

GUIDE FOR

CLASSIFICATION OF DRILLING SYSTEMS OCTOBER 2017

Guide to Color Coding Used in Online Version of the Guide

The following summarizes the colors corresponding to Rule Changes, Corrigenda items and editorial changes in the Guide files which are available for download.

Rule Changes:

Corrigenda:

CORRIGENDA/EDITORIALS – 9 November 2017

Editorials:

Editorial Changes



GUIDE FOR THE

CLASSIFICATION OF DRILLING SYSTEMS

OCTOBER 2017 (Updated November 2017 – see next page)

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

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Updates

November 2017 consolidation includes:

- October 2017 version plus Corrigenda/Editorials

10/10/2017

Foreword

This Guide describes criteria to be used for drilling systems, which are approved by the American Bureau of Shipping (ABS), and built to requirements of recognized codes and standards.

This Guide is to be used in conjunction with other applicable ABS Rules and Guides, codes and standards as referenced therein, and applicable national regulations.

ABS Classification continues to provide the offshore industry with a pathway toward agreement with Regulatory Authorities. Any Owner/Operator's specific request for compliance with applicable requirements of flag or Coastal State Authorities affecting the drilling systems is to be filed as an addendum to the Request for Classification.

The 2017 edition of the *Guide for the Classification of Drilling Systems* is an updated version of the 2012 edition of the subject Guide. The first edition of the *CDS Guide* was published in 1986 to support the drilling regulations developed for rigs operating in the UK sector of the North Sea. As part of ABS's commitment to promoting the security of life and property and preserving the natural environment, ABS has endeavored to continuously update the Guide by applying the latest industry standards and trends in risk abatement.

Previous Sections of this Guide have been reformatted to Chapters and each Chapter has been updated in accordance with the latest industry standards and practices as well as ABS plan review and survey practices. This Guide specifies only the unique requirements applicable to drilling systems. This Guide is always to be used with the *ABS Rules for Conditions of Classification – Offshore Units and Structures (Part 1)*.

The particular changes made to the Guide are as follows:

General:

- i) All sections have been reformatted into Chapters with previous Sections 2 and 3 being combined into a new Chapter 2.
- ii) Other Sections have been renumbered into new Chapters so the Guide now consists of eight Chapters
- iii) Added sections on scope for **CDS** notations and sub-notations (**WCS, DSD, DSC, DSP**)

General Changes: New Chapter 1: Scope and Conditions of Classification

Chapter 1 Section 1: Classification:

- i) Section 1 was updated to refer to the "Generic" Rules
- ii) Paragraphs covered by the Offshore "Generic" Rules have been removed and the Generic Rules have been updated to include reference to this Guide.

Chapter 1 Section 2: Classification Symbols and Notations:

- i) Paragraphs covered by the Offshore "Generic" Rules have been removed.
- ii) Included Classification items unique to CDS that are not covered by the "Generic" Rules.

Chapter 1 Section 3: Rules for Classification:

- i) This Chapter has been edited to separate Sections on Rules, Submittal Requirements and Alternatives.
- ii) "Generic" Rules have been referenced where applicable.

Chapter 1 Section 4: Plans and Data to be Submitted for Review:

- i) A new Section has been added.
- ii) Text has been condensed with respect to plan submission by referencing Chapter 2 content.

Chapter 1 Section 5: Alternatives:

- i) This Section was updated to address General Considerations, National Standards and Novel Features.
- ii) The Risk section was moved to a new Section 6.

Chapter 1 Section 6: Risk based Techniques for Alternatives:

- i) A new Section has been added to provide guidance on risk based techniques.
- ii) This Section includes material from *ABS Guidance Notes on Risk Assessment Application for Marine and Offshore Oil and Gas Industries*.

Chapter 1 Section 7: Definitions:

- i) New definitions have been added.
- ii) Text in existing definitions has been modified where needed to provide clarity.

Chapter 1 Section 8: Acronyms and Abbreviations:

- i) Acronyms have been added for **CDS** Sub Class notations

General Changes: New Chapter 2: Drilling Systems

- i) Existing Sections 2 and 3 have been combined into new Chapter 2.
- ii) Focus has been placed on performance objectives for equipment layout considerations.
- iii) Stakeholders and stakeholders responsibilities in the CDS class process have been more clearly defined.
- iv) Requirements for submittal of material specification used in the engineering design has been clarified.
- v) References to technical standards have been updated.
- vi) Risk assessments and FMEA/FMECA requirements have been updated and clarified.
- vii) The previous table on submittal of plans has been removed.
- viii) Well Test provisions were removed and flare booms were moved to the Well Control section (2016). (completed in 2016 and restated here for reference)
- ix) The definition of service temperature has been clarified.
- x) Standard listings of cross references have been removed where redundant and replaced with a general statement on generic requirements.
- xi) Vessel motions analysis text has been clarified.
- xii) Align the Guide requirements with API 16Q and a site-specific global riser analysis is to be carried out by operator per API 16Q
- xiii) Submittal of drilling riser global analysis is not mandatory
- xiv) Deleted requirement to submit a global riser analysis deferring to 16Q
- xv) Added a requirement for submittal of a Riser Operations Manual (16Q)
- xvi) Removed man-riding provisions. Reference has been made to the optional application of the *ABS Guide for Certification of Lifting Appliances (Lifting Appliance Guide)* for man-riding.
- xvii) An updated definition on pressure relief system capacity has been provided.
- xviii) BOP Stack up requirements have been aligned to API 53.
- xix) BOP closing capacity requirements have been updated.
- xx) Vent height requirements on Mud Gas Separator units have been updated.
- xxi) “Kill Unit” with Cementing Unit provisions have been consolidated and MAC requirements for prime movers and gears has been applied.

- xxii) Clarification added for applicable standards for Stack Mounted Valves.
- xxiii) Zone Management is renamed as Collision Avoidance and the detail requirements are added under Chapter 2, Section 7.
- xxiv) Added interlock override function requirement for Diverter Control System.
- xxv) Clarification provided for Drawworks Breaking System.
- xxvi) Added a new section for Riser Running Equipment.
- xxvii) Reference to *MODU Rules* for electrical requirements has been clarified.
- xxviii) Lifting attachments and foundation anchoring provisions have been modified to focus on equipment items associated with CDS classification.
- xxix) Skid requirements have been enhanced for clarity.
- xxx) Requirements for bolted connections on derricks/masts have been updated.
- xxxi) Lifting appliances dedicated to drilling operations has been maintained under CDS. (*Lifting Appliance Guide* applies to non-drilling cranes and personnel lifting).
- xxxii) FMEA/FMECA, FAT and Commissioning plan submittals have been added.
- xxxiii) Software security control and change history requirements have been added.
- xxxiv) A section on hydraulic motors used in critical load path service has been added.
- xxxv) Design Plans and Data – Submittal Requirements is included in Appendix.

General Changes: New Chapter 3: Scope of Drilling System and Equipment Approval

- i) Previous Section 4 has been renumbered to new Chapter 3 including cross references.
- ii) Subsection 3/1, “Design Review” has been updated.
- iii) Subsection 3/3, “Survey”: 3.3.1iv) has been removed.
- iv) The Vendor Co-ordination Subsection 3/9 has been enhanced to make this process mandatory. New section name is “Project Management and Vendor Co-ordination”
- v) IRC/COC is now only offered to Primary Drill-Thru Equipment.
- vi) Previous equipment Section 4, Table 1 has been reformatted and renumbered to Tables 1 through 10 with the following additional updates:
 - Revised to align with **CDS** Class sub notations
 - Added informative API references
 - Clarified Testing requirements
 - Enhanced readability
 - Added Approval Tiers in 3-2/Table 1
 - Removal of personnel lifting/hoisting equipment as this equipment is now in the *Lifting Appliance Guide*.

General Changes: New Chapter 4: Drilling System Piping

- i) Previous Section 5 was renumbered to Chapter 4 including cross-references.
- ii) Section 1: General: Removed list of systems (redundant)
- iii) Section 2: Design Criteria:
 - Enhanced to provide for use of split flanges
 - Expanded pressure rating for Socket Welds

- Revised to simplify provisions for threaded joints
- Removed reference to Hydrocarbon Hoses

General Changes: New Chapter 5: Materials for Drilling Systems and Equipment

- i) Text has been edited to focus on materials and related processes (Specifications, Properties, Manufacturing, Fabrication, Coatings and NDE)
- ii) Requirements for threaded fasteners have been added with measures to prevent hydrogen embrittlement.
- iii) NDE provisions for materials was transferred from Chapter 6 to Chapter 5.
- iv) Material traceability requirements were expanded and added into Data Book requirements.
- v) Additional requirements for Critical Components have been provided.
- vi) Subsection 1/3, “Material Specifications” has been supplemented to include primary load bearing, pressure retaining, containing and controlling components.
- vii) Subsection 1/5, “Manufacturing Specifications” has been enhanced with provisions for submittal requirements for threaded fasteners; primary load bearing and critical components. Comments have been added on surface treatment (plating, thermal spraying, cladding).
- viii) Subsection 1/7, “Material Selection”: Mechanical and structural load bearing traceability and Data Book requirements have been clarified.
- ix) Subsection 1/9, “Corrosion-Sour Service”: Definitions have been clarified.
- x) Subsection 1/11, “Threaded Fasteners”: New paragraphs have been added requiring API 20E as mandatory with ASTM B849 being required for applicable coating processes. Additional comments added comment on sources of hydrogen contamination.
- xi) Subsection 1/13, “Critical Components”: Quality management system requirements have been extended to subcontractors. Q1 requirement has been replaced with generic requirements. Roles and responsibilities have been clarified.
- xii) Section 2, “Materials for Mechanical and Structural”: Mechanical and Structural requirements have been combined.
- xiii) Subsection 2/5, “Toughness”: CVN requirements have been aligned with industry practice and current standards applied and the CVN table has been condensed.
- xiv) Section 3, “Materials for Pressure Retaining/Containing/Controlling”: A new Section has been added with toughness requirements.
- xv) Section 4, “Manufacturing Considerations”: The API Q1 requirement has been replaced with generic requirements.
- xvi) Subsection 4/3, “Rolled Products”: Industry standard EN 10164 has been added.
- xvii) Subsection 4/5, “Forgings”: Text has been clarified.
- xviii) Subsection 5/1, “Welding”: Weld repairs on casting forgings and rolled products was transferred to Chapter 5 from Chapter 6.
- xix) Subsection 7/1, “Documentation and Traceability”: This section was retitled and text clarified or added including documentation requirements, weld repair maps and treatment of corrective actions.
- xx) Section 8, “Nondestructive Testing”: This Section was both condensed and clarified and the reference to equipment fabrication was moved to new Chapter 6.
- xxi) Subsection 8/1, “Specifications, Procedures and Material Documentation”: Surveyor acceptance text has been clarified.
- xxii) Subsection 8/7, “Extent of Examination”: This section was clarified to apply to raw materials only.

General Changes: New Chapter 6: Welding and Nondestructive Examination

- i) Text has been edited to focus on Welding and Nondestructive testing of fabricated items.
- ii) A section has been added on post-weld heat treatment.
- iii) Applicable NDE provisions for materials have been moved to Chapter 5.
- iv) Material traceability Data Book requirements have been expanded.
- v) Records Retention requirements have been enhanced.
- vi) Additional requirements have been added for Critical Components.
- vii) Section 1, “General”: The Chapter purpose (welding fabrication related processes) has been clarified.
- viii) Section 2, “Welding”: Text for requirements for repair welding have been enhanced.
- ix) Subsection 2/3, “Welding Procedures”: Requirements for Weld Procedure Specs and application of WPSs at “other” locations has been defined.
- x) Subsection 2/5, “Filler Metals”: Text has been enhanced for clarification.
- xi) Section 3, “Post Weld Heat Treatment”: A new Section has been added.
- xii) Section 4, “Nondestructive Examination”: Text changed to focus on fabrication and repairs during the fabrication process. NDE on raw materials has been moved to Chapter 5.
- xiii) Extent of Nondestructive Testing: References to raw materials have been removed and 6-5/Table 1 has been aligned with industry standards.
- xiv) Section 6, “Inspection for Delayed (Hydrogen Induced) Cracking”: Changed headings in this Section for clarity.
- xv) Subsection 7/1, “NDE Procedures”: Requirements have been enhanced and text has been clarified.
- xvi) Section 8, “Record Retention”: Enhanced text for clarification of requirements for tracking welds and associated welders.

General Changes: New Chapter 7: Surveys at Vendor’s Plant, During Installation and Commissioning

- i) Text added to require submittal of FMEA/FMECA validation test procedures.
- ii) A section has been added on non-conformances during the design and fabrication process. (Complimented by definitions in Chapter 1)
- iii) Text has been added to address treatment of major and minor engineering changes (complimented by definitions in Chapter 1)
- iv) Vendor coordination and prefabrication discussions have been made mandatory.
- v) Data Book content requirements have been clarified and added.
- vi) Skid testing requirements have been changed to align with changes in Chapter 2.
- vii) Changes have been made to requirements for lifting attachments and padeyes.
- viii) Drawworks brake testing section has been updated to align with current practice.
- ix) Expanded and clarified details on manufacturing plans, specifications and fabrication details.

General Changes: New Chapter 8: Surveys after Construction and Maintenance of Class

- i) The requirement for a Drilling Equipment Maintenance Plan has been removed.
- ii) A requirement for computer based maintenance records has been added. (replaces DEMP)
- iii) A section has been added on the temporary use of non-classed equipment.
- iv) A section on Marine Drilling Riser has been added. MDR requires a PMP program.

- v) Text has been clarified to allow for survey of sub class notations.
- vi) “Unscheduled Survey” has been renamed “Well Control Event Survey”.
- vii) Reference has been made to the ABS publication pertaining to Surveys Based on Risk Based techniques
- viii) Added section on use of temporary drilling equipment
- ix) Expanded review of NDE records for shear rams for Survey of Drilling Systems

This Guide becomes 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 this Guide is the most current.

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



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CHAPTER 1 Scope and Conditions of Classification

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CHAPTER 1 Scope and Conditions of Classification

SECTION 1 Classification

The requirements for conditions of classification are contained in the separate, generic *ABS Rules for Conditions of Classification – Offshore Units and Structures (Part 1)*. Additional requirements specific to drilling systems are contained in this Chapter.



CHAPTER 1 Scope and Conditions of Classification

SECTION 2 Classification Symbols and Notations

1 ABS Class Notation

Drilling systems, related subsystems, equipment, and/or components that have been built, installed and commissioned to the satisfaction of the Surveyors to the full requirements of this Guide, where approved by the Committee for service for the specified design environmental conditions, may be classed and distinguished in the *ABS Record* by the notation **✕ CDS**. For new construction or for existing systems being brought in **CDS** class, the full requirements of this Guide apply.

3 Sub Class Notations

Upon completion of 1-2/1 above and at the Owner's request, **✕ CDS** can be limited in scope. Following completion of the requirements to change the class scope, the existing **✕ CDS** may be exchanged for one or more of the following sub-class designations (See also 1-2/Figure 1):

- **✕ CDS (WCS)** applies to the classification of the well control system including well control equipment and associated control systems
- **✕ CDS (DSD)** applies to the classification of the derrick systems including drawworks, hoisting and drilling and motion compensating systems and associated control systems
- **✕ CDS (DSC)** applies to the classification of the drilling fluid circulating system and associated control systems
- **✕ CDS (DSP)** applies to the classification of the specialized pipe and tubular handling systems and associated control systems

Note: **✕ CDS (WCS+DSD)** class designation would apply where the Well Control and Derrick systems were classed and **✕ CDS (DSC)** and **✕ CDS (DSP)** were not selected.

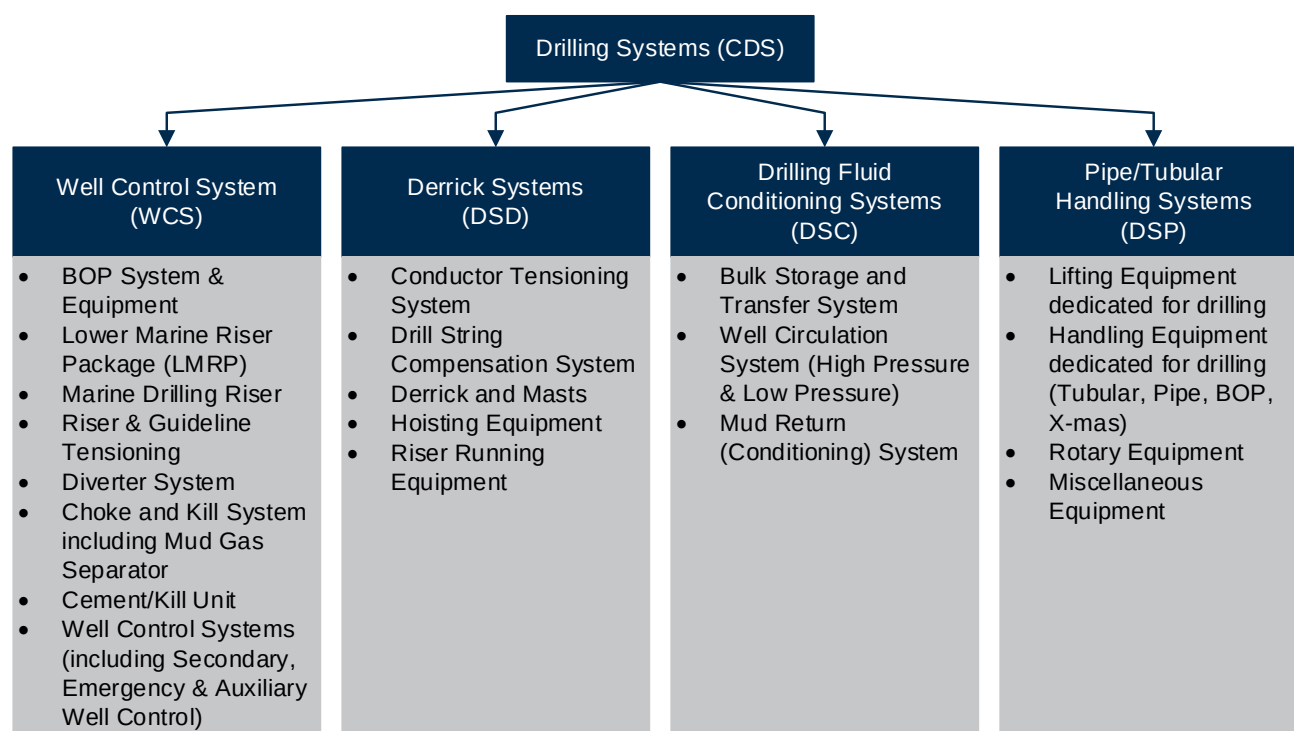
3.1 CDS Ready Notation

The **✕ CDS Ready** class notation indicates that required design approvals, testing, system installation, and commissioning is complete with the exception of non-technical operational items requiring clarification between the manufacturer and builder prior to the facility commencing drilling operations and assignment of full **CDS** notation or full Sub Class notation.

Examples of non-technical operational items include:

- i) Operation Manuals
- ii) Data Books (Mini Review Books)
- iii) Manufacturers Certificates

FIGURE 1
Notations Application



5 Systems Not Built Under Survey

The symbol “✕” (Maltese-Cross) signifies that the drilling system, subsystems, equipment, and/or components were built, installed and commissioned to the satisfaction of the Surveyors. Drilling systems, subsystems, equipment, and/or components that have not been built under ABS survey, but which are submitted for Classification, will be subjected to special consideration. Where found satisfactory and thereafter approved by the Committee, they may be classed and distinguished in the *Record* by the notation described above, but the symbol “✕” signifying survey during construction will be omitted.

A listing of Classification Symbols and Notations available to the Owners of vessels, offshore drilling and production units and other marine structures and systems, “List of ABS Notations and Symbols” is available from the ABS website “<http://www.eagle.org>”.

7 Managed Pressure Drilling (MPD) Systems

For managed pressure drilling (MPD) systems and associated optional notations refer to the *ABS Guide for Classification and Certification of Managed Pressure Drilling Systems*.



CHAPTER 1 Scope and Conditions of Classification

SECTION 3 Rules for Classification

1 General

This Guide is applicable to optional classification of drilling systems and associated equipment used to construct wells or support such activities on mobile offshore drilling units, offshore installations, tendering vessels and other units that are classed with ABS. This Guide is intended for use in conjunction with the

- *ABS Rules for Building and Classing Mobile Offshore Drilling Units (MODU Rules)*
- *ABS Rules for Building and Classing Offshore Installations (Offshore Installations/FOI Rules)*
- *ABS Rules for Building and Classing Floating Production Installations (FPI Rules)*
- *ABS Rules for Building and Classing Steel Vessels (Steel Vessel Rules)*
- *ABS Rules for Building and Classing Facilities on Offshore Installations (Facilities Rules)*
- or other applicable ABS Rules and Guides.

If requested by the Owner, this Guide can also be used as a basis for acceptance or certification under the requirements of other Administrations. An Owner who requires a drilling system to be evaluated for compliance with other national regulations should contact ABS.

If requested by the manufacturers, Owner, or designers, ABS can provide approval of individual equipment or component associated with drilling systems or subsystems in accordance with the requirements of this Guide where the installation unit may not be classed with ABS.

3 Application

Application of the Rules and Guides is, in general, based on the contract date for construction between the shipbuilder and the prospective owner. (e.g., Rules which became effective on 1 January 2017 are not applicable to a drilling unit for which the contract for construction was signed on 30 June 2016.) See also 1-1-4/3 of the *ABS Rules for Conditions of Classification – Offshore Units and Structures (Part 1)*. For application of codes and standards, see 2-2/1.1 of this Guide.



CHAPTER 1 Scope and Conditions of Classification

SECTION 4 Plans and Design Data to be Submitted for Review

1 Submission of Plans

Typical documentation that is required to be submitted for review for drilling systems, subsystems, equipment, and/or components for the ABS Classification process is provided in Appendix 7 of this Guide.

The ABS approval process for drilling systems, subsystems, equipment, and/or components is provided in Chapter 3, Section 2. Subsequently, 3-2/Tables 1 through 10 identify the typical drilling systems, subsystems, equipment, and/or components that are part of the ABS Classification process.

Drilling systems, subsystems, equipment and/or component-related drawings, calculations and documentation are required to be submitted to ABS for review by the contracting party or the party assigned by the contracting party to substantiate that the design of the systems, subsystems, equipment and/or components are in compliance with this Guide and applicable codes or standards as listed in this Guide.

Upon satisfactory completion of ABS review of the submitted design plans and data, ABS will issue an approval letter and/or an Independent Review Certificate (IRC), as specified in 3-2/7.1. This letter or certificate, in conjunction with ABS-approved documentation, will be used and referenced during surveys. Subsequently, the Surveyor will issue appropriate survey reports and Certificate of Conformity (COC) as specified in 3-2/7.1.

Upon satisfactory completion of all of the required engineering design review and survey processes (inspection, testing, installation and commissioning), ABS may issue the Classification Certificate to the operating unit, including the Class notation **✱ CDS** (abbreviation for Classed Drilling System).



CHAPTER 1 Scope and Conditions of Classification

SECTION 5 Alternatives

1 General

The Committee is willing to consider alternative arrangements and designs which can be shown, through either satisfactory service experience or a systematic analysis based on sound engineering principles, to meet the overall safety, serviceability and design standards of the applicable Rules and Guides.

3 National Standards

The Committee will consider special arrangements or design of drilling systems and their equipment which can be shown to comply with standards recognized in the country provided that the proposed standards are not less effective.

When alternate standards are proposed, comparative analyses are to be provided to demonstrate equivalent level of safety to the recognized standards as listed in this Guide and to be performed in accordance with this Chapter.

5 New Technologies and Novel Concepts

Drilling systems which involve new technologies or contain novel design features to which the provisions of this Guide are not directly applicable may be classed, when approved by the Committee, on the basis that this Guide, insofar as applicable, has been complied with and that special consideration has been given to these aspects, based on the best information available at that time. The *ABS Guidance Notes on Qualifying New Technologies* and the *ABS Guidance Notes on Review and Approval of Novel Concepts* provide a methodology for approval of such designs and their incorporation on an asset.



CHAPTER 1 Scope and Conditions of Classification

SECTION 6 Recognition of Risk Based Techniques to Justify Alternatives and Novel Features

1 General

ABS will consider the application of risk evaluations for alternative arrangements and novel features in the design of the drilling system, subsystems, equipment or components. Risk evaluations for the justification of alternative arrangements or novel features may be applicable either to the drilling system as a whole, or to individual systems, subsystems, equipment or components. Any alternatives to the requirements of this Guide may be specially considered by ABS on the basis of a risk assessment submitted for review.

- i) In case of such alternatives, ABS approval will be contingent upon a demonstration of fitness for purpose and equivalent level of safety in accordance with the principles of ABS Guides and Rules, as well as recognized codes and standards.
- ii) Risk acceptance criteria are to be developed in line with the principles of the ABS Rules and will be subject to ABS approval. In instances where a direct alternative recognized code or standard is used, ABS verification of compliance with the standard will be considered to demonstrate equivalent level of safety.
- iii) The *ABS Guidance Notes on Risk Assessment Application for the Marine and Offshore Oil and Gas Industries* provides an overview of risk assessment techniques and additional information.
- iv) For risk based inspection techniques refer to 8-4/5 of this Guide.

3 Application

When this optional risk assessment is applied at the specific request of the contracting party, designer or manufacturer, all hazards that may affect the drilling system or any of its subsystems, equipment or components are to be identified.

- i) A systematic process is to be applied to identify situations where a combination or sequence of events could lead to undesirable consequences (property damage, personnel safety and environmental damage), with consideration given to all reasonably foreseeable causes.
- ii) As appropriate, account must be given to hazards outside the bounds of the system under consideration. Such account is to include incidents relating to remote hazards impacting on or being influenced by the system under consideration.
- iii) Portions of the installation not included in the risk assessment are to comply with the applicable parts of the ABS Rules and Guides.
- iv) The objective of the hazard identification is to identify areas of the design that may require the implementation of further risk control options in order to reduce the risk to an acceptable level.
- v) The identified risk control options (prevention and mitigation measures) deemed necessary to be implemented are to be considered part of the design basis of the drilling system.

- vi) At minimum, HAZID workshop is to identify potential hazardous situations and verify that adequate risk control measures are provided to address the following:
- Dropped objects/loads
 - Release of hydrocarbons
 - Release of H₂S, CO₂, etc.
 - Release of toxic chemicals
 - Fire and explosion
 - Pollution to the sea
 - Loss of well control/blowouts
 - Release of pressurized fluids
 - Loss of system function
 - Loss of station-keeping
 - Loss of stability/buoyancy
 - Structural damage
 - Damage of subsea equipment
 - Collisions
 - Injury due to interface with machinery
 - Blackout
 - Environmental events
 - Mechanical Failure
 - Electrical Failure
 - Domino effects or impairment of emergency response equipment and/or activities (Not to be considered on its own, but in conjunction with each hazardous event)
 - Loss of purged air
 - Loss/failure at mooring
 - Helicopter crash

The following design principals are to be verified for the integrated drilling plant HAZID study:

- Safety of personnel and operation
- Separation of nonhazardous areas from classified hazardous areas
- Separation of fuel and ignition source as far as practical
- Minimizing probability of ignition
- Minimizing likelihood of uncontrollable releases of hydrocarbon
- Minimizing spread of flammable liquids and gases
- Minimizing consequences of fire and explosions
- Preventing fire escalation and equipment damage
- Providing for adequate arrangements for escape and evacuation
- Facilitating effective emergency response
- Minimizing dropped object hazards to personnel, equipment (on installation and subsea) and structure

- Protection of critical systems, subsystems, equipment and/or components from damage during drilling operation, (such as: electrical cables, well control equipment, control and shutdown systems, fire/gas detection and fire-fighting equipment arrangement, exhaust ducting and air intake system)
- Equipment arrangements provide access for inspection and servicing and safe means of egress from all machinery spaces

The ABS *Guide for Risk Evaluation for the Classification of Marine-Related Facilities* contains detail procedure for Risk Evaluation Process for classification of Alternative Arrangements and Novel Features. Appendix 4 in that Guide contains a description of the most common hazard identification techniques. In addition, Appendix 2 in that Guide provides an overview of how to assemble an appropriate risk assessment team.

When the risk assessment technique is considered, ABS' participation in the hazard identification meeting(s) is recommended. Tangible benefits can be derived by the participation of an ABS representative who will later be directly involved in reviewing the designs for ABS Classification.

5 Other Requirements

Where it is intended that risk-based techniques are used as a basis for compliance with flag and coastal State requirements, the contracting party is directed to contact the Administration, either directly or through ABS, to obtain an understanding as to the extent to which the Administration is prepared to consider alternatives to such requirements. The Administration may require additional hazards to be considered and safety functions.



CHAPTER 1 Scope and Conditions of Classification

SECTION 7 Definitions

The following definitions are provided to clarify the use of certain terms in the context of this Guide:

Accumulator: A pressure vessel charged with high pressure gas and used to store hydraulic energy under pressure.

Acoustic Control Systems: Acoustic signal transmission may be used as an emergency backup means for controlling critical BOP stack functions, such as pipe ram preventers, shear ram preventer and marine drilling riser connector including LMRP. The acoustic control system includes a surface electronics package, acoustic pod transponder, subsea electronic package and a subsea electro-hydraulic package.

Acoustic Pod Transponder: Device which receives acoustic signals from the surface and provides command signals to the subsea BOP control system.

Actuator: A mechanical component that is responsible for moving or controlling a mechanism such as for the remote or automatic operation of a valve or choke.

Annular Blowout Preventer: Blowout preventer that uses a shaped elastomeric sealing element to seal the space between the tubular and the wellbore or an open hole.

Autoshear System: A system that is designed to automatically shut-in the wellbore in the event of a disconnection of the LMRP. When the autoshear is armed, disconnect of the LMRP closes the shear ram on BOP stack.

Auxiliary Line: A conduit (excluding choke and kill lines) attached to the outside of the drilling riser main tube (e.g., hydraulic supply line, buoyancy control line, mud boost line).

Backup: An element or system that is intended to be used only in the event that the primary element or system is nonfunctional.

Backup Power: Secondary power source equal to or greater than the power required for operation from the primary power source.

Bell Nipple: A piece of pipe, with inside diameter equal to or greater than the blowout preventer bore, connected to the top of the blowout preventer or marine riser with a side outlet to direct the drilling fluid returns to the shale shaker pit.

Blind Rams: See “Rams”

Blind-shear Rams: See “Rams”

Blowout: An uncontrolled flow of well fluids/gas and/or formation fluids/gas from the wellbore to the surface or into lower pressured subsurface zones (underground blowout).

Blowout Preventer Equipment:

Blow Out Preventer: The equipment installed at the wellhead or wellhead assemblies to contain wellbore fluids either in the annular space between the casing and tubulars or in an open hole during drilling, completion and testing operations.

BOP Handling Crane: Typically a bridge or gantry-type crane used to move BOP from storage location to BOP transporter/skidder location.

BOP Operating and Control System: System of pumps, valves, accumulators, fluid storage and mixing equipment, manifold, piping, hoses, electrical systems, software and control panels and other items necessary to hydraulically operate the BOP equipment.

BOP Stack Assembly: The complete assembly of well control equipment, including preventers, spools, valves, and nipples connected to the top of the wellhead or wellhead assemblies and related structural stack frames.

BOP Seafixing: Mechanism to secure the BOP onboard the drilling unit.

BOP Stack Frame: Steel frame to which the lower stack is mounted for handling and mating with LMRP. Also serves as a support structure to mount various subsea equipment, such as subsea accumulators and control pods.

BOP Transporter/Skidder: Mechanism to position the BOP for deployment, retrieval or storage.

Bolting: Threaded fasteners including all-thread studs, tap-end studs, double-ended studs, headed bolts, cap screws, screws, and nuts.

Buffer Chamber: A targeted, horizontal or vertical, cylindrical tank that changes the direction of fluid flow downstream of the choke and serves as a flow director to the flare line, gas buster or mud-gas separator.

Bulk Storage: Tanks that are designed for storage of bulk materials for drilling fluid and cement mixing (barite, bentonite, cement, etc.).

Buoyancy Equipment: Devices added to riser joints to reduce their weight, thereby reducing riser top tension requirements.

Burner Boom: Boom which extends over the deck edge to flare hydrocarbon from kick circulation or well test operations.

Casing Pressure: The pressure existing at the surface on the casing side of the drill string/annulus flow system.

Casing Stabbing Board: Folding platform located in the derrick which positions the stabbing hand (pipe stabber) while running casing.

Catwalk: Elongated platform adjacent to the rig floor where pipe is laid out and lifted into the derrick. The catwalk is connected to the rig floor by a pipe ramp.

Cementing Manifold: Used to direct high pressure cement through the cement standpipe.

Cement Pump: High pressure positive-displacement-type pump used for cementing operations, often connected to the kill line for emergency kill operations, usually smaller capacity than mud pump.

Choke: A device with either a fixed or variable orifice used to control the rate of flow of liquids and/or gas.

Choke/Kill Line: The high-pressure piping (flexible lines, rigid piping, valves, connectors, fittings, etc.) that allows fluids to be pumped into or removed from the well with the BOPs closed.

Choke/Kill Line Valve: The valve(s) connected to and a part of the BOP stack that allows fluids flow to the choke manifold.

Choke/Kill Manifold: An assembly of valves, chokes, gauges, and piping components through which drilling fluid is circulated when the blowout preventer is closed to control the pressure encountered during a kick.

Circulation Head: Accessory attached to the top of the tubulars to form a connection with the mud system to permit circulation of drilling mud.

Clamp Connection: A pressure sealing device used to join two items without using conventional bolted flange joints. The two items to be sealed are prepared with clamp hubs. These hubs are held together by a clamp containing a minimum of four bolts.

Classified Area: A location in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures (see the *ABS MODU Rules*, API 500 or API 505 for additional details).

Closure Bolting: Threaded fasteners used to assemble or join well-bore pressure-containing parts including end and outlet connections. Examples include flange bolting, bonnet bolting, bolting on end connections on BOPs, bolting on hub clamps and ram door bolting.

Certificate of Conformity (COC): A Certificate of Conformity issued by the attending Surveyor in accordance with the provisions of this Guide.

Collision Avoidance Systems: Systems and/or devices that prevent the collision of power actuated equipment with personnel, equipment and fixed structures during drilling operations.

Computer-Based System: A system of one or more microprocessors, associated software, peripherals and interfaces.

Contracting Party: The commercial entity that enters into a Classification agreement with ABS.

Control Panel/Console: An enclosure displaying an array of switches, push buttons, lights and/or valves and various pressure gauges or meters to control or monitor functions. These panels can be pneumatic, electric or hydraulic powered.

Control Manifold: An assembly of valves and piping to control the flow of hydraulic fluid to operate the various components of systems, equipment or components.

Control Panel, Remote: A panel containing a series of controls that will operate the valves on the control manifold from a remote point.

Control Pod: An assembly of subsea valves and regulators that when activated from the surface will direct hydraulic fluid through special apertures to operate the BOP equipment.

Control Stations: Spaces containing the following, as applicable:

- Radio or main navigation equipment
- Central process control rooms
- Drilling and hoisting control systems
- Dynamically positioning control system
- Centralized ballast control
- Fire control equipment and fire recording
- Fire extinguishing system serving various locations
- Emergency source of power
- CO₂ bottle room

Control Signal: The signal (hydraulic, pneumatic, electrical, etc.) applied to the device that makes corrective changes in a controlled process or machine.

Control Systems: An assembly of devices interconnected or coordinated to generate or convey the command(s) and maintain a desired output. A control system may be comprised of hydraulic, pneumatic, electrical sources, or combinations thereof with control signals.

Critical Component: Any structural/mechanical component in a Critical Load Path.

Critical Load Path: A path in an assembly of mechanical components, along which force/load is transferred from one component to its connected component(s), failure of any of which will compromise the load carrying capacity of the assembly under intended operational conditions.

Critical Well Control Equipment: Equipment items that are issued IRCs and COCs per 3-2/Table 3.

Criticality Analysis: provides relative measures of significance of the effects of a failure mode as well as the significance of an entire piece of equipment or system, on defined performance requirements. It is a tool used to prioritize and minimize the effects of critical failures early in the design.

Criticality Ranking: Criticality rankings based on risk use a combination of the consequence (severity) of the failure and the anticipated likelihood of the consequence occurring. When used as part of a risk analysis study (e.g., FMECA) will highlight failure modes with high probability of occurrence and severity of consequences, allowing corrective actions to be implemented where they will produce the greatest impact.

Crown: Upper section of the derrick.

Crown Block: Assembly of sheaves mounted at the derrick top (crown) through which the drilling line is reeved.

Deadline Anchor: Device to securely fasten one end of drill line to the drill floor or derrick structure.

Deadman System: A system that is designed to automatically close the wellbore in the event of a simultaneous absence of hydraulic supply and signal (control and communication) transmission capacity in both subsea control pods.

Degasser: Device used to remove entrained gas from a drilling fluid in normal well circulation.

Desander: Centrifugal device for removing sand from drilling fluid.

Desilter: Centrifugal device used for removing silt from drilling fluid.

Derrick (Mast): Main load-bearing structure in drilling unit used as support structure for various equipment associated with hoisting, lifting, handling, etc.

Designer/Integrator: The group responsible for the design and integration of the overall functional system which includes components and interconnecting piping and controls as applicable.

Design Pressure: The pressure used in the design of pressure-retaining equipment or piping systems for the purpose of determining the minimum permissible thickness or physical characteristics of the different parts of the pressure-retaining equipment or piping systems. When applicable, static head and other external loads (e.g., bending, torsional, tension, compression, temperature gradient, etc.) are to be added to the design pressure to determine the thickness of any specific part of the pressure-retaining equipment or piping systems.

Design Validation, Testing: Process of proving a design by testing to demonstrate conformity of the product to design requirements. Design validation includes one or more of the following:

- Prototype tests;
- Functional and/or operational tests of production products;
- Tests specified by industry standards and/or regulatory requirements;
- Field performance tests and reviews.

Diverter Equipment:

Diverter: A device attached to the wellhead or marine drilling riser to control the upward flow of well fluids and direct flow into a line away from the rig floor.

Diverter Control System: The assemblage of pumps, accumulator bottles, manifolds, control panel, valves, lines, etc., used to operate the diverter system.

Diverter System: The assemblage of an annular sealing device, flow control means, vent system components, and control system that facilitates closure of the upward flow path of well fluids and opening of the vent to atmosphere.

Diverter Vent Line/Diverter Piping: The conduit which directs the flow of gas and wellbore fluids away from the drill floor to the atmosphere.

Drape Hoses: A flexible line connecting a choke, kill, and auxiliary line terminal fitting on the telescopic joint to the appropriate piping on the rig structure.

Drawworks: Large winch typically located on the drill floor used to raise and lower the drill string, top drive assembly by taking in or paying out the drilling line through the crown block and traveling block.

Drift-off: An unintended lateral move of a dynamically positioned vessel off of its intended location relative to the wellhead, generally caused by loss of station keeping control or propulsion.

Drill Floor Substructure: The foundation structure(s) on which the derrick, rotary table, drawworks, and other drilling equipment are supported.

Drill Pipe Safety Valve: A full-opening valve located on the rig floor with threads to match the drill pipe connections or other tubulars. The valve is used to close off the drill pipe to prevent flow.

Driller's Cabin: An enclosed space on the drill floor that provides clear view for the driller to monitor and control drilling activities.

Drilling Spool: Pressure containing piece of equipment having end connections, and outlets used below or between drill-through equipment.

Dual Gradient Drilling (DGD): A drilling process that creates multiple pressure gradients to manage the annular pressure profile by either increasing or decreasing annular pressure.

Dump Tank: Calibrated tank used to measure the volume of a liquid, may be drilling mud or reservoir fluids.

Elevator, Drilling: Manually or hydraulically/pneumatically operated hinged clamp-type device used to grasp drill pipe or casing for lifting.

Engineering Changes:

Major Engineering Change: A change that affects form, fit, or function of the component or system that could include, but not necessarily be limited to, a change in items in the load path (main or operational load path), pressure boundary, a change in materials, testing requirements, operational characteristics, or updates of the rules that requires further engineering evaluation.

Minor Engineering Change: A change that does not have an impact on the design, validation, and/or testing requirements with no effect on the form, fit, or function of a component or system that can be accepted by attending Surveyor.

Equipment Skids: Structural support assemblies used for different purposes and segregated as follows:

Permanently installed: Skid assemblies supporting drilling equipment permanently installed on the rig.

Portable: Skid assemblies supporting drilling equipment that are not permanently affixed and are moved (together with the associated installed equipment) for use during drilling operations.

Shipping: Skid assemblies used solely for the purpose of the one way transfer of the equipment for permanent installation on board.

Escape Routes: Designated path used by personnel to evade an immediate danger and ultimately leads to a temporary refuge or muster station.

Fail-safe: An engineering design principle wherein a system, equipment or component is designed to inherently respond to a specific type of failure or malfunction in such a manner that there is no or minimal impact on the safety of people, asset and the environment.

Finger Board: A rack located in the derrick that supports the top of the stands of pipe stacked in the derrick.

Flammable Fluid: Any fluid, regardless of its flash point, capable of fueling a fire. Examples are diesel fuel, hydraulic oil (oil-based), lubricating oil, crude oil, or hydrocarbons.

Flash Point: The minimum temperature at which a combustible liquid gives off vapor in sufficient concentration to form an ignitable mixture with air near the surface of the liquid or within the vessel used, as determined by the test procedure and apparatus specified in NFPA 30.

Flex/Ball Joint: A steel and elastomer assembly installed directly above the subsea BOP stack and at the top of the telescopic riser joint (slip joint) having central through-passage equal to or greater in diameter than the riser bore, positioned to permit relative angular movement of the riser string to reduce local bending stresses due to vessel motions and environmental forces.

Flexible Lines/Hydraulic Hoses: Conduits that can accommodate the relative motion and/or vibration encountered on the drilling facility and are used to transfer fluids (mud, cement, hydraulic fluids, etc.). Typical uses for flexible lines and/or hydraulic hoses within the drilling facility are:

- Rotary and vibratory hoses
- Cementing hoses
- Choke and kill flexible lines, and auxiliary lines (drapes and jumpers)
- Hydraulic hoses for control functions and operations

Fluid Cushion: A provision to dampen the effects of high pressure fluid flow by use of a blind flanged machined with a fluid cushion bore.

FMEA (Failure Modes and Effects Analysis): A systematic process to identify potential failures to fulfill the intended function, to identify possible failure causes so the causes can be eliminated or minimized, and to locate the failure impacts so the impacts can be reduced to acceptable levels.

FMECA (Failure Modes, Effects and Criticality Analysis): An extension of the FMEA that includes a criticality assessment - an explicit estimation of the severity of the consequences of the failure or a combination of the likelihood of the failure and severity of the consequences.

FMEA/FMECA Validation: Validation program developed to test when necessary the conclusions of the FMEA or to establish conclusively the effects of failure modes that the FMEA desktop exercise had a high degree of uncertainty about.

FMEA Critical Results: Critical Results are defined as those areas of a mechanical or control system identified from the FMEA as having mitigating barrier(s) to prevent the occurrence of a hazardous situation. These are considered as part of the FMEA Validation program to validate that upon the specified failure, a minimum of one mitigating barrier performs as intended in order to prevent occurrence of a hazardous situation. Examples of such mitigating barriers are hydraulic load holding valves, alarms, sensors, etc.

FMEA Selected Results: Those results for which there is reasonable uncertainty or disagreement of the FMEA assumptions. During the FMEA, uncertain assessments results are to be identified and discussed with the designer at time of Design Review for resolution. If a resolution is not achieved, these items require testing in the Validation program. Examples of areas where inadequate data may be available to perform definitive analysis include the behavior of interlocks that may inhibit operation of essential systems.

Form, Fit and Function:

Form: The shape, size, dimensions, material, design specification parameters that uniquely distinguish a part.

Fit: The ability of a part to physically interface with, connect to, or become an integral part of another part.

Function: The action or actions that a part is designed to perform per the applicable design specifications.

Gimbal: Support for the riser spider which allows some angular movement of the spider and riser relative to the rig support structure.

Gooseneck: Curved connection between the rotary hose and the swivel or top drive.

Hazardous Area: See "Classified Areas".

HAZID (Hazard Identification study): A process to find, list and characterize hazards. This is the first step to risk assessments.

HAZOP (Hazard and Operability study): A method of identifying hazards that might affect the safety and operability of a system process using process performance metrics (example: flow/no flow, high/low pressure, rotation/no rotation). A HAZOP can be considered a HAZID tool.

Heave: Vessel motion in the vertical direction due to marine environment.

High-Pressure High-Temperature (HPHT): Wells with a potential pressure greater than 103.43 MPa (15,000 psi) at the wellhead, and/or with a potential reservoir temperature of greater than 177°C (350°F).

Hook, Drilling: Hook-shaped lifting device attached to the traveling block from which the swivel (or top drive) is suspended.

Horizontal to Vertical Equipment: Equipment to move tubulars from/to horizontal position to/from vertical position for stand building or breaking, and tubulars operations.

Hydraulic connector: A mechanical connector that is activated hydraulically and connects the BOP stack to the wellhead or the LMRP to the BOP stack.

Hydraulic Cylinder: Mechanical device used to convert hydraulic fluid pressure to linear action.

Hydraulic Hoses: Conduits that can accommodate the relative motion, and/or vibration encountered on a drilling facility and are used to transfer fluid for hydraulic system functions.

Hydraulic Power Unit (HPU): Skid-mounted systems used to provide hydraulic power, usually comprised of a hydraulic fluid reservoir, filters, hydraulic pump, motor and control.

Hydrocarbon: A compound of hydrogen and carbon, such as any of those that are the chief components of petroleum and natural gas.

Hydrogen Sulfide (H₂S): A highly toxic, flammable, corrosive gas sometimes encountered in hydrocarbon-bearing formations.

Hydrogen Sulfide (Sour) Service: Refers to equipment designed to resist corrosion and hydrogen embrittlement caused by exposure to hydrogen sulfide.

Ignitable Mixture: A mixture that is within the flammable range (between the upper and lower limits) and is therefore capable of propagation of flame away from the source of ignition.

Inside Blowout Preventer (IBOP): A valve installed in drill string to prevent a blowout inside the drill string. Flow is possible only downward, allowing mud to be pumped in but preventing any flow back up the drill string.

Integrated Drilling System: Collective set of systems, subsystems and equipment related to Well Control Systems (WCS), Derrick Systems (DSD), Drilling Fluid Conditioning Systems (DSC) and Pipe/Tubular Handling Systems (DSP) including associated interfaces with drilling support systems, utilities and marine systems.

Iron Roughneck/ Power Tongs: Tool with automated combination of spinning and torquing for make-up or break-down of drill string pipes during drilling operation.

Jumper Line: A flexible section of choke, kill, or auxiliary line that provides a continuous flow around a flex/ball joint while accommodating the angular motion at the flex/ball joint.

Kelly Equipment: The uppermost component of the drill string; the kelly is an extra-heavy joint of pipe with flat or fluted sides that is free to move vertically through a “kelly bushing” in the rotary table; the kelly bushing imparts torque to the kelly and thereby the drill string is rotated.

Kelly Bushing: Device which imparts torque to the kelly from the master bushing and permits vertical movement of the kelly.

Kelly Cock: A valve immediately above the kelly that can be closed to confine pressures inside the drill string.

Kelly Spinner: Pneumatically-operated device mounted to the top of the kelly used to spin up the kelly for making and breaking connections on a rotary table-type rig.

Kelly Valve, Lower: A full-opening/full-closing valve installed immediately below the kelly, with outside diameter equal to the tool joint outside diameter.

Kick: Influx of water, gas, oil or other formation fluid into wellbore.

Kick Out: Terminal fittings on the lower riser adapter that serve to connect the riser choke, kill and auxiliary lines to the corresponding flexible hoses or flex loops on the BOP stack.

Kill: In drilling/well servicing, to prevent a threatened blowout by taking suitable preventative measures (e.g., to shut in well with blowout preventer, circulate kick out, and increase weight of drilling/completion/workover fluid).

Kill Line: The high-pressure piping (flexible lines, rigid piping, valves, connectors, fittings, etc.) between the pumps (cement or mud pumps) and BOP outlets or wellhead outlets.

Kill Unit: A unit to pump kill mud to kill the well.

Links, Drilling: Strong rods which connect the drilling elevators to the hook and allow movement for the elevator to be pushed out of the way when not in use.

Loose Gear: Off-the-shelf equipment including, but not limited to, shackles, chain, hooks, connecting links, turnbuckles, binders, sheave blocks, and swivels used in an assembly to suspend, secure, or lift a load.

Lower Marine Riser Package (LMRP) equipment:

LMRP: Part of the blowout preventer stack assembly; usually contains LMRP connector, one or more annular-type preventers, lower flex joint, riser adapter, and MUX control pods.

LMRP Connector: Hydraulic connector used to securely latch the LMRP to the BOP stack.

LMRP Frame: Structural frame which is used for handling of the LMRP and integration with the BOP stack. It also serves as a support structure to mount various subsea equipment such as subsea accumulators and control pods.

MAC (Manufacturer's Affidavit of Compliance): A document certified by the manufacturer that the specified product meets the required specifications. Also referred to as a Manufacturers Certificate of Compliance (MCOC).

Machinery Spaces of Category A: All spaces which contain internal combustion-type machinery used either:

- For main propulsion; or
- For other purposes where such machinery has in the aggregate a total power of not less than 375 kW; or
- Which contain any oil-fired boiler or oil fuel unit; and trunks to such spaces.

Machinery Spaces (other than Category A): Other Machinery Spaces: Spaces, including trunks to such spaces, containing propulsion machinery, boilers, oil fuel units, steam and internal combustion engines, generators and major electrical machinery (SCR, MCC and switchgear); oil filling station; refrigerating, ventilation and air-conditioning machinery with motors having an aggregate capacity greater than 7.5 kW (10 hp); and similar spaces, but are not machinery spaces of Category A.

Manifold: An accessory system of piping to a main piping system (or another conductor) that serves to divide a flow into several parts, to combine several flows into one, or to reroute a flow to any one of several possible destinations.

Manipulator Arm: Mechanism to guide tubulars from/to well center to/from the V-door.

Marine Drilling Riser System: The extension of the well bore from the subsea BOP stack to the floating drilling vessel which provides for fluid returns to the drilling vessel, supports the choke, kill, and control lines, booster lines, auxiliary lines (for specialized needs including riser boost, mud return for a dual gradient drilling program and glycol injection to control hydrate formation), guides tools into the well, and serves as a running string for the BOP stack.

Master Bushing: Device which imparts torque from the rotary table to the kelly bushing and accepts the slips.

Maximum Allowable Working (Operating) Pressure (MAWP) or Rated Working Pressure (RWP): The maximum internal pressure equipment or system is designed to operate or work and to contain and/or control the pressure.

MCOC: See MAC.

Mechanical Load-bearing Component: Components transmitting, resisting, or converting loads.

Primary Mechanical Load-bearing Component: A path in an assembly of mechanical components, along which force/load is transferred from one component to its connected component(s), failure of any of which will compromise the load carrying capacity of the assembly under operational conditions.

Minimum Design Service Temperature (MDST): The lowest predictable metal temperature occurring during normal operation including start-up, shut-down and ambient situation is to be used.

Mitigating Barriers: Those areas of a mechanical or control system which have barrier(s) to prevent the occurrence of a hazardous situation. The FMEA/FMECA Validation testing is to validate that upon the specified failure, a minimum of one mitigating barrier performs as intended in order to prevent occurrence of a hazardous situation. Examples of such mitigating barriers are hydraulic load holding valves, alarms, sensors, etc.

Monkey Board: Elevated platform on the derrick structure for the support of the derrickman to place and/or withdraw tubulars into the finger board.

Mud Agitator: Device to mix, or maintain mixture of, drilling mud in the mud pits.

Mud Boost Line: An auxiliary line which provides supplementary fluid supply from the surface and injects it into the riser at the LMRP to assist in the circulation of drill cuttings up the marine drilling riser, when required.

Mud-Gas Separator (Poor Boy Degasser): A vessel for removing free gas from the drilling fluid returns, generally used when circulating a gas kick out of the well.

Mud Pit Level Indicator: An indicator system that monitors and reports the level of mud in the pits. Serves as an indicator of losses and well kicks. Sometimes referred to a PVT (Pit Volume Totalizer).

Mud Pump: Large high-pressure pump used to circulate drilling fluid, usually positive-displacement type.

Multiplex (MUX) Control System: A system utilizing electrical or optical conductors in an armored subsea umbilical cable such that, on each conductor, multiple distinct functions are independently operated by dedicated serialized coded commands.

New Technology: Any design (material, component, equipment or system), process or procedure which does not have prior in-service experience, and/or any Classification Rules, Statutory Regulations or industry standards that are directly applicable. It is possible to categorize the type of “novelty” in one of four categories:

- i) Existing design/process/procedures challenging the present boundaries/envelope of current offshore or marine applications
- ii) Existing design/process/procedures in new or novel applications
- iii) New or novel design/process/procedures in existing applications
- iv) New or novel design/process/procedures in new or novel applications.

Non-conformance:

Major Non-conformance: A condition that affects form, fit or function.

Minor Non-conformance: A condition that does not affect form, fit or function.

Nonhazardous Areas (Unclassified Locations): Locations determined to be neither “hazardous areas” nor “classified areas” (see Classified Area” for definition).

Novel Concept: An offshore drilling unit that with the inclusion of new technologies, the service scope, functional capability, and/or risk profile is appreciably altered.

Operating Conditions: A set of conditions (e.g., pressure, temperature, flow rates, composition, loads, etc.) chosen for normal operation of a system, subsystem, equipment or component.

Pin: Male member of a riser coupling or a choke, kill, or auxiliary line stab assembly

Pipe Rams: See “Rams”

Pipe Racking Mechanism: Automated equipment to place and/or withdraw tubular strands to/from the setback area

Power Slips: Automated slips typically controlled by the driller, usually hydraulically or pneumatically operated.

Power Subs: A power sub is a device which moves with a hoisting system and is designed to provide rotary power to the top of the tubular/string. It attaches to the bottom of the rotary swivel, but does not include a rotary seal or bearing for supporting the tubular/string.

Power Swivels: A power swivel is a device which moves with a hoisting system and is designed to provide rotary power to the top of the tubular/string. It replaces the rotary swivel and includes a rotary seal and bearing for supporting the tubular/string weight.

Pressure Containing Equipment: Equipment/parts exposed to wellbore fluid/pressurized fluid whose failure to function as intended would result in a release of wellbore fluid/pressurized fluid to the environment.

Pressure Controlling Equipment: Equipment/parts intended to regulate the movement of wellbore/pressurized fluids.

Pressure Retaining Equipment: Equipment/parts not exposed to the wellbore/pressurized fluids whose failure to function as intended will result in a release of wellbore fluid to the environment.

Primary Load Bearing: Load bearing components in the critical load path.

Primary Structural Weld: Primary structure welds which are single point failure, with no redundancy, and are considered critical by the designer, will require 100% Volumetric NDE plus 100% Surface NDE

Product Design Assessment (PDA): A certificate issued by ABS upon completion of ABS Engineering plan review (to the manufacturer's requested standards and/or ABS Rules and Guides) and survey of prototype testing (as applicable to the product).

Programmable Logic Controller (PLC): An industrial computer control system that continuously monitors the state of input devices and makes decisions based upon a custom program to control the state of output devices.

Prototype Testing: Design validation testing of equipment designs in accordance with the applicable design standard.

Pulsation Dampeners: Chambered device used to dampen pressure pulsations in a fluid flow.

Pup Joint: A shorter-than-standard-length riser joint, tool joint, or drill pipe.

Rams: Mechanical device used for closing, shearing and sealing component of a blowout preventer. One of three types – blind, shear, or pipe – may be installed in several preventers mounted in a stack on top of the wellbore.

Blind Rams: Blind ram ends are not intended to seal against any drill pipe or casing. The rams seal against each other to effectively close the hole.

Shear Rams:

Shear Rams (non-sealing): Closing component in a ram blowout preventer that is capable of shearing or cutting certain tubulars but, does not seal

Blind-shear Rams: Closing and sealing component in a ram blowout preventer that first shears the tubular in the wellbore and then seals off the bore or acts as a blind ram if there is no tubular in the wellbore

Pipe Ram is a sealing component with an indentation and packing for drill pipe, drill collars or casing that closes the annular space between the pipe and the blowout preventer or wellhead. Separate rams are necessary for each size (outside diameter) pipe in use. Pipe rams can include:

Fixed Bore Pipe Ram: Closing and sealing component in a ram blowout preventer that is capable of sealing only specified tubular size.

Variable Bore Pipe Ram: Closing and sealing component in a ram blowout preventer that is capable of sealing on a range of tubular sizes.

Rated Load: The load specified by the manufacturer that the machine/structure is rated to carry. Maximum operating load, both static and dynamic, to be applied to the equipment

Rated Setback Load: The maximum weight of tubular goods which can be supported by the substructure in the setback area.

Rated Working Pressure (RWP) or Maximum Allowable Working (Operating) Pressure (MAWP): The maximum internal pressure the equipment or system is designed to operate or work and to contain and/or control the pressure.

Remotely Operated Vehicle (ROV): An unmanned vehicle for offshore subsea use.

Reels (MUX, Hotline): Large spool and winch system used to store, deploy, and retrieve flexible lines.

Riser Adapter: Crossover between riser and flex/ball joint.

Riser Chute: To guide risers from vertical position at set back area to drill-floor.

Riser Feeding Machine: A machine designed for horizontal transportation of casing, riser/slip joint and material from pipe deck to drill floor and vice versa.

Riser Flood Valve Joint: A special riser joint having a valve which allows the riser annulus to be opened to the sea based on differential pressure.

Riser Joint: A section of riser main tube having flanged connector (or equivalent) ends fitted with a box and pin and including choke, kill and (optional) auxiliary lines, booster lines, and their support brackets.

Riser Recoil System: A means of limiting the upward acceleration of the riser for unplanned disconnect (EDS).

Riser Running/Handling Tool: A device that joins to the upper end of a riser joint to permit the lifting and lowering of the joint and the assembled riser string in the derrick by the elevators.

Riser Spider – Fixed: A device having retractable jaws or dogs used to support the riser string on the uppermost coupling support shoulder during deployment and retrieval of the riser.

Riser Spider – Elevator: Riser spider that is capable of being used as elevators.

Riser Tensioners: Systems for providing and maintaining top tension on the deployed riser string to prevent buckling.

Riser Tensioner Ring: The structural interface of the telescopic joint outer barrel and the riser tensioners. The tensioner ring may be an integral part of the telescopic joint (slip joint).

Rotary Hose (also known as Kelly Hose): Flexible hose which conducts high-pressure drilling fluids from the standpipe to the gooseneck/swivel and kelly or top drive.

Rotary Swivel: A device hanging on the traveling hook that allows the drill string to rotate while hanging and provide path for fluids flow.

Rotary Table: A device through which passes the bit and drill string and that transmits rotational action to the kelly.

Rupture (or Bursting) Disc: A device designed to rupture or burst and relieve pressure at a defined pressure and rate. The device will not close after being activated.

Safe Working Load (SWL): The maximum rated load within the equipment rated capacity for the given operating conditions.

Safety Factor: The relationship between maximum allowable stress level and a defined material property, normally specified minimum yield strength.

Safety System – Equipment: A system designed to automatically lead equipment being controlled to a predetermined less critical condition in response to a fault which may endanger the equipment or the safety of personnel and which may develop too fast to allow manual intervention.

Service Temperature (ABS MODU Rules): The service temperature of the unit refers to the minimum temperature of the steel in all modes of operation and is to be taken as the lowest mean daily average air temperature based on available meteorological data for anticipated areas of operation.

Shale Shaker: Any of several mechanical devices utilizing screens and vibration that remove cuttings and other large solids from drilling fluid.

Shear Rams: See “Rams”.

Sheaves: Grooved pulley for use with wire rope.

Shut-in: A condition resulting from a shutting-in of the wellbore caused by the occurrence of one or more undesirable events and/or actions of the safety shutdown.

Shutdown: A system action that will be initiated upon signal or failure and is to result in shutdown of systems, subsystems, equipment, component, or part of the facility.

Skid: A steel frame on which equipment is mounted to facilitate handling.

Slip Critical Connection: A bolted structural steel connection which relies on friction between the two connected elements rather than bolt shear or bolt bearing to join two structural elements.

Sour Service: Exposure to environments that contain H₂S and can cause cracking of materials by the mechanisms addressed in NACE MR0175/ISO 15156.

Structural Load-bearing Component: Components supporting loads due to hoisting, lifting, handling, or self/assembled weight, etc.

Primary Structural Load-bearing Component: Component that is necessary to maintain stability of a structure and that resides within the primary load path of the structure when the structure is loaded. Failure of primary structural load bearing components may cause significant structural damage to the unit.

Subsystem: An assembly of interconnected or interrelated parts that performs tasks as a component as a subset of a system.

System: An assembly of various subsystems and equipment, including all associated hardware and software, combined into a unified whole.

Supplier: Manufacturer of components and subsystems that form part of a complete system.

Surveyor: ABS’s representative on location to perform examination or inspection activities.

Survival Condition: Condition during which a unit may be subjected to the most severe environmental loading for which the unit is designed. Drilling or similar operations may have been discontinued due to the severity of the environmental loading. The unit may be either afloat or supported on the sea bed, as applicable.

Telescopic Joint (Slip Joint): A riser joint having an inner barrel and an outer barrel with sealing means between. The inner and outer barrels of the telescopic joint move relative to each other to compensate for the required change in the length of the riser string as the vessel moves due to marine environment.

Tensioning System: Systems for providing and maintaining tension on the deployed equipment.

Test Pressure: The pressure at which the component or system is tested to verify structural and pressure integrity.

Test Stump: Stump with wellhead profile used to support the BOP during surface pressure test operations. Also used during BOP storage.

Threaded Fasteners: Includes all-thread studs, tap-end studs, double-ended studs, headed bolts, cap screws, screws, and nuts.

Tongs (Power or Manual): Automated or manual tongs used to torque drill pipe to final torque or to break out pipe connections.

Top Drive: A top drive is either a power swivel or a power sub, typically with integrated pipe handling and hoisting capabilities below the drive. The pipe handler may comprise an elevator, elevator links, link tilt system and a pipe gripper mechanism to assist in making and breaking connections.

Transit Conditions: All unit movements from one geographical location to another.

Traveling Block: Set of sheaves which move up and down in the derrick as drilling line is paid out or taken in.

Trip: The operation of hoisting the drill string from and returning it to the wellbore.

Trip Tank: Small mud tank used to keep track of the volume of mud displaced by the drill string during “trip in” and “trip out”.

Tubulars: Tubular goods can be tubing, casing, drill pipe, and line pipe.

Tubular Horizontal Transporter/Tubular chute: A machine designed for horizontal transportation of tubulars and materials from pipe deck to drill floor and vice versa.

Type Approval: See Appendix 1-1-A2 of the *ABS Rules for Conditions of Classification – Offshore Units and Structures (Part 1)*.

Umbilical: A control hose bundle or electrical cable that runs from the reel on the surface to the subsea control pod on the LMRP.

Uninterruptible Power Supply (UPS): Device supplying output power in some limited time period after loss of input power with no interruption of the output power.

Unit Certification: Unit certification includes a technical review and survey during fabrication of individual systems, subsystems, equipment, components, and materials for compliance with ABS Rules, Guides, or other recognized codes and standards. This allows these items to be placed on a vessel, marine structure or system to become eligible for classification

Unsafe Situation: An event or situation that would cause damage to Life, Property, or Natural Environment.

Upset Condition: A condition that occurs in a system, subsystem, equipment or component when an operating variable deviates substantially from its normal operating limits. If left unchecked, this condition will result in a threat to safety, or undesirable events, and may cause shutting-in of system, subsystems, equipment or component.

Utility Systems: Various systems providing the supporting functions to the drilling operations. Typical utility systems are cooling water, hot oil for heating, chemical systems for injection, hydraulic, potable water, nitrogen generation and system, instrument air and power generation system, etc.

Vibratory Hose: A flexible hose assembly used to convey high-pressure drilling liquids between two piping systems or between the mud-pump discharge outlet and the high-pressure mud piping system for the purpose of attenuating noise and/or vibration, or compensating for misalignment and/or thermal expansion.

Wellhead Connector: Hydraulic connector used to securely latch the lower BOP stack to the wellhead.

Wire Rope: Cable composed of steel wires twisted around a central core of wire or fiber.

Wireline Spoolers: System consisting of a drum, motor and control system used for running or retrieving wireline. Often skid-mounted, may be electrically, pneumatically or hydraulically operated.



CHAPTER 1 Scope and Conditions of Classification

SECTION 8 Acronyms and Abbreviations

The following acronyms and abbreviations are used in this Guide

AHC	Active Heave Compensation
BHA	Bottom Hole Assembly
BOP	Blowout Preventer
COC	Certificate of Conformity
CTOD	Crack-tip Opening Displacement
CTU	Conductor Tensioning Unit
CVN	Charpy V-Notch
DCS	Distributed Control System
DN	Diameter Nominal
DSC	Drilling System- Conditioning
DSD	Drilling System- Derrick
DSP	Drilling System- Pipe handling
EDS	Emergency Disconnect System
ESD	Emergency Shutdown
FAT	Factory Acceptance Testing
FMEA	Failure Modes and Effects Analysis
FMECA	Failure Modes, Effects and Criticality Analysis
GA	General Arrangement
H ₂ S	Hydrogen Sulfide
HAZ	Heat-Affected Zone
HAZID	Hazard Identification
HAZOP	Hazard and Operability
HP	High Pressure
HPHT	High-Pressure High-Temperature
I/O	Input/Output
IBOP	Inside Blowout Preventer
IRC	Independent Review Certificate
ITP	Inspection and Test Plans
LEL	Lower Explosive Limits

LMRP	Lower Marine Riser Package
LP	Liquid Penetrant Examination
MAC	Manufacturer's Affidavit of Compliance
MASP	Maximum Anticipated Surface Pressure
MAWP	Maximum Allowable Working (Operating) Pressure
MCOC	A Certificate of Compliance issued by the Manufacturer
MDST	Minimum Design Service Temperature
MGS	Mud-Gas Separator
MLP	Mud Lift Pumps
MRL	Mud Return Line
MRN	Maintenance Release Note
MT	Magnetic Particle Examination
MTR	Material Test Report
MUX	Multiplex Systems
NCR	Non-Conformance Report
NDE	Nondestructive Examination
NDT	Nil Ductility Transition
NPS	Nominal Pipe Size
NPT	National Pipe Thread Tapered Thread
NRV	Non-Return Valve
OEM	Original Equipment Manufacturer
P&ID	Piping and Instrumentation Diagram
PDA	Product Design Assessment
PFA	Process Hazards Analysis
PHC	Passive Heave Compensation
PLC	Programmable Logic Controller
PM	Preventive Maintenance
PO	Purchase Order
PoC	Point of Contact
PPM	Parts per Million
PQR	Procedure Qualification Record
PT	Dye Penetrant Examination
PVT	Pit Volume totalizer
ROV	Remotely Operated Vehicles
RQS	Recognized Quality Systems
RT	Radiographic Examination
RWP	Rated Working Pressure
SBP	Surface-applied Back Pressure

SG	Specific Gravity
SIT	System Integration Test
SMYS	Specified Minimum Yield Strength
SR	Survey Report
SSL	Structural Safety Level
SWL	Safe Working Load
TA	Type Approval
UPS	Uninterruptible Power Supply
UT	Ultrasonic Examination
UTS	Ultimate Tensile Strength
VIV	Vortex-Induced Vibration
WCS	Well Control System
WP	Working Pressure
WPS	Weld Procedure Specification



CHAPTER 2 Drilling Systems

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CHAPTER 2 Drilling Systems

SECTION 1 General

1 General

The designer of a drilling system is to evaluate the system as a whole, considering the interfacing and interdependence of subsystem equipment and controls. The required design plans and data to be submitted for ABS design review and approval related to the drilling systems, subsystems, equipment, and/or components are listed in 3-2/Tables 1, 3, 5, 7, 9 and Appendix 7 of this Guide.

Well Test systems are not covered under this Guide. For Well Test system requirements, refer to 4-1-1/7.13 of the *MODU Rules* and the *ABS Guide for Well Test Systems*. Drilling systems consist of multiple subsystems designed for well construction operations.

This Guide provides detailed procedures for ABS approval of drilling systems, subsystems, equipment, and/or components for Classification of a drilling system.

The following general items are required to be addressed in the Drilling Systems Classification process:

- i) The drilling system, subsystems, equipment, and/or components are to be designed and manufactured in compliance with the applicable recognized codes and standards, as listed in Appendix 1, and the additional requirements specified in this Guide.
- ii) Where a certain aspect of the design is not in compliance with the recognized code, standard or the requirements of this Guide, the specific variations are to be advised and justified and will be specially considered by ABS in accordance with Chapter 1, Section 5 of this Guide, on a case-by-case basis.
- iii) ABS approval requirements for typical drilling systems, subsystems, equipment, and/or components are outlined in Chapter 3, Section 1 and 3-2/Tables 1 through 10 of this Guide.
- iv) Pressure vessels, piping, valves, fittings, electrical systems, control systems, material, welding and NDE associated with equipment and systems for CDS Class are required to be in accordance with the applicable sections of this Guide unless alternate requirements are provided.

3 Equipment Layout

Equipment layout and work areas associated with the drilling activities are to be arranged with the following objectives:

- i) Safety of personnel
- ii) Separation of nonhazardous areas from those classified as hazardous areas
- iii) Separation of fuel and ignition source as far as practical
- iv) Prevention and mitigation of uncontrollable releases of hydrocarbons
- v) Prevention and mitigation of spills and the spread of flammable liquids and gases which may result in a hazardous event
- vi) Control of potential sources of ignition
- vii) Prevention and mitigation of fire and explosions
- viii) Providing for adequate arrangements for escape and evacuation

- ix) Facilitating effective emergency response
- x) Prevention of dropped object hazards to personnel and assets
- xi) Protection of equipment and components from physical damages, such as:
 - Electrical cables and cableways
 - Well control equipment
 - Exhaust ducting and air intake ducting
 - Control and shutdown systems
 - Fire/gas detection, and fire-fighting equipment
- xii) Provisions for safe access for maintenance and inspection
- xiii) Hazardous areas and associated electrical installations are to be in compliance with the *MODU Rules*. Combustion equipment and combustion engines are not to be located in hazardous areas unless the equipment and engines are designed and rated to operate in hazardous areas.
- xiv) Arrangement drawings are to show the location of all equipment in hazardous areas and systems, controls and equipment relative to the location of living quarters, all machinery spaces, tanks, derrick, wellheads/moon pool, flare and vents, escape route, evacuation equipment, air intake, opening to close spaces, and any fire and barrier walls.
- xv) Prevention of collision between equipment, structures and personnel. Layout of equipment is to consider the static and operating footprints for potential collisions between equipment, personnel and structures. Collision avoidance systems and/or devices are to be incorporated into designs, as applicable.

5 Over Pressurization Protection

Systems, subsystems, equipment, and/or components that may have the potential of exposure to pressure greater than for which they are designed are to be protected by suitable pressure protection devices. Pressure regulators are not to be used as a substitute for pressure relief devices.

It is to be the responsibility of the systems and equipment designers to specify and consider the most severe combination of pressure sources, such as formation pressure, pumps, flow restriction, static heads, hammer effects, fire and/or thermally-induced pressures, in the design and selection of suitable overpressure protection devices. Pressure relief devices will be reviewed for the applicable design parameters, as specified in this Guide.

7 Materials

The materials for each equipment or component are to be selected with consideration of their fitness for the intended service and in accordance with the applicable codes and standards as referenced in Appendix 1, in addition to the material requirements of Chapter 5 of this Guide.

Engineering design material specifications that demonstrate compliance with the applicable design standards are to be submitted with the design package for each system/component in both structure and pressure related systems.

9 Welding and Nondestructive Examination

General requirements for welding and nondestructive examination (NDE) are to be in accordance with Chapter 6 of this Guide.

11 Platforms and Railings

It is to be noted that various national and international regulatory bodies have requirements for the loading, arrangement and construction of local structures such as walking/working platforms, guardrails, handrails, ladders, stairs and walkways. It is the designer's responsibility to be in compliance with the applicable regulatory requirements and the design loads as given below, as applicable. Drawings are to be submitted for working platforms and storage areas. For general traffic areas, manufacturer's affidavit of compliance is sufficient for submittal.

The following are the minimum vertical live loads that are to be considered in the design of walkways:

- General Traffic Areas – $4,500 \text{ N/m}^2$ (94 psf)
- Working Platforms – $9,000 \text{ N/m}^2$ (188 psf)
- Storage Areas – $13,000 \text{ N/m}^2$ (272 psf)



CHAPTER 2 Drilling Systems

SECTION 2 Design Specifications

1 Design Specifications

The design specification for drilling systems, subsystems, equipment and/or components is to consider as a minimum, but not limited to, the most adverse combination of applicable loads listed in 2-2/3.3 and consisting of design plans, drawings, data, and calculations, as outlined in Appendix 7 of this Guide, to substantiate the design. The design specifications are to include material specifications, welding specifications, NDE procedures, and testing procedures/specifications utilized in the manufacturing, installation, and commissioning of each system, subsystem, equipment, and/or component and are to comply with the applicable section of this Guide, in addition to the codes or standards used.

1.1 Recognized Standards

The submitted design is to be in accordance with the requirements of this Guide and the latest edition of the specified codes and standards, as referenced herein and in Appendix 1 of this Guide, from contract date (see 1-1-3/1.3 of the *MODU Rules*).

- i) Design complying with other international or national standards not listed in Appendix 1 will be subject to special consideration in accordance with Chapter 1, Section 5 of this Guide.
- ii) ABS advises the designer/manufacturer to contact the ABS Technical office early in the design phase for acceptance of alternate design codes and standards.
- iii) When alternate design codes and standards are proposed, justifications can be achieved through equivalency, gap analysis or appropriate risk analysis/philosophy to demonstrate that the proposed alternate design code and standard will provide an equivalent level of safety to the recognized standards as listed in this Guide, and are required to be performed in accordance with Chapter 1, Section 5 of this Guide.

1.3 Alternative Basis of Design

Designs based on manufacturers' standards may also be accepted. In such cases, complete details of the manufacturer's standard and engineering justification are to be submitted for review.

- i) The manufacturer will be required to demonstrate by way of testing or analysis that the design criteria employed results in a level of safety consistent with that of a recognized standard or code of practice.
- ii) Where strain gauge testing, fracture analysis, proof testing or similar procedures form a part of the manufacturer's design criteria, the procedure and results are to be submitted for ABS review.
- iii) Historical performance data for drilling systems, subsystems, equipment or components is to be submitted for justification of designs based on manufacturers' standards.
- iv) ABS will consider the application of risk evaluations for alternative or novel features for the basis of design in accordance with Chapter 1, Section 5 of this Guide, as applicable.

3 Design Considerations

In addition to the codes and standards listed in 2-2/1.1 the following additional requirements are to be complied with:

3.1 Corrosion/Erosion Allowance

Where drilling systems (including piping systems), subsystems, equipment, and/or components are subjected to a corrosive, erosive or abrasive environment, the design is to include allowances for such extra material as applicable in accordance with the requirements as specified below:

- i) Corrosion/erosion allowance is to be defined as specified by the applicable design codes and standards.
- ii) Alternative allowances will be considered when supplemented with technical justifications for the life-cycle of the equipment, such as:
 - a) Previous documented service experience
 - b) Active corrosion protection and maintenance, such as galvanizing, anodes, etc.
 - c) Passive corrosion protection and maintenance, such as special coating, etc.
- iii) In the absence of 2-2/3.1i) through 2-2/3.1iii) above, a minimum corrosion/erosion allowance of 1.6 mm (0.0625 in.) is to be utilized.

3.3 Design Conditions

The drilling systems, subsystems, equipment, and/or components are to be designed to account for all applicable environmental, operational, test loads, or combination thereof. These include, but are not limited to, the following:

- i) Environmental Conditions, as applicable
 - a) Earthquake
 - b) Ice
 - c) Current, waves
 - d) Wind
 - e) Temperature
 - f) Storm events as per the *MODU Rules* for operating, standby and survival conditions
- ii) Operational
 - a) Static pressure
 - b) Transient pressure excursion
 - c) Temperature excursion
 - d) Tension
 - e) Bending
 - f) Vibration
 - g) Acceleration loads due to movement of the drilling unit
 - h) Deployment and retrieval
- iii) Hang off and Drifting
- iv) Transportation
- v) Installation
- vi) Commissioning

- vii) Storage and Maintenance
- viii) Test Loads
- ix) MODU inclination

3.5 Risk Assessments for Drilling System Design

A risk assessment for the integrated drilling system and individual systems, subsystems, and equipment is to be performed as listed below. These assessments are to be performed sequentially, starting with the identification of hazards for the overall design, and focusing to detailed risk studies driven by the findings of the previous studies, as necessary

3.5.1 Levels of Risk Assessment

Three (3) levels of risk assessments are to be performed, as applicable:

- Integrated Drilling System Risk Assessment
- Functional FMEA/FMECA
- Component level FMEA/FMECA (Only if required by the results of functional FMEA)

3.5.1(a) Integrated Drilling System Risk Assessment. An integrated drilling system risk assessment is to be conducted using a qualitative hazard identification technique such as HAZID, HAZOP, What-If or similar and submitted for review. The purpose of the risk assessment is to identify the major hazards to people, environment and equipment associated with the drilling systems/drilling plant and its integration to verify the adequacy of the risk control measures for various modes of operations. The most commonly applied technique is the HAZID and the study involves systems designers, systems integrators and equipment manufacturers/vendors. It is the responsibility of the contracting party to coordinate the process and the submittal of the required information.

The HAZID study is to focus on identifying hazardous situations originating from:

- i) Arrangement, location and general layout of different drilling systems, subsystem and equipment.
- ii) Integration and interactions between the different drilling systems, subsystems and equipment.
- iii) Interfaces with drilling support systems, utilities and marine systems.
- iv) Various operating modes.

7/1.12 of the *ABS Guidance Notes on Failure Mode and Effect Analysis (FMEA) for Classification (FMEA Guidance Notes)* provides detailed steps for carrying out the integrated drilling system risk assessment.

3.5.1(b) Functional and Component-level Failure Mode and Effect Analysis/Failure Modes, Effects and Criticality (FMEA/FMECA). The purpose of an FMEA is to verify that the individual drilling systems, subsystems and equipment comply with the following design philosophy:

- No single failure will lead to a hazardous situation to people, environment or equipment, and
- That there are at least two means of protection in place to prevent the hazardous event.

A functional FMEA/FMECA is to be conducted for individual systems, subsystems and their associated control systems and submitted for review. Based on the results of functional FMEA/FMECA, a component level FMEA/FMECA may be deemed necessary to be performed for the critical components as identified during the functional FMEA/FMECA.

If component level FMEA/FMECA is required, the results of the component level FMEA/FMECA is to correlate to the functional FMEA/FMECA to provide an overall understanding of the local effects of the equipment failure mode and 'global' effects of the failure of the control/safety function and other equipment/interfaces in the system.

For certain simple systems, standard engineering methods may suffice to demonstrate compliance with the stated design philosophy. Such simple systems may be exempt from a FMEA study and typically refer to those systems for which the following statements hold true:

- Manual control only – could be hydraulic, pneumatic, electrical, etc. (e.g., on/off switches, manual lever)
- Do not have any PLC or computerized control system
- Control function cannot be altered by operator
- Go mechanically to safe state in all failure modes
- Failure of control will not impact other systems
- System will not be impacted by other system failure

A FMEA/FMECA Validation Program and related test procedures are to be developed and submitted for review. The purpose of the FMEA/FMECA Validation Program is to verify critical and selected results (that are not already covered by FAT and SIT procedures) from the FMEA.

The specific goals of the tests are to validate the:

- Effectiveness of system to identify failures
- Effect of identified failures on system/equipment
- Response of safety controls
- Other measures to protect against failure

Validation tests are to be carried out during factory acceptance testing and/or as part of the on board commissioning of the integrated systems in accordance with the approved program and verified by the attending Surveyor.

When final testing requires assembly and installation on-board the facility, it may not be possible to perform all required testing at vendor's plant. In this case, FMEA/FMECA Validation testing is to be carried out as part of the system integration testing (SIT) during commissioning. Any modifications made to the Validation test plan are to be submitted for review.

7/1.11 of the *FMEA Guidance Notes* provides detailed steps for the FMEA/FMECA and FMEA Validation Program.

3.5.2 Maintenance of Risk Assessment

Risk study results are to be maintained by the Owner of the drilling unit. If any subsequent modifications to the classed drilling system, subsystems, equipment or components are carried out, relevant risk studies are to be updated to incorporate the modifications; and to demonstrate that any hazards derived from the modifications have been mitigated, as applicable.



CHAPTER 2 Drilling Systems

SECTION 3 Well Control Systems (WCS)

1 General

The **WCS** notation comprises classification of the following systems including their subsystems, equipment, components, and associated control system:

- i) Sub-sea BOP stack:
 - Lower BOP stack
 - Lower Marine Riser (LMRP)
 - Blowout Preventers (BOPs)
- ii) Surface BOP stack (only for surface installations)
- iii) Marine Drilling Risers including Riser Tensioning
- iv) Diverter System
- v) Choke & Kill System including Mud Gas Separator
- vi) Kill/Cement Unit
- vii) Secondary Well Control Systems:
 - Acoustic
 - ROV Interface
- viii) Emergency Well Control Systems:
 - Deadman
 - Autoshear
 - Emergency Disconnect System (EDS)
- ix) Auxiliary Well Control System

The well control systems, equipment, and/or components are to be in compliance with the API standards indicated in 2-3/Table 1, and the additional requirements of this Guide.

TABLE 1
Well Control System (WCS)

<i>Description</i>	<i>Standards (as applicable)</i>
Blowout Preventer (BOP) System and Equipment	API 16A, 16D, 53, 59
Lower Marine Riser Package (LMRP)	API 16A, 16D, 16F, 16R, 16Q
Choke and Kill System and Equipment	API 16C, 6A, 16F, 53
Diverter System and Equipment	API 16D, 53, 64
Marine Drilling Riser System	API 16F, 16R, 16Q
Auxiliary Well Control Equipment	API 53, 7-1, 7G