which is used as reception tank of a pressure relief valve is to be provided with vent pipe.

Any void space through which pressure piping is routed is also to be fitted with air vent.

4.2 Arrangement of air vent pipes

4.2.1 Air pipes are to be so arranged as to be self-draining when unit is on normal position.

4.2.2 Air pipes are to be so arranged and the upper part of compartments so designed that air or gas likely to accumulate in the said compartments can freely evacuate

4.2.3 Air vent pipes are to terminate in open air and are to terminate by way of return bends. Efficient devices, permanently attached, are to be provided for closing the vent pipes.

4.2.4 Air vent pipes height above the deck is not to be less than 760 mm.

Lower heights may be accepted in cases where these are essential for the working of the unit, provided that the design and arrangements are otherwise satisfactory. In such cases, efficient permanently attached closing appliances of an approved automatic type are generally required.

In all cases, the height of air pipes may be required to be increased on units for purpose of compliance with stability requirements. Tank vents which could cause progressive flooding after damage are to be avoided unless special considerations have been taken in the damage stability review.

4.2.5 The internal diameter of air pipes is not to be less than 50 mm. However, for small tanks, the Society may admit smaller values of diameter subject to a minimum of 35 mm.

The air pipes are to be of reinforced thickness.

In each compartment likely to be pumped up and where no overflow pipe is provided, the total cross-section of air pipes is not to be less than 1,25 times the cross-section of the filling pipes.

4.2.6 The open ends of air pipes of tanks intended to contain flammable fluids are to be fitted with a removable wire gauze diaphragm made of material not sensitive to corrosion. The cross-section through the wire gauze is to be not less than the required section of the corresponding pipe.

5 Crude oil pipes

5.1 General

5.1.1 Crude oil pipes and their accessories are to be sized, manufactured, surveyed and tested according to Part C, Chapter 1 of the "Rules for the Classification of Offshore Units".

The loads induced by the underbuoy pipes are to be taken into consideration for the design of the cargo oil pipes to which they are connected to, in addition to the internal pressure loads.

5.1.2 Suitable provisions are to be made for expansion. Expansion devices are to be type approved by the Society for their intended use.

5.1.3 In case the protection against over pressures is achieved by a pressure relief valve fitted on the buoy's cargo transfer system, the discharge of this relief valve is to be led to a suitable tank.

5.2 Materials

5.2.1 Crude oil pipes are generally to be made of steel or spheroidal graphite cast iron. Grey cast iron is not to be used for pipes, valves and other accessories which withstand the loads of the underbuoy pipes.

5.3 Arrangement

5.3.1 Shut off valves are to be provided at inlets and outlets of the product swivel.

5.3.2 Cargo oil pipes are to be securely fitted and attached on the buoy to resist the forces resulting from internal pressure and flow inside the system and loads induced by the underbuoy pipes connected to it.

5.3.3 In order to minimize the risk of generating static electricity, crude oil pipe sections and their accessories are to be electrically bonded together and to the buoy's hull.

6 Hydraulic power station

6.1 General

6.1.1 The following requirements refer to hydraulic power installations using flammable oil that may be installed on board buoys.

6.1.2 Installations using fluids other than flammable oils are to be considered on a case by case basis by the Society.

6.1.3 Oil used for hydraulic power installations is not to have a flash point lower than 150°C and be suitable for operating temperature range.

6.1.4 Alleviations to these requirements may be granted to hydraulic power installations of a design pressure lower than 25 bar.

6.2 Arrangement

6.2.1 The hydraulic power units are to be so arranged as to prevent hydraulic oil from coming into contact with sources of ignition.

6.2.2 In application of [6.2.1], shields or similar devices are to be provided around the hydraulic power units in order to avoid an accidental oil spray or mist on heated surfaces which may ignite oil.

6.2.3 Tanks intended to contain oil for hydraulic power installations are to be fitted with air pipes leading to a safe space above the open deck. Open ends of these air pipes are to be fitted with a removable wire gauze diaphragm made of material not sensitive to corrosion.

6.3 Design

6.3.1 Where the installation is intended for essential services, pumps, filters and reduction units are to be duplicated. The capacity of the pumps and of their connection to the piping system are to be such that all the essential services operated by the hydraulic power installation can be maintained simultaneously with one of the pumps out of service. Piping and accessories are to be so arranged that it is possible to carry out maintenance and repairs of any one pump or filter or reduction unit, while the other remains in operation.

In case the power unit is used for remote control of valves, any failure of the power unit is not to cause an undesired change of the valves position.

6.3.2 Safety relief valves of sufficient capacity are to be provided at the pressure side of the installation. Provisions are to be taken to avoid any accidental or unexpected disturbance of the overpressure protecting devices. Except when specially accepted, the safety relief valves are to be sealed after setting.

6.3.3 A device is to be fitted which efficiently filters the hydraulic oil in the circuit.

6.3.4 At any point of the circuit, the temperature of the hydraulic fluid is to be kept within limits appropriate to its nature and in any case, below the value specified in [6.1.3]. Where necessary, appropriate cooling devices are to be provided.

6.3.5 Monitoring of the installation is to be in accordance with Tab 1 hereunder. The Society may require the type testing of the installation including simulation of any abnormal functioning condition.

6.3.6 The hydraulic power units are to be capable of being stopped in case of emergency from a safe position away from the space where they are located.

Table 1 : Monitoring of hydraulic power installations

| Failure | Monitoring | |
|------------------------|------------|--------------------|
| | Alarm | Automatic shut-off |
| Oil tank level - low | X | X |
| Pressure - low | X | |
| Pressure - high | X | |
| Oil temperature - high | X | X |

6.4 Construction and testing

6.4.1 Hydraulic power installations are to be designed, manufactured, surveyed and tested in compliance with the applicable requirements of the present Rule Note and of the Rules for the Classification of Offshore Units.

6.4.2 Pipes are to be seamless steel pipes or, if specially approved by the Society, welded steel pipes.

6.4.3 The flanged connections of oil pipes are to be of the close fitting type or of an equivalent type of protection against projection. The number of mechanical connections is to be kept to a minimum.

6.4.4 The flexible pipes are to be type approved by the Society.

6.4.5 At the completion of the installation, working tests are to be carried out in the presence of the Surveyor, as per a programme accepted by the Society.

SECTION 6

EQUIPMENT AND SAFETY

1 General

1.1 Application

1.1.1 The equipment are to comply with the applicable National Rules and, for items covered by Classification, with requirements of Part C, Chapter 2 to Chapter 4 of the "Rules for the Classification of Offshore Units".

The present Section gives particular requirements to be met for buoys.

2 Fire fighting

2.1 General

2.1.1 Buoys are to be provided with portable fire extinguishers of appropriate types. At least one portable fire extinguisher suitable for fires of class B and C is to be provided.

2.1.2 The portable fire extinguishers are to be type approved by the Society.

3 Hazardous areas

3.1 General

3.1.1 The requirements given in [3] are applicable to hazardous areas due to hydrocarbon handling and transfer.

For hazardous areas due to other causes, refer to Part C, Chapter 4 of the "Rule for Classification of Offshore Units".

3.1.2 For definitions used in [3.2], refer to Part C, Chapter 4 of the "Rule for Classification of Offshore Units".

3.2 Definitions

3.2.1 Hazardous areas are all those areas where, due to the possible presence of a flammable atmosphere, the use without proper consideration of machinery or electrical equipment may lead to fire hazard or explosion.

3.2.2 Hazardous areas as defined in above prescription, are divided in zones as follows:

- Zone 0: zone in which an explosive gas/air mixture is continuously present or present for long periods.
- Zone 1: zone in which an explosive gas/air mixture is likely to occur in normal operation.

- Zone 2: zone in which an explosive gas/air mixture is not likely to occur, and if it occurs, it can exist only for a short period.

3.2.3 Enclosed spaces are spaces delineated by floors, bulkheads and decks, which may have doors or windows.

3.2.4 Semi-enclosed locations are locations where natural conditions of ventilation are notably different from those on open decks due to the presence of structures such as roofs, windbreaks or bulkheads, and which are so arranged that dispersion of gas may not occur.

3.3 Classification of hazardous area due to oil transfer

3.3.1 For the purpose of machinery and electrical installations, hazardous areas are classified as in [3.3.2] to [3.3.4].

3.3.2 Zone 0

Zone 0 spaces include internal spaces of closed tanks, product swivels and pipes for crude oil and gas products, or spaces in which an oil/gas/air mixture is continuously present or present for long periods.

3.3.3 Zone 1

Zone 1 spaces include the following spaces and locations:

- a) Enclosed spaces or semi-enclosed locations containing a possible source of release such as:
 - sample or valve outlets, frequently operated, releasing crude oil or gas products in the atmosphere
 - product swivels.
- b) Outdoor locations within 3 m from:
 - sources mentioned in a)
 - safety valves or other openings releasing to the atmosphere
 - ventilation outlets or access to zone 1 spaces.
- c) Outdoor locations within 3 m from vent outlets of tanks containing crude oil.
- d) Pits, ducts, or similar structures in locations which otherwise would be zone 2 but which are arranged so that dispersion of gas may not occur.

3.3.4 Zone 2

Zone 2 spaces include the following spaces and locations:

- a) Areas within 1,5 m from zone 1 areas defined in [3.3.3] b) and c).
- b) Areas within 3 m from a product swivel when located in a non-enclosed or semi-enclosed area.

- c) Enclosed spaces or semi-enclosed locations containing detachable pipes for crude oil and gas products, with flanges and valves, where leakage is liable to occur, except if these spaces are to be classed as zone 1 areas.
- d) Outdoor locations within 3 m from detachable pipes for crude oil and gas products, with flanges and valves, where leakage is liable to occur, except if these spaces are to be classed as zone 1 areas.
- e) Pits, ducts or similar structures in locations limiting zone 2 areas which otherwise would be classed as safe areas but which are arranged so that dispersion of gas may not occur.
- f) Air locks between a zone 1 area and a non-hazardous area.

SECTION 7

ELECTRICAL AND AUTOMATION

1 General

1.1 Application

1.1.1 These provisions supplement those of the "Rules for the Classification of Offshore Units".

2 Source of power

2.1 Main source of electrical power

2.1.1 Buoys are to be provided with a main source of electrical power of sufficient capacity to supply all the services mentioned in Sec 6, [4.1.2].

For small installations, where renewable sources of energy are used, for example photo-voltaic cells or wind generators, stationary batteries are to be provided to guarantee the distribution of the electrical power during the time without sun or wind. The battery autonomy is to be subjected to approval by the Society.

Where wind generators are used, an alternative means of charging batteries is to be installed.

Note 1: To allow for safe maintenance of wind generator systems, a suitable means of breaking is to be fitted to the turbines together with a safe means of access.

2.2 Services to be supplied

2.2.1 The following services are to be supplied:

- navigation aids mentioned in Sec 6, [4.2]
- control and monitoring systems mentioned in [5].

2.3 Emergency source of electrical power

2.3.1 A self contained emergency source of electrical power is to be provided.

The emergency source of power is to be capable to guarantee the supply of the afore mentioned services in case of loss of the main source of electrical power, with a minimum of 96 hours for navigation aids (signal lights and fog horn). Due regard is to be paid to simultaneous operation of services, the battery autonomy is to be subjected to approval by the Society.

3 Navigation aids

3.1 Signal lights

3.1.1 Buoys are to be provided with signal lights in accordance with the National Authorities requirements.

As a minimum, buoys are to be marked at night by at least one white light so constructed and fixed as to ensure that the light is visible upon approaching the buoy from any direction. The light is to:

- be placed not less than 6 meters above sea water level
- have a minimum effective intensity of 1400 candelas
- be operated with a flashing character according to Morse letter "U" and with a maximum period of 15 seconds. In case several lights are fitted, they are to be operated in unison
- be located in such a way that the vertical distribution of the projected beam is to enable the light to be visible from the immediate vicinity of the buoy to the maximum luminous range of the light.

It is recommended to mark the floating hose with winker lights.

Note 1: Additional requirements are applicable for buoy situated in North Sea.

3.2 Sound signal

3.2.1 Buoys are to be provided with fog horn in accordance with the National Authorities requirements.

As a minimum, buoys is to carry at least one sound signal so constructed and fixed as to be audible upon approaching the buoy from any direction. The sound signal is to:

- be placed as far as practicable not less than 6 meters above the sea water level
- have a range of at least 2 miles
- be rhythmic blasts corresponding to Morse letter "U" every 30 seconds with a minimum duration of 0,75 seconds for the short blast
- be operated when the meteorological visibility is 2 miles or less.

3.3 Radar deflector

3.3.1 Buoys are to be provided with radar deflector in accordance with the National Authorities requirements.

4 Equipment

4.1 General

4.1.1 Electrical and automation equipment are to comply with the applicable National Rules and, for items covered by classification, with requirements specified in Pt C, Ch 2 and Pt C, Ch 3 of the "Rules for the Classification of Offshore Units".

4.1.2 Electrical equipment intended for use in areas where explosive gas or vapour atmospheres may occur is to be of a "safe type" suitable for the relevant flammable atmosphere encountered on board. The explosion group and temperature class of electrical equipment of a certified safe type are to be at least II A and T 3.

4.2 Photo-voltaic system

4.2.1 Solar panels are to be designed and manufactured according to IEC 61215.

4.2.2 Solar panels are to be designed to be highly resistant to salty water and hail impact. They are to be provided with bird spikes.

4.2.3 The system is to be sized in a way that guarantees the power for normal operating conditions and ensures, with certainty, the supply of the loads even in periods of "no sun".

The following items are to be considered for sizing:

- environmental conditions
- geographical location
- solar radiation
- days foreseen with "no sun"
- required energy by the loads (Wh/d)
- energy required to supply the services listed in Sec 6, [4.1.2]
- rated voltage and current
- photo-voltaic module maintenance coefficient
- safety factor
- efficiency of storage battery.

Note 1: For information on photo-voltaic design and systems, reference is to be made to IEC 60904 series and IEC 61194.

4.3 Eolic system

4.3.1 The system is to be sized in a way that guarantees the power for normal operating conditions and ensures, with certainty, the supply of the loads even in periods of "wind lull".

The following items are to be considered for sizing:

- environmental conditions
- geographical location
- ventilation
- days foreseen with "wind lull"
- required energy by the loads (Wh/d)
- energy required to supply the services listed in Sec 6, [4.1.2]

- rated voltage and current
- wind generator maintenance coefficient
- safety factor
- efficiency of storage battery.

Note 1: For information on wind energy systems, reference is to be made to A.W.E.A 3.1 and 6.1.

5 Control of installations

5.1 General requirements

5.1.1 Control and monitoring systems are to be based on the fail-to-safety principle.

5.1.2 Choice of the data transmission medium (electric or fibre optic cable, radio) for remote monitoring is to be made according to the environmental conditions.

5.1.3 Safety functions are not to be impaired in case of failure of the data transmission link between the offloading buoy and the main control station.

5.1.4 Failure of the data transmission is to generate an alarm at the main control station.

5.1.5 The control and monitoring systems and components are to be chosen from among the list of type approved products. They are to be approved on the basis of the applicable requirements of Pt C, Ch 3 of the "Rules for the Classification of Offshore Units".

Case by case approval may also be granted at the discretion of the Society, based on submission of adequate documentation and subject to the satisfactory outcome of any required tests.

5.2 Control and monitoring functions

5.2.1 Buoy is to be provided with a control system designed for continuously monitoring and controlling crude oil offloading. Control, alarm and monitoring functions are required according to Tab 1. Control system is to enable the monitoring of those parameters locally and from a permanently manned remote control stations.

5.2.2 Common sensors for alarms and automatic shutdown functions are acceptable as specified in Tab 1.

5.2.3 When offloading operation has been shutdown, the latter is not to be restarted automatically before of manual reset has been carried out.

Table 1 : Offloading buoy

| Symbol convention H=high, HH=high high, G=group alarm L=low, LL=low low, I=individual alarm X=function is required, R= remote | Monitoring | | Automatic control | |
|--|------------|------------|-------------------|---------|
| Identification of system parameter | Alarm | Indication | Shutdown | Control |
| Crude oil pressure | HH | X | X | |
| Crude oil temperature | | X | | |
| Offloading valves status | | X | | X (2) |
| Crude oil level in each surge relief tank (1) | HH | X | X | |
| Process swivel leak detection | H | X | | |
| Mooring hawser tension | L + H | X | | |
| Position of buoy (GPS) or draft | | X | | |
| Power system battery low voltage | L | X | | |
| Local emergency push button | | X | X | |
| Shutdown from remote control station | | X | X | |

(1) For buoy fitted with surge relief tanks
 (2) Offloading pumps are not to be started until relevant valves are open

SECTION 8

SWIVELS AND FLUID TRANSFER LINES

1 Swivels

1.1 Pressure swivels

1.1.1 The pressure parts of a pressure swivel are to be designed and manufactured according to the requirements of Pt C, Ch 1, Sec 3 of Bureau Veritas "Rules for the Classification of Steel Ships" or other recognized pressure vessel code.

1.1.2 A pressure swivel is to be isolated from the structural loads due to the anchoring systems and vessel mooring.

1.1.3 Piping loads on swivel are to be minimized (e.g. by means of an expansion joint).

1.1.4 Materials of swivel and seals are to be compatible with transported products.

1.1.5 Bearings are to be protected against internal fluids and marine environment. Bearings are to be designed for the rated life of the swivel.

1.1.6 If necessary, pressure seals are to be protected against mechanical aggression.

1.1.7 The sealing system of flammable or toxic products is to constitute, at least, a double barrier against leakage to environment and, for multiple product swivels, between the different products.

Means are to be provided to allow the checking of the sealing system integrity with the swivel in operation. A leak detection and alarm system is to be provided.

1.1.8 Means are to be provided to collect and safely dispose of liquid leaks of flammable products.

1.2 Electrical swivels

1.2.1 Electrical swivels are to be designed and manufactured according to the applicable requirements of Part C, Chapter 2 of the "Rule for Classification of Offshore Units".

1.2.2 Where relevant, electrical swivels are to be suitable for the hazardous area in which they are located.

1.3 Test of pressure swivels

1.3.1 Static resistance tests

A pressure swivel is to be subjected to a pressure resistance static test, according to its design code.

1.3.2 Dynamic tests

Rotation and oscillation tests including rest periods are to be performed at design pressure with measurement of starting and running moments.

At least two complete rotations, or equivalent, in each direction are to be performed. The rotation speed is to be around 1°/s.

1.4 Tests of electrical swivels

1.4.1 Static tests

An electrical swivel is to be subjected to dielectric and insulation resistance tests in accordance with Part C, Chapter 2 of the "Rule for Classification of Offshore Units" and IEC 502.

1.4.2 Dynamic tests

A continuity test is to be performed with the swivel in rotation.

2 Fluid transfer lines

2.1 General

2.1.1 Application

The provisions of the present article are applicable to fluid transfer lines as defined in Sec 1, [1.2.2] when the additional class notation **RIPRO** is requested.

For risers, the limit of classification is in principle the connector of the riser with the pipeline end manifold.

Other limits may be agreed upon and in this case are to be specified on the Certificate of Classification.

2.1.2 Definitions

a) Underbuoy pipe system:

The underbuoy pipe system includes the underbuoy pipe itself, its supports and all integrated underbuoy pipe components.

b) Underbuoy pipe components:

The underbuoy pipe components are all the equipment associated with the underbuoy pipes such as clamps, connectors, joints, end fittings, bend stiffeners, etc.

c) Underbuoy pipe supports:

The underbuoy pipe supports are the ancillary structures giving the underbuoy pipe its configuration and securing it, such as buoyancy modules and sinkers, arch systems, anchor points, tethers, etc.

2.2 Floating hoses

2.2.1 Each hose and associated components is to be designed, fabricated, tested and installed in accordance with the requirements of a recognized standard, submitted to the agreement of the Society, such as OCIMF "Guide to Purchasing, Manufacturing and Testing of Loading and Discharge Hoses for Offshore Moorings".

2.3 Underbuoy pipes

2.3.1 Underbuoy pipe system design

Underbuoy pipes are subject to actions of currents and waves along the line, and primarily, to imposed displacements of underbuoy pipe head attached to the unit. Design analyses are to be carried out in order ascertain that the design configuration is appropriate and to verify that extreme tensions, curvatures, and cyclic actions are within the design limits of the specified product.

The load cases selected for analysis are to be examined as being the most unfavorable combinations of vessel offsets and current / wave loadings.

An analysis of interference is to be performed in order to verify that all the underbuoy pipes, umbilical and anchor lines remain at an acceptable distance from each other (and from the buoy) during operation.

The fatigue life of the underbuoy pipes is to be assessed.

Each underbuoy pipe and associated components is to be designed, fabricated, tested and installed in accordance with the requirements of a recognized standard, submitted to the agreement of the Society, such as:

a) for rigid underbuoy pipe systems:

- ANSI B 31.4 "Liquid transportation systems for hydrocarbons, liquid petroleum gas, anhydrous ammonia and alcohols"
- ANSI B 31.8 "Gas transmission and distribution piping systems"
- BS 8010 "Code of practice for pipelines"
- API RP 2RD "Design of Risers for Floating Production Systems (FPSs) and Tension-Leg Platforms (TLPs)"
- API RP 1111 "Design, Construction, Operation and Maintenance of Offshore Hydrocarbon Pipelines (Limit State Design).

b) for non-bonded flexible underbuoy pipe systems:

- Bureau Veritas Guidance Note NI 364 "Non-bonded flexible steel pipes used as flow-lines"
- API Spec 17J "Specification for Unbonded Flexible Pipes"
- API RP 17B "Recommended Practice for Flexible Pipe".

c) for bonded flexible underbuoy pipe systems:

- OCIMF "Guide to Purchasing, Manufacturing and Testing of Loading and Discharge Hoses for Offshore Moorings" within 100 m waterdepth
- API Spec 17K "Specification for bonded flexible pipe".

2.3.2 Underbuoy pipe supports

Equipment for supporting of underbuoy pipes are to be designed in accordance with the relevant provisions of Part B, Chapter 3 of the "Rules for the Classification of Offshore Units".

Steel cables and fibre ropes used as tethers and associated fittings are to be designed and constructed in accordance with the relevant provisions of the NI 493 "Classification of Mooring Systems for Permanent Offshore Units".

APPENDIX 1**THICKNESS MEASUREMENTS: ACCEPTANCE CRITERIA, LOCATIONS****1 Acceptance criteria for thickness measurements****1.1 General**

1.1.1 Acceptance criteria stipulate limits of wastage which are to be taken into account for reinforcements, repairs or renewals of steel structure. These limits are generally expressed for each structural item as a maximum percentage of acceptable wastage (W). When the maximum percentage of wastage is indicated, the minimum acceptable thickness (t_{min}) is that resulting from applying this percentage to the rule thickness (t_{rule}), according to the following formula:

$$t_{min} = \left(1 - \frac{W}{100}\right) t_{rule}$$

However, when the rule thickness is not available, the as-built thickness can be used.

Only for criteria related to item (see [1.3.4] b), the Society may establish a list of renewal thicknesses tailored to the different structural items. In such a case these thicknesses are used in lieu of the minimum thicknesses calculated from the percentage of wastage.

Note 1: In any case, at the request of the Owner, the Society may perform a direct calculation based on the current measurements in order to permit adjustments of the criteria.

1.1.2 In cases where the buoy has some structural elements with reduced wear margins (e.g. due to buoy refurbishment, increase of draught), the minimum acceptable thickness for these elements is to be calculated with reference to the rule scantlings without taking account of any reduction originally agreed.

1.1.3 Decisions on steel renewals are taken by the attending Surveyor applying the criteria given in the present Appendix and based on his judgement and the actual condition of the buoy. Should advice be needed to support his decision, the Surveyor may refer to the relevant technical office of the Society.

1.2 Criteria

1.2.1 The acceptance criteria for the minimum thicknesses are divided into:

- criteria on local strength, given in [1.3]
- criteria on buckling strength, given in [1.4]
- criteria on pitting, given in [1.5].

1.2.2 Each measured item is to be checked against these three criteria, as far as applicable. When the criteria are not met, repairs and renewals are to be carried out as appropriate.

1.3 Local strength criteria

1.3.1 Local strength criteria are given for each structural parts of the buoy.

1.3.2 For the evaluation of the buoy strength, it is a prerequisite that fillet welding between bottom, deck, side shell, radial bulkheads and centre well is maintained effective as to keep continuity of buoy structure.

The same applies to the buoy particular structural areas (such as main bearing structure, mooring line support structure... as detailed in Sec 4).

1.3.3 These structural items are also listed in Tab 1, grouped according to their position and contribution to the local strength of the buoy (see also Sec 4, Fig 1).

1.3.4 Each structural item is to be assessed according to four different criteria which vary with regard to the domain under which it is considered, namely:

- a) An isolated area, which is meant as a part of a single structural item. This criterion takes into consideration very local aspects such as grooving of a plate or stiffener, or local severe corrosion; however, it is not to be used for pitting for which separate criteria are considered (see [1.5]).
- b) An item, which is meant as an individual element such as a plate, a stiffener, etc. This criterion takes into consideration the average condition of the item, which is assessed by determining its average thickness using the various measurements taken on the same item.
- c) A group of items, which is meant as a set of elements of the same nature (plates, stiffeners...) belonging to the same zone (such as deck, one radial bulkhead...).
- d) A zone, which is meant as a set of elements of the same structural element (deck, one radial bulkhead, side shell...), contributing to the integrity and strength of the buoy. This criterion takes into consideration the average condition of all groups of items belonging to the same zone.

1.3.5 The assessment of the thickness measurements is to be performed using the values given in Tab 1 for each structural element with regard to the four criteria defined above, in the following order:

- a) Isolated areas (column 1 of Tab 1).

If the criterion is not met, the wasted part of the item is to be dealt with as necessary.

b) Items (column 2 of Tab 1).

If the criterion is not met, the item is to be dealt with as necessary in the measured areas as far as the average condition of the item concerned is satisfactory. In cases where some items are renewed, the average thicknesses of these items to be considered in the next step are the new thicknesses.

c) Groups of items (column 3 of Tab 1).

If the criterion is not met, a sufficient number of elements are to be renewed in order to obtain an increased average thickness satisfying the considered criterion of the group (generally the elements to be renewed are those most wasted). As an example, for the assessment

of the group "deck plates" all deck plates are measured and an average thickness of each of them is estimated. Then the average of all these values is to satisfy the criteria given for this group.

d) Zones (column 4 of Tab 1).

In principle, the criterion of the zone is met when all groups of items belonging to the zone meet their own criteria (see c) above). However, a greater wastage than those given in column 3 may be accepted for one group of items if, considering the other groups of items belonging to the same zone, the overall wastage of the zone does not exceed the criterion given for it in column 4.

Table 1 : Local acceptance criteria for buoys (given in % of wastage)

| Group of items | Description of items | 1 Isolated area | 2 Item | 3 Group | 4 Zone |
|--|--|-----------------|---------------|--------------|-------------|
| | DECK ZONE (1) | - | - | - | 10 |
| 1 | Deck plating | 25 | 20 | 10 | - |
| 2 | Deck stiffener web flange | - 25 20 | - 20 15 | 10 - - | - - - |
| | BOTTOM ZONE (1) | - | - | - | 10 |
| 3 | Bottom plating | 25 | 20 | 10 | - |
| 4 | Bottom stiffener web flange | - 25 20 | - 20 15 | 10 - - | - - - |
| | RADIAL BULKHEAD (1) | - | - | - | 10 |
| 5 | Radial bulkhead plating | 25 | 20 | 10 | - |
| 6 | Radial bulkhead stiffener web flange | - 25 20 | - 20 15 | 10 - - | - - - |
| | SIDE SHELL (1) | - | - | - | 10 |
| 7 | Side shell plating | 25 | 20 | 10 | - |
| 8 | Side shell stiffener web flange | - 25 20 | - 20 15 | 10 - - | - - - |
| | CENTRE WELL (1) | - | - | - | 10 |
| 9 | Centre well plating | 25 | 20 | 10 | - |
| 10 | Centre well stiffener (if applicable) web flange | - 25 20 | - 20 15 | 10 - - | - - - |
| <p>(1) Each zone is to be evaluated separately</p> <p>Note 1:Example: The deck zone consists of two groups of items:</p> <ul style="list-style-type: none"> • deck plating, which has an average wastage of 12% (criterion 10%) • deck stiffeners, which has an average wastage of 4% (criterion 10%) <p>Even though the deck plating group exceeds its acceptance criterion, the average wastage of the zone, which can be very roughly estimated at 8%, is acceptable and thus the deck plating group can be accepted as it is.</p> | | | | | |

1.4 Buckling strength criterion

1.4.1 In case buckling is observed during survey, special consideration will be given by the Society.

1.5 Pitting

1.5.1 The maximum acceptable depth for isolated pits is 35% of the as-built thickness.

1.5.2 For areas with different pitting intensity, the intensity diagrams shown in Fig 5 (at the end of the present appendix) are to be used to identify the percentage of affected areas.

For areas having a pitting intensity of 50% or more, the maximum average depth of pits is 20% of the as-built thickness. For intermediate values between isolated pits and 50% of affected area, the interpolation between 35% and 20% is made according to Tab 2.

1.5.3 In addition, the thickness outside the pits in the area considered is to be assessed according to [1.3] and [1.4].

Note 1: Application of filler material (plastic or epoxy compounds) is recommended as a means to stop or reduce the corrosion process, but it is not considered an acceptable repair for pitting exceeding the maximum allowable wastage limits. Welding repairs may be accepted when performed in accordance with procedures agreed with the Society.

2 Location of measurements

2.1 General

2.1.1 The locations of the measurements are identified:

- in [2.2] for the bottom and the deck
- in [2.3] for the side shell
- in [2.4] for the radial bulkheads
- in [2.5] for the stiffeners

2.1.2 The "x" on the figures indicates the location where the measurements are to be done.

Table 2 : Pitting intensity and corresponding maximum average depth of pitting

| Pitting intensity (%) | Maximum average pitting depth (% of the as built thickness) |
|-----------------------|---|
| Isolated | 35,0 |
| 5 | 33,5 |
| 10 | 32,0 |
| 15 | 30,5 |
| 20 | 29,0 |
| 25 | 27,5 |
| 30 | 26,0 |
| 40 | 23,0 |
| 50 | 20,0 |

2.2 Bottom and deck

2.2.1 The measurements on the bottom and the deck are to be performed as indicated in Fig 1.

2.3 Side shell

2.3.1 The measurements on the side shell are to be performed as indicated in Fig 2.

Figure 1 : Location of bottom and deck measurements

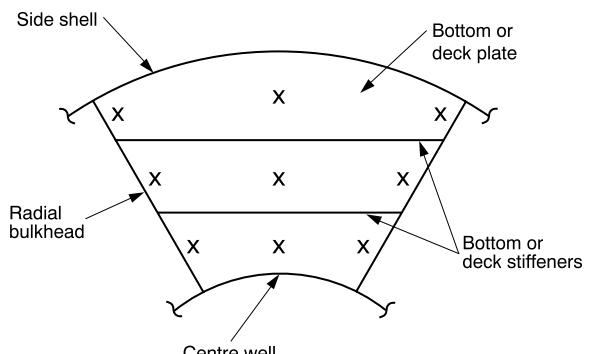
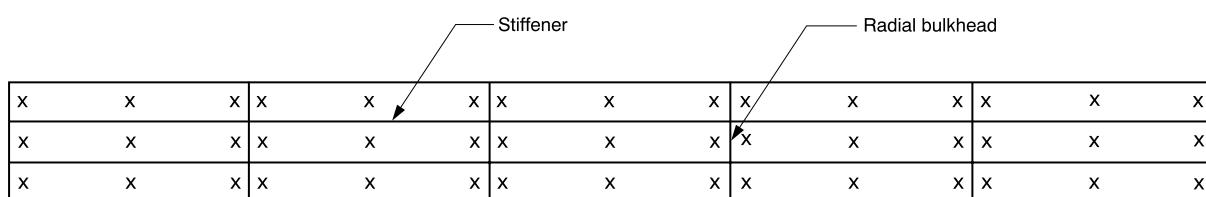


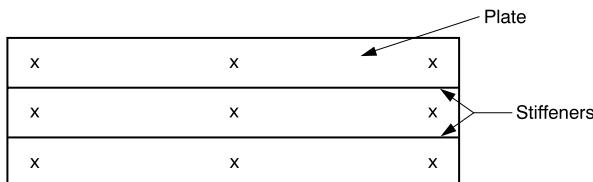
Figure 2 : Location of side shell measurements



2.4 Radial bulkhead

2.4.1 The measurements on the radial bulkheads are to be performed as indicated in Fig 3.

Figure 3 : Location of radial bulkhead measurements



2.5 Stiffener

2.5.1 The measurements on the stiffeners are to be performed as indicated in Fig 4.

Figure 4 : Location of stiffener measurements

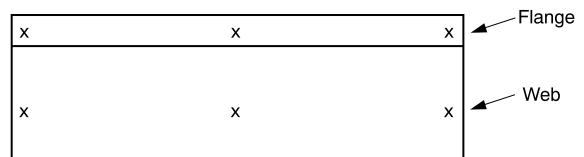


Figure 5 : Pitting intensity diagrams (from 1% to 50% intensity)

