GUIDANCE NOTES ON

CONVERSION OF MOBILE OFFSHORE DRILLING UNITS TO FLOATING PRODUCTION INSTALLATIONS

MAY 2017 (Updated August 2018 – see next page)

American Bureau of Shipping
Incorporated by Act of Legislature of
the State of New York 1862

ABS Plaza
16855 Northchase Drive
Houston, TX 77060 USA

Updates

August 2018 consolidation includes:

- March 2018 version plus Corrigenda/Editorials

March 2018 consolidation includes:

- May 2017 version plus Corrigenda/Editorials

Foreword

Converting a mobile drilling unit to a production installation can be a cost effective approach for the development of offshore fields. The classification requirements of the existing drilling unit are to be changed to those for a site-specific floating offshore installation. The design of conversion is based on the site-specific conditions for the site where the unit is to be installed and operated through the intended period of operation.

These Guidance Notes are intended to provide information on the items that need to be considered for the conversion, and give specific criteria that should be applied for classification in accordance with the ABS Rules and Guides. Two types of conversions are covered in these Guidance Notes: column-stabilized drilling units to column-stabilized production installations, and drillships to ship-type floating production installations. It is not the intention of these Guidance Notes to alter the technical criteria of the ABS Rules and Guides referenced herein. The main focus of these Guidance Notes is to aid in the application of these criteria to the converted installations.

The Guidance Notes contained herein should be used in conjunction with the ABS *Rules for Building and Classing Floating Production Installations* and the ABS *Rules for Building and Classing Mobile Offshore Drilling Units*.

These Guidance Notes become effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of these Guidance Notes is the most current.

We welcome your feedback. Comments or suggestions can be sent electronically by email to rsd@eagle.org.

Terms of Use

GUIDANCE NOTES ON

CONVERSION OF MOBILE OFFSHORE DRILLING UNITS TO FLOATING PRODUCTION INSTALLATIONS

CONTENTS

CHAPTER 1 Introduction

CONTENTS

CHAPTER 1 Introduction

SECTION 1 General

Converting a mobile drilling unit to a production installation can be a cost effective approach for the development of offshore fields. Two of these types of conversions are covered in these Guidance Notes: column-stabilized drilling units (CSDUs) to column-stabilized production installations, and drillships to ship-type floating production installations (FPIs). The classification requirements involve changing an existing mobile drilling unit to a site specific floating offshore installation. The requirements for the converted unit are based on the site-specific conditions for the operating site where the unit is to be installed and operated through the intended period of operation, and the transit conditions. These Guidance Notes are intended to provide information on the items that need to be considered resulting from the conversion, and give specific criteria that should be applied for classification in accordance with the ABS Rules and Guides. The Guidance Notes are to be used in conjunction with the ABS *Rules for Building and Classing Floating Production Installations (FPI Rules)* and other applicable ABS Rules and Guides.

Chapter 2 provides the requirements for conversion of column-stabilized drilling units to column-stabilized production installations, and Chapter 3 provides the requirements for conversion of drillships to ship-type floating offshore installations.

It is not the intention of these Guidance Notes to alter the technical criteria of the ABS Rules and Guides referenced herein. The main focus of these Guidance Notes is to aid in the application of these criteria in the conversion process.

CHAPTER 1 Introduction

SECTION 2 Application of Referenced Rules

The application of referenced Rules in these Guidance Notes is based on the contract date for conversion between the shipbuilder and the prospective Owner. See also 1-1-4/3 of the ABS *Rules for Conditions of Classification – Offshore Units and Structures (Part 1)*.

Structures other than hull structures (such as deckhouses), machinery equipment and/or marine systems which will remain unchanged will be considered on the basis of the original Rules used for the construction as well as the safety features of the converted unit.

CHAPTER 1 Introduction

SECTION 3 Abbreviations

ABS	American Bureau of Shipping
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
AISC	American Institute of Steel Construction
CSDU	Column-Stabilized Drilling Unit
DEC	Design Environmental Condition
DISEC	Disconnectable Environmental Condition
DOC	Design Operating Condition
FEA	Finite Element Analysis
FOI	Floating Offshore Installation
FPS	Floating Production (and Offloading) System
FPSO	Floating Production, Storage, and Offloading System
FPI	Floating Production Installation
FSO	Floating Storage and Offloading System
GM	Metacentric Height
GOM	Gulf of Mexico
ISIP	In-Service Inspection Program
ISE	Initial Scantling Evaluation
LCG	Longitudinal Center of Gravity
LSA	IMO Code for Life Saving Appliances (such as lifeboat, life jackets, etc.)
MARPOL	International Convention for the Prevention of Pollution from Ships (Marine Pollution)
MODU	Mobile Offshore Drilling Unit
NACE	National Association of Corrosion Engineers
OCS	Outer Continental Shelf
OHCM	Offshore Hull Construction Monitoring
POB	Person on Board
SOLAS	International Convention for the Safety of Life at Sea
SFP	Structural Fire Protection
SPM	Single Point Mooring
SWBM	Still Water Bending Moment
SWSF	Still Water Shearing Force

TSA	Total Strength Assessment
TCG	Transverse Center of Gravity
VCG	Vertical Center of Gravity

CHAPTER 2 Conversion of Column-Stabilized Drilling Units to Column-Stabilized Installations

CONTENTS

CHAPTER 2 Conversion of Column-Stabilized Drilling Units to Column-Stabilized Installations

SECTION 1 Introduction

1 Overview

This chapter provides guidance for the conversion of CSDUs to column-stabilized production installations and addresses three major items: the installation, the position mooring system, and as applicable the production facilities if they are requested to be classed. Sections 2 and 3 of the chapter addresses the items that may be considered for the conversion and specific criteria that should be applied for classification in accordance with the ABS Rules and Guides.

3 Classification Notations

3.1 Class Symbols and Notations

For a column-stabilized installation that is converted from a CSDU, the class symbols and notations are to be as indicated in 1-1-2/3.1, 1-1-2/3.3 and 1-1-2/3.5 of the *FPI Rules* as applicable. The class notation to be assigned depends on whether production and offloading systems are added, and whether storage capability is available for the converted unit.

3.3 Additional Notations

Additional notations can be assigned in accordance with 1-1-2/5 of the *FPI Rules.* For automatic or remote control and monitoring systems, class notations can be assigned in accordance with 1-1-2/9 of the *FPI Rules.*

5 Documentation

The Owner or Designer is required to submit all applicable design documentation, such as reports, calculations, plans and other documentation necessary to verify the structural strength of the column-stabilized installation itself and adequacy of the mooring system, production and other utility and riser system (if included in the classification) for the intended operations to ABS for review. The submitted design documentation is to be in accordance with Section 1-1-4 of the *FPI Rules,* and include the design environmental conditions (see Section 3-2-4 of the *FPI Rules*).

CHAPTER 2 Conversion of Column-Stabilized Drilling Units to Column-Stabilized Installations

SECTION 2 Conversion Considerations

1 General

The conversion of CSDUs to column-stabilized installations generally requires major modifications in order to support the intended service at a specific site. This section outlines possible modifications and related considerations.

3 Potential Modifications for Conversion

The following is a list of modifications that may be come out during conversion:

- Modification of upper hulls, lower hulls, decks, vertical columns, diagonal and horizontal braces
- Addition of production systems and supporting structures
- Addition of processing systems and supporting structures
- Addition of export systems and supporting structures
- Addition of fire and safety system design
- Addition of accommodation space and lifesaving appliances
- Addition of mooring systems and supporting structures
- Modification of existing positioning systems and supporting structures
- Addition of power generation and distribution systems and equipment
- Modification of deck rearrangements and design
- Removal of thrusters and thruster compartment closures

This list gives potential items to be addressed based on experience with similar conversion and should not be taken as being inclusive.

5 Considerations for Conversion

The following items may be considered for conversion as applicable:

- Consideration of lifting capabilities, crane reach, access of welders to welding positions and ventilation, should be given to structural work related to reinforcements, deck extensions, moonpool closure, and thruster compartment closure.
- Care should be taken to survey the lower braces, especially if new brackets are added.
- New mooring loads in a FPI may be significantly higher than those when operating as a mobile offshore drilling unit (MODU). In such a case, additional mooring lines may be required. Structural reinforcement in way of mooring equipment may be needed. Fairleads, chain stopper and winch may need to be changed, and may necessitate the installation of additional back-up structure.

- New processing equipment and risers are typically heavier than drilling equipment. Sponsons and/or blisters may need to be installed to increase stability/payload.
- Location of the flare boom may affect the locations of helideck and hazardous areas. Similar consideration may be made for turbines and turbine exhausts.
- Location and loads applied to new riser porches may create a need for major structural reinforcements. Similar consideration may be needed for riser pull-in equipment.
- Care should be taken on the design of riser hard pipes from riser porches to process systems due to interference, structural reinforcements, restrictions in pipe bend radius and locations of hazardous areas. Protection of riser pipes by using riser guard structures may need to be considered.
- Moonpools are most likely to be closed off to increase deck area, provided heavier modules may be in place. This may exceed the existing deck loading capacity and major deck reinforcement may be required.
- New processing equipment may demand more sea water for cooling, and an increased sea chest capacity may be needed. Owners may consider the use of lift pumps with caissons installed on the side of the columns. Consideration should be given to the ease of inspection and replacement of sea chest valves.
- FPIs usually require more personnel on board (POB) than MODUs, which could impact lifesaving appliances and accommodation spaces.
- Additional space or a floatel for temporary POB may be needed during startup and commissioning.
- Consideration should be given to the ability to enter ballast tanks and pontoon tanks at the production draft.
- Consideration should be given to the installation of firewalls to segregate hazardous areas from non-hazardous areas due to tight spaces.
- Vent pipes may need replacement.
- Possible methods to close the thruster compartments should be considered, noting that the desired method of welding of a cover plate may not be feasible.
- Site-specific geotechnical assessment and anchor design.
- New or upgraded power generation system.
- Avoid routing of process piping below accommodations.

This list gives potential items to be addressed based on experience with similar conversion and should not be taken as being inclusive.

7 General Requirements

7.1 General

This Section covers the requirements for column-stabilized installations undergoing a major conversion. The application of these requirements will be considered by ABS based on the service history, age, condition of the existing mobile unit, etc.

7.3 Lightweight data and Center of Gravity

The lightweight and center of gravity should be determined for the converted column-stabilized installation. An inclining test is required for the first converted column-stabilized installation of a series, when as near to completion as practical, to determine accurately the lightweight and position of center of gravity. An inclining test procedure is to be submitted for review prior to the test. The inclining test is to be witnessed by an ABS Surveyor. The final lightweight and center of gravity are to be calculated based on the results of the inclining test and are to be submitted for approval.

7.5 Maximum Draft

The converted column-stabilized installation is to have marks that designate the maximum permissible draft to which the installation may be loaded. The requirements of maximum draft are to be in accordance with 3-3-1/5 of the *FPI Rules*.

7.7 Operating Manual

An operating manual is required to be resubmitted for review for marine operation of a column-stabilized installation, containing the information listed in Section 1-1-5 of the ABS *Rules for Building and Classing Mobile Offshore Drilling Units (MODU Rules)*, the Supplement to the ABS *Rules for Conditions of Classification – Offshore Units and Structures (Part 1)* and 5B-1-4/11 of the *FPI Rules*, as applicable. This is to verify changes to the design information and limitations considered in the conversion of the unit. Further, where **Disconnectable** is requested as an additional classification notation, the operating manual is to include procedures for disconnection and reconnection of the installation to its mooring and riser system. (See 3-4-1/13 and Section 7-1-5 of the *FPI Rules*.)

7.9 Stability

The intact and damage stability of the installation are to be evaluated in accordance with the requirements of the Flag and Coastal States. Column-stabilized installations are to be complied with 2-3/5.

7.11 Engineering Analysis

Documentation necessary to verify the adequacy of the structure, equipment and systems for the selected scope of classification is to be submitted for review. (See 3-3-1/13 of the *FPI Rules*.)

7.13 Mooring Systems and Equipment

After a column-stabilized installation is converted from a CSDU, position mooring systems become a mandatory classification requirement. Position mooring systems are to meet the requirements of Part 6 of the *FPI Rules*. For temporary mooring equipment, see 1-1-2/11 of the *FPI Rules*.

7.15 Onboard Computers for Stability Calculation

The use of onboard computers for stability calculations is not a requirement of class. However, if stability software is installed onboard the converted installations, it needs to cover all stability requirements applicable to the converted installation and is to be approved by ABS for compliance with the requirements of Appendix 3-3-A2, “Onboard Computers for Stability Calculations” of the *MODU Rules*.

CHAPTER 2 Conversion of Column-Stabilized Drilling Units to Column-Stabilized Installations

SECTION 3 Assessments

1 Design Basis and Loads

1.1 Design Basis

The design basis of the converted column-stabilized installation is to be submitted with adequate data for the specific site of operation. The environmental data are to be provided in accordance with 3-2-4/1 of the *FPI Rules*.

The general design basis of a column-stabilized installation are given in Section 3-2-1 of the *FPI Rules*.

1.3 Environmental Conditions

The converted column-stabilized installation is to be designed for in-service conditions to withstand a specified extreme storm in the Design Environmental Condition (DEC) and operate in the Design Operating Condition (DOC). The environmental conditions required are defined in 3-2-3/1.1 and 3-2-3/1.3 of the *FPI Rules* and the environmental criteria required for these design conditions are defined in Section 3-2-4 of the *FPI Rules*. Additionally, the column-stabilized installation is to be designed for all pre-service conditions such as loadout, transportation, and installation. The environmental conditions for loadout and installation are to be specified by the Designers or Owners. The environmental condition for transportation is to be a 10-year return event of the selected transit route, unless a weather routing plan is implemented for the voyage.

1.5 Loads

The modifications performed during the conversion may significantly influence the anticipated loads for the converted unit during pre-service and in-service conditions. Also, operating loads may change, which include gravity loads together with relevant environmental loads due to the effects of wind, waves, currents, and, where deemed necessary by the Owner or Designer, the effects of earthquake, temperature, fouling, ice, etc. The loads to be considered are to include, as applicable, the following loads listed in 2-3/1.5.1 to 2-3/1.5.8 as below.

Combinations of these loads that produce the most severe local and global effects on the installation, as determined by the operational and installation requirements of the in-service and pre-service conditions, should be used in design assessments.

The effects that are critical to the installation's global strength are given in 5B-1-2/5.1.2(a) of the *FPI Rules*.

1.5.1 Environmental Loads

Loads due to wind, waves, and current are to be considered. The criteria for establishment of environmental loads can be seen in Section 3-2-4 of the *FPI Rules*.

1.5.2 Hydrostatic Pressure and Buoyancy

Hydrostatic pressures and buoyancy are to be considered for all submerged structural members.

1.5.3 Gravity and Functional Loads

Gravity loads should be taken into account in the design of the structural strength and stability. Gravity loads include steel, equipment and outfitting weights, liquid and solid variables, and live loads. For all modes of operation, the combinations of gravity and function loads are to be specified by the Owners or Designers as per operations designed. However, maximums (or minimums) of the combinations that produce the most unfavorable load effects in the strength or stability of the unit should be addressed in the design.

A loading plan is to be prepared to show the maximum uniform and concentrated loadings that are to be considered for the decks of the topside deck structure in each mode of operation. In the preparation of this plan, the following loadings are to be considered as minimums.

- *Crew spaces (walkways, general traffic area, etc.)*

  4510 N/m^2 (460 kgf/m^2, 94 lbf/ft^2) or 0.64 m (2.1 ft) head

- *Work areas*

  9020 N/m^2 (920 kgf/m^2, 188 lbf/ft^2) or 1.28 m (4.2 ft) head

- *Storage areas*

  13000 N/m^2 (1325 kgf/m^2, 272 lbf/ft^2) or 1.84 m (6.0 ft) head

1.5.4 Inertial Loads

Inertia loads due to motions of the column-stabilized installation are to be considered.

1.5.5 Operational Loads

Loads induced by operations of production are to be considered.

1.5.6 Mooring and Riser Loads

Loads due to mooring and riser systems are to be considered.

1.5.7 Marine Operation Loads

Loads encountered during transportation and installation are to be taken into account in the design. These include loads experienced during transport (wet or dry), and launch or float-off.

1.5.8 Slamming

Wave slamming loads should be considered for members such as pontoons, columns, braces, and members forming the underside of the topside deck structure that are subject to wave slamming during transportation and operation. Breaking wave slamming loads should also be considered, if applicable.

1.7 Directionality

Directionality of wind, waves, and current should be considered if accurate data is available. Where accurate data are not available, the directionality of wind, waves, and current that generates the most severe local and global load effects should be used for design. An adequate number of headings for the environment should be analyzed so that the most critical heading for the environment is covered.

1.9 Soil Conditions

A site investigation is to be carried out in accordance with Section 3-2-5 of the ABS *Rules for Building and Classing Offshore Installations (OI Rules)*. Soil data should be taken in the vicinity of the foundation system site. An interpretation of such data is to be submitted by a recognized geotechnical consultant. To establish the soil characteristics of the site, the foundation system borings or probings are to be taken at all foundation locations to a suitable depth of at least the anticipated depth of any piles or anchor penetrations plus a consideration for the soil variability. As an alternative, sub-bottom profile runs may be taken and correlated with at least two borings or probings in the vicinity of anchor locations and an interpretation may be made by a recognized geotechnical consultant to adequately establish the soil profile at all anchoring locations.

3 Structures and Global Performance Analysis

The design and construction are to be based on the applicable requirements in the *FPI Rules*. Local authorities having jurisdiction for the waters where the installation is to operate should be contacted to obtain any further regulatory criteria that are applicable to the installation.

3.1 Structures Design

The structural design is to be based on the applicable portions of the *FPI Rules*. Where the conditions at the installation site are less severe than those required for a MODU based on the requirements of the *MODU Rules*, the design criteria for various related components of the structure may be reduced to reflect those differences. However, when the installation site conditions produce more arduous demands, the design criteria are to be increased appropriately. The design of the structure is to include the following:

- Scantlings of the installation, including the hull, topside deck structure, columns, braces and pontoons are to be designed in accordance with 5B-1-2/3 of the *FPI Rules*.
- Deckhouses are to be designed in accordance with 5B-1-2/1.3 of the *FPI Rules*.
- The design of the helicopter deck is to comply with the requirements of 5B-1-2/1.5 of the *FPI Rules*.
- All openings in decks or column tops, hatch covers and companionway sills are to comply with 5A-4-1/3 of the *FPI Rules*. Portlights or other similar openings are not to be fitted in columns.
- Guards and rails are to comply with the requirements of 5B-1-2/1.9 of the *FPI Rules*.
- The design of hull interfaces with riser systems (riser porches, supports, and guides) are to comply with the requirements of 5B-1-2/7.1 of the *FPI Rules*.
- The design of hull interfaces with mooring systems (fairlead, chain stopper, and winch foundations) are to comply with the requirements of 5B-1-2/7.3 of the *FPI Rules*.
- The design of topside deck structure interfaces with deckhouses and deck mounted equipment/ machinery are to comply with the requirements of 5B-1-2/7.5 of the *FPI Rules*.

3.3 Materials and Welding

The materials used in the original construction and those to be used for structural modifications are to be clearly identified. Existing material is to be checked for the service temperature at the intended installation site. New material is to be selected in accordance with the applicable Rules as defined below.

Welding is to be done in accordance with the ABS *Rules for Material and Welding (Part 2)*. The design of hull and topside deck structures are to be in accordance with 5B-1-2/9.1 of the *FPI Rules*.

A corrosion protection and control system utilizing anodes and coating in accordance with the recognized industry standards such as API and NACE is to be provided. The design life of the corrosion protection and control system is to be the design life of the installation. In the splash zone, corrosion allowance is to be added to the external shell plating.

3.5 Structural Strength Assessment

The structural assessment is to verify the adequacy of the structural strength of the installation, including yielding, and buckling strength of the hull, topside deck structure and main intersections of primary structural components of the hull and topside deck structure. The criteria in 5B-1-2/5.1 of the *FPI Rules* relate to the analyses required to verify the design of the converted unit. The results of analysis that are required in 5B-1-2/5.1 of the *FPI Rules* cannot be used to reduce the scantlings below those established from 5B-1-2/3 of the *FPI Rules*. Depending on the specific features of the installation, additional analyses to verify the design of other portions of the installation's structural components will be required. Such additional analyses include those for the topside deck structural components supporting deck-mounted equipment/machinery and the installation structure interface with the position mooring and riser systems. Analysis criteria for interface structures are given in 5B-1-2/7 of the *FPI Rules*.

3.5.1 Global Strength Analysis

The primary structural components of the hull and topside deck structure are to be analyzed in accordance with 5B-1-2/5.1.2 of the *FPI Rules*. The acceptable criteria are to be in accordance with 5B-1-2/5.1.6 of the *FPI Rules.*

3.5.2 Major Joint Analysis

Analysis for main intersections of primary structures is to be in accordance with 5B-1-2/5.1.3 of the *FPI Rules*.

3.5.3 Structural Redundancy Analysis

The hull and topside deck structural redundancy analysis is to be carried out in accordance with 5B-1-2/5.1.5 of the *FPI Rules*.

3.5.4 Structural Robustness Check

For U.S. waters, a structural system robustness check is recommended for a column-stabilized installation in accordance with the applicable sections of API RP 2FPS.

3.7 Structural Fatigue Assessment

The fatigue assessment is to verify adequate strength against fatigue failure within its design life after conversion. The remaining fatigue life is to be determined in order to assign the notation **RFL(years)**.

The accumulated fatigue damage from the past service as a mobile unit is to be accounted for when calculating the remaining fatigue life for the converted column-stabilized installation. Consideration is to be given to the effects of corrosion and wastage on the remaining fatigue life of existing structures.

3.7.1 Fatigue Analysis

Fatigue analysis is to be carried out in accordance with 5B-1-2/5.1.4 of the *FPI Rules*.

3.7.2 Fatigue Criteria

The accumulated fatigue damage from the past service should be assessed in accordance with the ABS *Guide for the Fatigue Assessment of Offshore Structures* based on its service history and the associated safety factors which are to be provided by the Owner and Operator. If the past service history is not available, a proper fatigue assessment for calculating the accumulated fatigue damage from the past service as a mobile unit should be provided by the Owner and Operator.

The fatigue acceptance criteria for the hull, including the main intersections defined in 5B-1-2/5.1.3 of the *FPI Rules* are to be in accordance with 5B-1-2/5.1.6 (c) of the *FPI Rules.* The criteria for other major structures, including the hull interface with riser systems, the hull interface with mooring systems, and the topside deck structure interface with deckhouses and deck mounted equipment/ machinery are to be in accordance with 5B-1-2/7 of the *FPI Rules*.

3.9 Global Performance Analysis

3.9.1 General

The modification of mooring systems and supporting structures and/or the addition of processing systems and supporting structures for the converted column-stabilized installation may affect the global effects of environmental loads on the overall installation and its components, such as mooring lines, risers, etc. Global performance analyses are to establish that the converted column-stabilized installation meets all of the pre-service and in-service requirements. It is suggested that global performance analysis be carried out during each of the most critical design phases. The following aspects should be included in the global performance analyses:

i) Motions of the installation in six degrees of freedom

ii) Mooring line tensions, including the maximum and minimum tensions and mooring line fatigue loads for mooring component design

iii) Equivalent design wave heights and periods for the global structural analysis

iv) Hull hydrodynamic pressure loads for global structural analysis

v) Installation accelerations for the determination of inertia loads

vi) Deck clearance – refer to 2-3/3.9.4

Global performance analyses are required for various loading conditions because complex motion characteristics of the converted column-stabilized installation will have different impact on different structural components. The topside deck structure, hull, moorings and risers should be included in these analyses. Several analytical methods with varying degrees of complexity may be used to achieve this goal. Loading and response predictions for the topside deck structure and hull, and those for the moorings and risers can be performed either separately or in an integrated form. Methods and models employed in the analyses should account for the relevant nonlinear and motion coupling effects. Due to numerical efficiency and limitations of each method, frequency domain analyses are usually performed for all of the load cases. For those cases that are determined to be critical to the global performance or to have highly nonlinear effects, a time-domain analysis should be performed. For the details of various available global analysis methods of column-stabilized installations, refer to API RP 2SK.

3.9.2 Frequency Domain Analyses

Frequency domain analyses are to be in accordance with 5B-1-1/7.3 of the *FPI Rules*.

3.9.3 Time Domain Analyses

Time domain analyses are to be in accordance with 5B-1-1/7.5 of the *FPI Rules*.

3.9.4 Deck Clearance

Unless topside deck structures are satisfactorily designed for wave impact, reasonable clearance between the bottom of the topside deck structures and the wave crests is to be maintained for all afloat modes of operation, taking into account the predicted motion of the installation relative to the surface of the sea.

Clearance is to be maintained between the lowest point of the topside deck and the wave crest. The deck clearance is normally determined by an appropriate model test. Alternatively, the deck clearance can also be determined by a detailed hydrodynamic analysis that accounts for relative motions between the column-stabilized installation and waves. The following items are to be considered when determining deck clearance:

i) Various environmental headings

ii) All motions due to wind, waves, and current

iii) Nonlinearity of wave profile

iv) Wave diffraction and run-up

v) Tide and water level effects

Deck clearance is also to be checked at various points on the underside of the topside deck for all critical environmental conditions.

The deck clearance analysis establishes the elevation of topside deck structure in still water condition so that the bottom of topside deck structure is not subjected to wave impact in the DECs, unless the topside deck structure bottom is designed for such loading. For deck clearance analysis, reference can be made to the ABS *Guidance Notes on Air Gap Analysis for Semi-Submersibles.*

Where topside deck structural members are designed for passage of waves or if wave impact on the underside of the topside deck structure is anticipated, local strengthening of these members is required. Wave impact criteria for a column-stabilized Installation is given in Part 5B, Appendix 1 of the *FPI Rules*. Structures and equipment subject to wave run-up or green water are to be designed for the associated forces.

For U.S. waters, the deck clearance for robustness checks is recommended to be in accordance with 8.10 of API RP 2FPS.

3.9.5 Model Testing

Model testing to derive certain design parameters, such as deck clearance and nonlinear effects, is recommended as the check for the converted column-stabilized installation design if innovative components are used in the design. Relevant environmental conditions are to be considered in the model testing. The primary objectives of model tests are to:

i) Determine the responses of a particular design, such as to calibrate low-frequency damping coefficients

ii) Verify analysis tools for prediction of system responses or simply to correlate the analysis results

iii) Derive design information as a substitute for numerical analysis

5 Stability

5.1 Transit Voyage Stability

Stability during wet tow to location is to comply with Coastal and Flag State requirements. If personnel will be on board during the tow, the stability is to meet the criteria for the column-stabilized unit in the *MODU Rules* at all transit drafts in association with wind speeds to be agreed with ABS based on the environmental parameters and procedures associated with the tow route.

During the installation phase (ballasting and deballasting on site), the installation is to have a positive metacentric height (GM) after correction for free surface effects. When evaluating GM, the effect of free surface from partially filled tanks during the ballasting/deballasting sequence is to be considered.

5.3 On-Site Stability

The converted column-stabilized installation is to have positive GM in the calm water equilibrium position for all afloat conditions after correction for free surface effects. The minimum GM used in design is to be specified by the designer and included in the operations manual.

Installations are to comply with the intact and damage stability criteria of 3-3-2/1 and 3-3-2/3 of the *MODU Rules* using the site-specific wind or 50 knots (25.7 m/s), whichever is greater. Height profile is to be taken from the *MODU Rules* or other recognized standard.

i) *Wind speed for normal operations* V_n – the 1-year, 1-minute average wind in the DOC as defined in 5B-3-1/5.3 of the *FPI Rules.*

ii) *Wind speed for storm survival* V_s – the 100-year, 1-minute average wind in the DEC as defined in 5B-3-1/5.3 of the *FPI Rules.*

iii) *Wind speed for damage conditions* V_d – the 1-year 1-minute average wind in the DOC as defined in 5B-3-1/5.3 of the *FPI Rules.*

The design wind velocities are to be selected by the designer and submitted with the design documentation.

5.5 Inclining Experiment

The inclining test is to be carried out while the installation is floating at a draft where pontoons are submerged. Braces or other structures should not affect the waterplane properties at any point during the test.

An inclining test is required to determine the lightweight and positions of center of gravity (LCG, VCG and TCG) of the unit. It is to be conducted when the conversion is as near to completion as practical and is to be conducted prior to leaving the conversion site. If integration of topsides takes place offshore, an alternative procedure may be applied using an inclining test or lightweight survey of the hull combined with weighing of the topside components to be installed. An inclining test procedure is to be submitted for review prior to the test. The inclining test or lightweight survey is to be carried out in the presence of an ABS Surveyor.

Changes of onboard load conditions after the inclining test and during service are to be accurately accounted for. The operations manual is to provide guidance for the maintenance of a weight change log and is to be kept onboard.

The inclining test or lightweight survey is to be complied with the requirements of the Flag and Coastal States and applicable international requirements.

5.7 Watertight and Weathertight Integrity

Watertight and weathertight integrity are to be established in accordance with 3-3-2/5 of the *MODU Rules.*

5.9 Penetrations

Penetrations are to comply with 5B-1-3/1.9 of the *FPI Rules*.

7 Position Mooring Systems

7.1 Mooring System

The position mooring system includes the mooring, anchoring and dynamic positioning (if any) systems. The purpose of the position mooring system is to keep the column-stabilized unit on station at a specific site. After converting to the column-stabilized installation, the requirements of position mooring systems are to comply with Part 6, Chapter 1 of the *FPI Rules.*

One or more mooring lines may be added to the converted installation, which affects the distribution of the mooring loads and should be considered. System conditions considered in the analysis of a column-stabilized installation are to be in accordance with 6-1-1/1 of the *FPI Rules*.

The analysis of a mooring system of a column-stabilized installation is to be in accordance with 6-1-1/3 of the *FPI Rules*. This analysis includes the determination of mean environmental forces and the extreme response of the installation in the DEC and the corresponding mooring line tension. The fatigue life analysis of mooring lines and mooring equipment is to consider fatigue damage in the mooring lines and mooring equipment prior to the conversion.

The mooring lines are to be designed with the factors of safety specified in 6-1-1/Table 1 of the *FPI Rules* with respect to the breaking strength and fatigue characteristics of mooring lines. These factors of safety are dependent on the design conditions of the system, as well as the level of analyses. Allowances for corrosion and abrasion of a mooring line should also be taken into consideration. See API RP 2SK for detailed recommendations.

The review of mooring equipment for the converted column-stabilized installation including winches, windlasses, chain, wire rope, in-line buoys and fairleads is to be in accordance with 6-1-1/13 of the *FPI Rules*. See also 6-1-1/15 of the *FPI Rules* for mooring line failure monitoring.

7.1.1 Anchor Holding Power

Foundation systems used for floating installations include drag anchors, pile anchors, vertically loaded anchors, dynamically installed piles and suction piles. The anchors are to be in accordance with Section 6-1-2 of the *FPI Rules*. Gravity boxes, grouted piles, templates, etc., may also be used and are considered to be within the scope of classification.

7.1.2 Field Test

The requirements of pull-test for each mooring line are to be in accordance with 7-1-3/9 of the *FPI Rules*.

7.3 Dynamic Positioning Systems

Dynamic positioning systems installed for position mooring purposes is subject to approval in accordance with the requirements of the ABS *Guide for Dynamic Positioning Systems*.

7.5 Thruster Assisted Mooring Systems

Where column-stabilized installations are equipped with thrusters to assist the mooring system, the thruster Assisted Mooring Systems are to comply with 6-1-1/11 of the *FPI Rules*.

9 Machinery and Systems

9.1 Marine Piping Systems

Marine piping systems are to comply with 5B-1-4/1 of the *FPI Rules*.

9.3 Electrical Systems

Electrical systems are to comply with 5B-1-4/3 of the *FPI Rules*.

9.5 Fire Fighting Systems and Equipment

Fire fighting systems and equipment are to comply with 5B-1-4/5 of the *FPI Rules*.

9.7 Machinery and Equipment

Machinery and equipment are to comply with 5B-1-4/7 of the *FPI Rules*.

9.9 Hydrocarbon Storage in Hull Tanks

If the converted column-stabilized installation is designed to store hydrocarbons in hull tanks, criteria for hull storage of hydrocarbons are to meet flag and coastal state requirements and applicable international requirements. The design for scantlings and strength for such storage tanks are to be in accordance with 5B-1-2/1 of the *FPI Rules*. See 3-5/5.9 of the ABS *Rules for Building and Classing Facilities on Offshore Installations (Facilities Rules)* for the storage facility arrangement requirements.

9.11 Additional Plans and Data to be Submitted

The information in accordance with 5B-1-4/11 of the *FPI Rules* is to be submitted and appropriate relevant information is to be provided in the Operating Manual.

11 Hydrocarbon Production and Process Systems

11.1 Installations Classed as FPSO or FPS

Hydrocarbon production and processing systems are to comply with the requirements of the *Facilities Rules* and Sections 4-1-2 through 4-1-11 of the *FPI Rules*.

11.3 Installations Classed as FSO or FOI (Production Facilities not Classed)

The systems and equipment for the production facilities are to be in accordance with 4-1-1/3 of the *FPI Rules*.

11.5 Installations Classed as FSO or FOI (with Production Facilities Indicated in the *Record*)

The safety features are to be in accordance with 4-1-1/5 of the *FPI Rules* in addition to the requirements in 4-1-1/3 of the *FPI Rules*.

CHAPTER 2 Conversion of Column-Stabilized Drilling Units to Column-Stabilized Installations

SECTION 4 Surveys

1 Surveys During Conversion

A column-stabilized installation is expected to remain permanently moored on site, and the following minimum survey requirements for conversion of an existing unit to a column-stabilized installation service are to be followed. All ballast and void spaces are to be hard coated and found in 'Good' coating condition. All external column and pontoon surfaces are to be hard coated.

1.1 Surveys of the Existing Unit

i) The unit is to be placed on dry-dock.

ii) A Special Survey of Hull is to be completed, including extensive gauging per Section 7-2-5 of the *MODU Rules*. All CVI and NDT requirements are to be completed in full without any consideration for areas examined previously during the cycle.

1.3 Surveys During Conversion or Modification

In general, surveys of column-stabilized installations are to follow the *MODU Rules* and the requirements of Part 5B of the *FPI Rules* for the vessel structure and machinery. In addition, Section 4-1-1 of the *FPI Rules* lists specific fire and safety systems that are covered in the *Facilities Rules*. The *OI Rules* are to be followed for topside structures.

1.5 Mooring System Surveys During Construction/Conversion

The requirements of mooring system surveys during the conversion process are to be in accordance with 7-1-1/5 of the *FPI Rules.*

3 Surveys During Installation and Commissioning

The requirements of surveys during installation and commissioning process are to be in accordance with Part 7, Chapter 1 of the *FPI Rules.*

5 Surveys After Construction

The requirements of surveys after construction are to be in accordance with Part 7, Chapter 2 of the *FPI Rules.*

CHAPTER 3 Conversion of Drillships to Floating Production Installations

CONTENTS

CHAPTER 3 Conversion of Drillships to Floating Production Installations

SECTION 1 Introduction

1 Overview

The requirements for the conversion of an existing ship-type unit to an FPI are specified in the *FPI Rules*. This chapter provides further details on the process for the conversion of drillships to floating offshore installations. These Guidance Notes:

- Provide information on the items that may need to be considered for the conversion
- Provide guidance on classification in accordance with current ABS Rules and Guides
- Give specific criteria that should be applied for classification

The Guidance Notes in this document are not intended to serve as a design standard, but rather to highlight the primary activities and considerations relating to the conversion.

3 Classification Notations

3.1 Class Symbols and Notations

For a ship-type FPI that is converted from a drillship, the class symbols and notations are to be as indicated in 1-1-2/3.3 and 1-1-2/3.5 of the *FPI Rules*. The class notation to be assigned depends on whether production and offloading systems are added, and whether storage capability is available for the converted unit.

3.3 Additional Notations

Additional notations can be assigned in accordance with 1-1-2/5 of the *FPI Rules*. For automatic or remote control and monitoring systems, class notations can be assigned in accordance with 1-1-2/9 of the *FPI Rules*.

CHAPTER 3 Conversion of Drillships to Floating Production Installations

SECTION 2 Conversion Considerations

1 General

The conversion of a drillship to a ship-type FPI requires major modifications in order to support the intended service at a specific site. This Section outlines possible modifications and related considerations for conversion.

3 Major Considerations of Conversion from Drillships to Ship-Type FPIs

For the conversion of a drillship to a ship-type FPI, the following is a list of items that should be considered:

i) Baseline information of the drillship under consideration

- Review of original design documentation, plans, modification records of any, and survey reports, etc.
- Survey of structure, mooring and machinery to establish conditions of the drillship

ii) System additions, removals and modifications, which include, but are not limit to:

- Removal of drilling equipment and derrick
- Modification or closure of moonpool
- Addition of a mooring system
- Addition of production and offloading systems
- Modification of topside structures
- Modification of hull interface structure related to mooring system
- Modification of topside interface structure
- Modification of safety systems
- Modification of other systems such as the electrical and firefighting systems
- Modification of offshore hull construction monitoring program (OHCM)
- Modification of accommodation facilities
- Modification of hoisting equipment
- Modification of tanks and holds
- Modification of Dynamic Positioning System (if applicable)

iii) Design assessment of the converted unit

- Necessary analyses should be performed based on the baseline information, proposed system and structural changes, and environmental conditions of sites and transit routes.
- Site-specific geotechnical assessment and anchor design.
- The assessment should be in accordance with the *FPI Rules* and are described in detail in Chapter 3, Section 3.

iv) Survey plan

- Survey plan should be in accordance with Chapter 3, Section 4.

5 General Requirements

General requirements of converted ship-type floating production installations are to comply with Section 3-3-1 of the *FPI Rules.* The design documentation to be submitted is to include reports, calculations, plans and other documentation necessary to verify the structural strength of the installation itself and adequacy of the mooring system, production and other utility facilities and riser system (if included in the classification) for the intended operations. The submission of plans, data and calculations for the converted floating installation is given in Section 1-1-4 of the *FPI Rules*, including:

- Structural design plans and data
- Design documents for position mooring systems
- Production facilities and production support facilities
- Design plans for marine and machinery systems
- Manuals and procedures

More detailed assessments and requirements are given in Chapter 3, Section 3.

CHAPTER 3 Conversion of Drillships to Floating Production Installations

SECTION 3 Assessments

1 General

The converted floating production installation is to be evaluated using the latest requirements specified in the *FPI Rules.*

3 Environmental Conditions

The site-specific design basis and environmental loading are given in 3-2-3/1.1 of the *FPI Rules*. For position mooring systems, the design environmental condition (DEC) and design operating condition (DOC) are to be as specified in 3-2-3/1 of the *FPI Rules.* For units with the **Disconnectable** optional notation, the client specified disconnectable environmental condition (DISEC) will be applied. For structure strength and fatigue life evaluation, the environmental condition is to be as specified in 3-2-3/3 of the *FPI Rules*. The site-specific environmental conditions are to be submitted in an environmental report in accordance with Section 3-2-4 of the *FPI Rules*.

The environmental conditions for the transit routes are given in 3-2-3/3.3 of the *FPI Rules.*

Environmental severity factors as defined in 5A-3-2/1.1 of *FPI Rules* are to be established for the site-specific environmental conditions. These factors are used to adjust the loadings and load effects produced by the site-specific long-term environment at the installation site compared with full ocean service. The SEAS program in ABS EAGLE FPSO software can be used to determine these environmental severity factors.

5 Hull Structures

Hull assessment for the converted unit includes stability, steel renewal assessment, structural strength, and fatigue analysis. The general procedure for hull structure assessment for conversion from drillship includes:

- Establish base line scantlings as a drillship;
- Establish environmental severity factors as described in 5A-3-2/1.1 of *FPI Rules* for the site specific environmental condition of the converted unit;
- Perform Initial Scantling Evaluation (ISE) per Section 5A-3-3 of the *FPI Rules;*
- Perform Total Strength Assessment (TSA) as required in Section 5A-3-4 of the *FPI Rules;*
- Establish steel renewal requirements based on the results of the ISE and TSA assessments.

In lieu of the predefined loading patterns (Section 5A-3-2 and Appendix 5A-3-A2 of the *FPI Rules*), the loading patterns according to the loading manual are to be considered for TSA, in consultation with an ABS technical office. The calculations are to be submitted for review and approval.

The following lists summarize the items and drawings/documents to be submitted for review of structural assessments.

Items to be considered:

- Longitudinal Scantlings
- Main Supporting Members
- Transverse Bulkheads Fore/Aft body Structures
- Hull Arrangements and General Arrangement
- Structural Modifications, if any
- Deck Loads
- Environmental Data and Route History
- Survey Records
- Loading Manual
- Statutory Items (MODU, SOLAS) – LSA, SFP, MARPOL, Load-Line & Tonnage, etc.
- Anchoring and Mooring
- Integration of Mooring System into the Hull
- Integration of Deck Mounted Equipment into the Hull
- Lifting Appliances/Vendor Items
- Helicopter Deck

Main drawings and documentation related to the conversion:

- Hull Plans
  - Midship Section Drawing
  - Profile and Plan Drawings, Longitudinal Sections
  - Shell Expansion
  - Transverse Sections and Bulkheads
  - General Arrangement and/or Capacity Plan
  - Hull Form, Lightship Weight and Dead Weight Distributions for Full Load Case
  - Design SWBM and SWSF envelopes for FPI
- Trading History and Historical site data
- Survey Reports
- Details of Modifications from Drillship to FPI
- Loading Manual
- Stability Booklet
- Transit Case (Shipyard to site)
- Site Environmental Data
- Finite Element Analysis (FEA) Reports for Hull Mounted Equipment foundations, Topside Modules/ Hull Interface and Mooring System/Hull Interface
- Helicopter deck Calculations
- Seakeeping Analysis Report, if any
- Deck Loading Plan
- Fire Safety Plan and Structural Fire Protection Plan

These lists present potential items to be addressed based on experience with similar conversion and should not be taken as being inclusive.

5.1 Stability

A stability analysis is to be carried out using the updated information of the deadweight, lightship and loading after the conversion. The Operational Manual is to be updated accordingly. The stability criteria for assessment of the stability are to be in accordance with 3-3-1/11 of the *FPI Rules*.

5.3 Steel Renewal Assessment

The steel renewal assessment procedure is provided in 5A-2-2 of the *FPI Rules*. The flow chart in Section 5A-2-2/Figure 1 of the *FPI Rules* has a detailed procedure for determining the reassessment scantling, renewal scantling and yard required scantling for conversion.

5.5 Structural Strength Assessment

The hull structure assessment for the converted unit follows the structural requirements for ship-type installations in Part 5A of the *FPI Rules*. The evaluation procedure for the hull structure of the converted unit is to follow the flow chart in 5A-2-1/Figure 1 of the *FPI Rules*.

For hull girder shear strength evaluation, the shear flow calculation specified in Subsection 4/5 of the ABS *Guide for Building and Classing Drillships (Drillship Guide)* can be used.

For TSA process, to evaluate the region where the moonpool is located before conversion, the extent of the hull structure to be modeled is to include the original moonpool region plus one hold aft and one hold fwd of the hold(s) where the moonpool is located, or the 0.4L amidships, which ever length of the hull structure is greater. To evaluate holds forward or aft of the hold(s) where the original moonpool is located, one additional hold length, fore and aft of the hold(s) that are to be evaluated, are to be included in the model. The model is to extend one or two frames fore and aft of the two end bulkheads.

The procedure to adjust hull girder shear force and bending moment as described in A4/15 of the *Drillship Guide* may be used.

The ABS software EAGLE FPSO can be used for the strength assessment.

5.7 Structural Fatigue Assessment

Fatigue assessment is to be performed to demonstrate the adequacy of fatigue life for the hull and topside interface.

Operating history as a drillship needs to be accounted for to evaluate fatigue damage to structure prior to the conversion. The fatigue acceptance criteria is to follow Section 5A-2-3 and Appendix 5A-3-A2 of the *FPI Rules*. In assessing the accumulated fatigue damage, the actual service history for both transit and normal drilling conditions, is to be used. This includes a description of the loading conditions, wave information, actual heading probability and loading patterns during the time as a drillship.

The remaining fatigue life is to be determined in order to assign the mandatory notation **RFL(years)**. The ABS software EAGLE FPSO can be used for the fatigue assessment.

5.9 Ship Length under 150 meters (492 feet)

For vessels with length under 150 m (492 ft), the structural assessment is to comply with the requirements in Part 5A, Chapter 4 of the *FPI Rules*.

5.11 Offshore Hull Construction Monitoring Program

For conversion from drillship to floating offshore installation, the notation **OHCM** is mandatory. The requirement for **OHCM** notation are contained in Appendix 5A-3-A5 of the *FPI Rules*.

7 Hull Interface Structures

Hull interface structures, as defined in 5A-1-1/3.5 of the *FPI Rules*, include the interface between the position mooring system and the hull structure, and the interface between deck-mounted equipment modules and the hull structure. The hull interface structures are to be assessed following 5A-1-4/3 of the *FPI Rules* using the updated design loads, including the changed weights, structural modification and metocean environmental condition change. The assessment of hull interface structures includes strength, fatigue and corrosion protection analysis. The verification of hull interface structures is to be performed using direct calculation of local 3-D hull interface finite elements models, developed using gross scantling and analyzed with loads and load cases described in 5A-1-4/3 of the *FPI Rules* with different interfaces. The fatigue assessment of the hull interface structures need to consider the accumulated fatigue damage during the previous service as drillships.

7.1 Hull Interface with Mooring System

Adding the mooring system needs major modification of the hull interface when converting a drillship to a ship-type FPI. The FEA procedure and requirements for modified hull interface with mooring system are to follow 5A-1-4/3.1 of the *FPI Rules*. The minimum extent of the FE model and the loading conditions are defined for different types of mooring systems (external or internal) and locations of the mooring systems (fore/aft end or midship). The loads to be applied to the FE model are to correspond to the worst-case tank loads, seakeeping loads as determined for both the transit condition and the on-site DEC, ancillary structure loads, mooring and riser loads for the on-site DEC if applicable. The DOC may also need to be considered for conditions which may govern. The loading patterns to represent the worst load effects are given in 5A-1-4/3.1.2iii) of the *FPI Rules*.

7.3 Hull Mounted Equipment Interface

The conversion of a drillship to an FPI requires the added or modified equipment to be mounted on the hull. The assessments of the modified hull interface are to comply with the requirements in Section 5A-1-4 of the *FPI Rules* using FEA analysis. The FEA modeling requirements for hull mounted equipment interface, including the topside module support stools and hull underdeck structures, and other hull mounted equipment foundations, such as crane pedestals and foundations, riser porches, flare boom foundations, gantry foundations, offloading equipment foundations, etc., and hull vessel structure in way of the foundations, are given in 5A-1-4/3.3 of the *FPI Rules*. The finite element model extent for these interface structures is to be sufficiently large to minimize the cut boundary effects. Openings, such as cutouts in way of critical areas, are to be incorporated into the finite element model. The loads for the on-site DOC, on-site DEC and transit condition are to be taken into account in the analysis.

9 Topside Structures

A weight control document reflecting changes in module weights after the conversion is to be submitted, if applicable. Topside structures are to be assessed in accordance with Section 5A-1-5 of the *FPI Rules* based on the new data including increased weights, structural modification and the new DEC or DOC, for the most unfavorable load combinations of topside stool reactions and hull structure loads.

Fatigue analysis of the modules on converted installations is optional. Where analysis is performed it should be performed in accordance with the ABS *Guidance Notes on Topside Structure Fatigue Assessment for Ship-Type Floating Production Installations*.

The structural fire protection aspects of the design of deck modules on a ship-type installation, including the arrangement of the hydrocarbon process area, are to be in accordance with Chapter 3, Section 8 of the *Facilities Rules*.

The design of the piping systems on the ship-type installation deck are to comply with Part 4, Chapter 2 of the *MODU Rules* and applicable requirements of the *Facilities Rules*.

11 Position Mooring Systems

When converting a drillship to an FPI, position mooring systems are to be added to keep the floating installation on station at a specific site. The position mooring systems include the mooring, anchoring and dynamic positioning (if any) systems. Thruster-assisted systems are defined in 3-1-4/7 of the *FPI Rules*. Typically, there are two types of position mooring systems: conventional spread mooring and single point mooring (SPM), as defined in 3-1-4/3 and 3-1-4/5 of the *FPI Rules*. For ship type floating installations, SPM is more commonly used. The Owner or Designer needs to decide if the thruster-assisted system or dynamic position system installed on the original drillship are to be removed or modified. Mooring systems are to be assessed, tested and surveyed as per Part 6, Chapters 1 to 3 of the *FPI Rules*.

11.1 Mooring Systems Assessment

The mooring system design is to be analyzed considering the system conditions defined in 6-1-1/1 of the *FPI Rules*, including intact cases, the damaged case with one broken mooring line and transient conditions with one broken mooring line for the DEC. The mooring analysis needs to be performed in accordance with 6-1-1/3 of the *FPI Rules*. The mooring system foundations are to be assessed per Section 6-1-2 of the *FPI Rules*. The following lists summarize the required analysis for the mooring system and the required drawings/procedures to be submitted for review.

List of required analysis:

- Model testing reports and calibration analysis
- Global performance analysis
- Mooring analysis
- Site investigation
- Foundation design

List of required drawings/procedures:

- Mooring arrangement or pattern
- Details of winching equipment
- Details of anchoring system
- Details of mooring line segments
- Connections at anchors and between mooring line segments
- Details of turret system to show turret structure, swivel, turntable and disconnecting device
- Environmental Report
- Details of arrangements and procedures for the crew to periodically verify that mooring lines have not failed
- Metocean report
- Operation manual
- Disconnecting procedure
- Hook-up procedures
- Installation procedures/manual
- Thruster specifications

For fatigue assessment of mooring system components, if existing mooring system components (e.g., chain stoppers) are to be used, previous expanded structural fatigue life should be reasonably accounted for.

For mooring systems incorporating fiber ropes, additional design considerations are specified in the ABS *Guidance Notes on the Application of Fiber Rope for Offshore Mooring*.

11.3 Field Test for Mooring System

After the mooring system is deployed, each mooring line is to be pull-tested. This field test needs to be performed in accordance with Section 6-1-3 of the *FPI Rules*.

11.5 Dynamic Positioning Systems

Dynamic positioning systems installed for position-keeping purposes are subject to approval in accordance with the requirements of the ABS *Guide for Dynamic Positioning Systems*.

11.7 Thruster-Assisted Mooring Systems

Where Floating Installations are equipped with thrusters to assist the mooring system, the thrusters are subject to approval in accordance with 6-1-1/11 of the *FPI Rules*. The contribution of the thrusters in the mooring system design will be reviewed on a case-by-case basis.

13 Marine and Industrial Machinery and Systems

Marine and industrial machinery and systems are to be assessed in accordance with Section 5A-1-6 of the *FPI Rules*. Typical systems are described below.

13.1 Marine Piping Systems

Marine piping systems are those systems that are required to conduct marine operations and are not associated with the process facilities. These systems include but are not limited to bilge, ballast, tank venting, sounding and fuel oil. Marine piping systems on ship-type installations are to be in accordance with the applicable requirements of Part 4, Chapter 6 of the *Steel Vessel Rules* and Chapter 3, Section 5 of the *Facilities Rules*, as applicable.

13.3 Electrical Systems

Electrical systems on the converted installations are to comply with the applicable requirements of Part 4, Chapter 8 of the *Steel Vessel Rules* and Chapter 3, Section 6 of the *Facilities Rules*. For hazardous area classification requirements, refer to Section 4-1-9 of the *FPI Rules*.

13.5 Fire Fighting Systems and Equipment

Fire fighting systems and equipment for service functions not associated with the process facilities are to be in accordance with the applicable requirements of Part 4, Chapter 7 of the *Steel Vessel Rules*. Fire fighting systems and equipment for protection of hydrocarbon process and associated systems are to be in accordance with Chapter 3, Section 8 of the *Facilities Rules*.

13.7 Machinery and Equipment

Machinery and equipment not associated with the process facilities are to be in accordance with the applicable requirements of Part 4, Chapters 2, 4, and 6 of the *Steel Vessel Rules*. Machinery and equipment forming a part of the hydrocarbon processing facilities are to be in accordance with applicable requirements of the *Facilities Rules*. Refer to Part 4, Chapter 1 of the *FPI Rules* regarding process-related machinery and equipment.

13.9 Process and Import/Export System

If import and export systems are used in converted floating installation and the optional notations **IMP/EXP** specified in 1-1-2/5.5 of the *FPI Rules* are requested, these systems are to be designed in accordance with the requirements in Part 4, Chapter 2 of the *FPI Rules*. These systems include rigid and flexible risers, connecting flow lines, submerged jumpers and floating offloading hoses. The plans and design data to be submitted for review for import/export systems are specified in Part 4, Chapter 2 of the *FPI Rules*.

13.11 Hydrocarbon Storage in Hull Tanks

If the converted floating installation is designed to store hydrocarbons in hull tanks, the installations for storage of hydrocarbons are to meet the applicable criteria contained in the Load Line, SOLAS, and MARPOL Conventions, in addition to flag and coastal State requirements, see 5A-1-1/1 of *FPI Rules*. The design for scantlings and strength for such storage tanks are to be in accordance with Part 5A, Chapter 3. See 3-5/5.9 of the *Facilities Rules* for the storage facility arrangement requirements.

15 Hydrocarbon Production and Process Systems

15.1 Installations Classed as FPSO or FPS

Hydrocarbon production and processing systems are to comply with the requirements of the *Facilities Rules* and Sections 4-1-2 through 4-1-11 of the *FPI Rules*.

15.3 Installations Classed as FSO or FOI (Production Facilities not Classed)

The systems and equipment for the production facilities are to be in accordance with 4-1-1/3 of the *FPI Rules*.

15.5 Installations Classed as FSO or FOI (with Production Facilities Indicated in the *Record*)

The safety features are to be in accordance with 4-1-1/5 of the *FPI Rules* in addition to the requirements in 4-1-1/3 of the *FPI Rules*.

CHAPTER 3 Conversion of Drillships to Floating Production Installations

SECTION 4 Surveys

1 Surveys During Conversion

A floating installation is expected to remain permanently moored on site, and therefore lacks the ready access to repair and maintenance facilities. Considering these conditions, the following minimum Hull survey for conversion of a drillship to an FPI are to be followed. All ballast and void spaces are to be hard coated and found in 'Good' coating condition. All external hull surfaces are to be hard coated.

1.1 Conversion Survey Requirements

1.1.1 Drydocking Survey

The unit is to be placed on drydock and examined in accordance with the requirements of Section 7-2-6 of *the MODU Rules* as applicable.

1.1.2 Special Periodical Survey

A Special Periodical Survey of Hull, appropriate to the age of the unit, is to be carried out in accordance with Section 7-2-5 of *the MODU Rules* as applicable.

1.1.3 Modifications

All modifications to the unit are to be carried out in accordance with 5A-2-1/9.1.3 of *the FPI Rules*.

1.3 Structural Repairs/Steel Renewal

Structural repairs and steel renewal survey is to comply with the requirements in 5A-2-1/9.3 of *the FPI Rules*.

1.5 Bottom Plate Pitting Repair

Any pitting found in the bottom plate may be addressed as noted in 5A-2-1/9.5 of *the FPI Rules*.

1.7 Mooring System Surveys

Surveys of the mooring system during construction are to be in accordance with Section 6-3-1 of the *FPI Rules*.

3 Surveys During Installation and Commissioning

The survey items and required survey procedures are specified in Part 7, Chapter 1 of the *FPI Rules*, including surveys during hook-up, installation of the mooring system, installation of import/export system if applicable, start-up and commissioning of hydrocarbon production systems.

The requirements of mooring system surveys during the conversion process are to be in accordance with Section 6-3-1 of the *FPI Rules*.

5 Surveys After Construction

The general requirements regarding conditions for surveys after construction are specified in the ABS *Rules for Survey After Construction (Part 7)* and Part 7 of the ABS *Rules for Building and Classing Mobile Offshore Drilling Units (MODU Rules)*, as applicable. Additional requirements specific to FPIs are specified in Part 7, Chapter 2, of the *FPI Rules*.

Requirements of In-Service Inspection Program (ISIP) for the converted installations are provided in 7-2-3 of *the FPI Rules*.

Annual surveys, intermediate surveys and special periodical surveys, drydocking surveys or equivalent, tailshaft surveys and auxiliary boiler surveys are to be carried out in accordance with the requirements in 7-2-2/1 to 7-2-2/13 of the *FPI Rules*.

APPENDIX 1 References

1. ABS *Rules for Conditions of Classification – Offshore Units and Structures (Part 1)*
2. ABS *Rules for Materials and Welding (Part 2)*
3. ABS *Rules for Building and Classing Mobile Offshore Drilling Units (MODU Rules)*
4. ABS *Rules for Building and Classing Offshore Installations (OI Rules)*
5. ABS *Rules for Building and Classing Floating Production Installations (FPI Rules)*
6. ABS *Rules for Building and Classing Facilities on Offshore Installations (Facilities Rules)*
7. ABS *Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*
8. ABS *Rules for Building and Classing Single Point Moorings (Single Point Mooring Rules)*
9. ABS *Guide for Building and Classing Drillships – Hull Structural Design and Analysis (Drillship Guide)*
10. ABS *Guide for the Fatigue Assessment of Offshore Structures (Offshore Fatigue Guide)*
11. ABS *Guide for Building and Classing Subsea Riser Systems (Riser Guide)*
12. ABS *Guide for Buckling and Ultimate Strength Assessment for Offshore Structures (Offshore Buckling Guide)*
13. ABS *Guide for Dynamic Positioning Systems*
14. ABS *Guide for the Classification Notation Thruster-Assisted Mooring (TAM, TAM-R, TAM (Manual)) for Mobile Mooring Systems*
15. ABS *Guide for the Certification of Offshore Mooring Chain*
16. ABS *Guidance Notes on the Application of Fiber Rope for Offshore Mooring*
17. ABS *Guidance Notes on Topside Structure Fatigue Assessment for Ship-Type Floating Production Installations*
18. ABS *Guidance Notes on Air Gap Analysis for Semi-Submersibles*
19. API RP 2FPS, *Recommended Practice for Planning, Designing, and Construction Floating Production Systems, Second Edition, 2011*
20. API RP 2SK, *Recommended Practice for the Design and Analysis of Stationkeeping Systems for Floating Structures, Third Edition, 2005*
21. API Spec 9A, *Specification for Wire Rope, Twenty-fifth Edition, 2004*
22. API RP 9B, *Recommended Practice on Application, Care, and Use of Wire Rope for Oil Field Service, Twelfth Edition, 2005*
23. API Bull 2U, *Bulletin on Stability Design of Cylindrical Shells, Third Edition, 2004*
24. API Bull 2V, *Bulletin on Design of Flat Plate Structures, Third Edition, 2004*
25. AISC Code, *Manual of Steel Construction – ASD, latest edition*
26. ASME Boiler Code, *Boiler and Pressure Vessel Code, Section VIII, latest edition*