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Guidelines for the Selection and Operation of Jack-ups in the Marine Renewable Energy Industry

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Industry guidance aimed at jack-up owners operators, developers and contractors engaged in site-investigation, construction, operation and maintenance of offshore wind and marine energy installations.

Acknowledgements

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Status of this Document

RenewableUK Health and Safety Guidelines are intended to provide information on particular technical, legal or policy issues relevant to the core membership base of RenewableUK. Their objective is to provide industry-specific guidance, for example where current information could be considered absent or incomplete. Health and Safety Guidelines are likely to be subject to review and updating, and so the latest version of the guidelines must be referred to. Attention is also drawn to the disclaimer below.

Disclaimer

Document Control Log

Issue 1: 2009—Original document
Issue 2: 2013—Full technical and regulatory update

Preface

The publication of Version 2 of these guidelines recognises not only the growth of the offshore wind and marine sector, but also the importance RenewableUK, its members and stakeholder partners give to Health and Safety matters.

The original guidelines were published in 2009 and appear to have been well received by all key participants in the sector. While the overall scope and content remain relevant, it is important that the guidelines are kept up to date to take account of changes in legislation and standards, as well as developing experiences within the sector. In particular the revisions have aimed to take account of:

- Progress and experience gained through the consenting and early development phases of Round 3 projects;
- Experience and knowledge gained through using and referencing the original guidelines, especially in light of the significant increase in installed offshore wind capacity;
- Increasing experience with wave and tidal projects and how to take into account the specific risks that may be encountered when selecting and using jack-up barges;
- New industry guidance that has been issued, including guidance on Offshore Wind and Marine Health and Safety and Vessel Safety;
- Lessons learned based on incidents and near misses experienced by developers and vessel operators;
- Changes to applicable regulatory requirements, including for example The Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Order 2013;
- Relevant standards (e.g. ISO) that have been amended or have replaced previous versions, with particular reference to replacement of SNAME TR5-5A by ISO 19905-1: 2012; and
- How marine technology and the operational use of jack-ups has developed rapidly in recent years (e.g. use of Dynamically Positioning (DP) capability on jack-ups).

Version 2 – 2013: List Of Principal Revisions To Version 1

Throughout this document the publication referred to in Version 1 describing the procedure to be followed for carrying out site-specific assessments for jack-ups, SNAME TR5-5A, including the recommended practice, has been replaced by ISO 19905-1: 2012. Current site-specific assessments for jack-ups that have been carried out in accordance with SNAME TR5-5A will continue to be deemed satisfactory; however, jack-up operators are encouraged to carry out future assessments in accordance with the latest international standard.

1. Introduction

Emphasis has been added to confirm that these guidelines apply to jack-ups of all types and sizes, whether self-propelled or non-propelled, manned or unmanned.

2. Legislation and guidelines

Reference to the CDM regulations and to the recent extension of the HSWA to construction and maintenance activities within the Renewable Energy Zone outside Great Britain has been added. The requirement to comply with site-specific rules and guidelines issued by site owners/operators and contractors has also been added.

3. Management and manning

Reference to the IMO Special Purpose Ships (SPS) Code has been added. The section on jack-up manning has been expanded with additional guidance on training and qualifications. A recommendation for the provision of two jacking engineers in circumstances likely to involve frequent or prolonged jacking operations has also been added.

4. Planning jack-up operations

Reference to the guidance under development by the Society for Underwater Technologies (SUT) has been included to emphasise the need for competently planned site investigations. The requirement to plan site layouts having due consideration for the requirement to deploy jack-ups, not only during construction, but also throughout the life cycle of the project has also been emphasised. A visual aid has been added illustrating the type of information that should be exchanged between the site operator and the jack up owner/operator in the interests of competent planning.

5. Weather-restricted and unrestricted operations

Guidance on the conduct of Weather-restricted operations has been clarified, and visual aids have been added.

6. Floating condition – motions and stability

Reference to Det Norske Veritas AS – Offshore Standard Marine Operations, General, DNV-OS-H101, or similar standards for the assessment of adequate weather windows for jack-up transit, has been added.

7. Grillage, sea fastenings and cargo design

Minor text revisions and corrections have been made.

8. Site data required for jack-up site-specific assessments

The basic requirements of site investigation for jack-up site-specific assessment remain unchanged; however, the requirements for geophysical survey and soil investigation have been revised in recognition of recent advances in site investigation and assessment technology.

9. Jack-up foundation (soils) assessment

Guidance on jack-up foundation assessment has been revised. Advice on the assessment of punch-through risk has been added, plus a visual aid illustrating the potential consequence of scour in layered soil conditions. Advice has been added to stress the importance of maintaining accurate site records of jack-up leg coordinates and leg penetrations achieved in order to improve future geotechnical assessments and to reduce the scope of subsequent analysis and/or eliminate the need to repeat time-consuming site-specific assessments for jack-ups throughout the life cycle of the project.

10. Elevated operations

The requirement for site-specific assessment has been revised in line with ISO 19905-1, and a visual aid illustrating the assessment process has been added.

11. Self-propelled and propulsion-assisted jack-ups

The required propulsion force for self-propelled jack-ups has been revised to clarify that the recommended environmental criteria applied to determine the required force for unrestricted transit does not apply to weather-restricted transit. Guidance on dynamic positioning has been revised, and reference to IMCA guidance on DP jack-up operations has been added.

12. Non-propelled jack-ups

Minor text revisions and corrections have been implemented.

13. Towing vessels

Minor text revisions and corrections have been implemented.

14. Moorings for positioning

A requirement to obtain written authority from the owners/operators of offshore oil and gas installations and subsea pipelines or cables prior to moving or deploying anchors in the vicinity of such installations has been added together with a caution that oil and gas facility operators may stipulate more-stringent exclusion zones than those recommended in this document. Guidance on suitable mooring arrangements for positioning jack-ups has been revised and visual aids have been added.

15. Lifting and load transfer

A requirement for the production of inspection reports and certificates for blocks, hooks and wires has been added. Guidance has been added to clarify that the limiting wind speed for the jack-up elevated operating mode and the limiting wind speed set by the crane manufacturer are separate and distinct, and neither limit shall be exceeded during lifting operations.

16. Crew transfer

Emphasis on the use of vertical ladders for access only as a last resort has been added. The development of new systems involving new equipment and new methods for personnel transfer that provide an equivalent or greater level of safety has been recognised. Reference to guidance on transfer of personnel by helicopter has been added. Reference to HSE and BS standards for gangways and ladders has been added.

17. Marine control for jack-up operations

Marine Traffic Controller has been replaced by Marine Coordinator in recognition of current practice.

18. Conduct of jack-up operations

Guidance for jack-ups fitted with truss-type legs on the monitoring of leg RPD at locations prone to scour has been added.

19. Emergencies and contingencies

Guidance on emergency response plans, together with a visual aid, has been added, and reference to the emergency-specific flowcharts contained in RenewableUK Guidelines for H&S Appendix 1 is included.

20. Hazard identification and risk assessment

A new section on hazard identification and risk assessment has been added.

Appendices

Appendices have been updated.

Contents

Appendices

1 Introduction

1.1 Instructions

1.1.1 This document has been prepared by London Offshore Consultants Limited for RenewableUK following various discussions with HSE and consultations with others involved with the jack-up industry. The report provides guidelines on the safety and integrity of jack-ups deployed in the marine renewable energy industry.

1.2 Nature of the guidelines

1.2.1 This guidance is intended to be relevant to all organisations contributing to the operation of jack-ups, but it is particularly relevant to jack-up owners'/operators' technical staff and crews responsible for the operation of jack-ups, and to project managers in the marine renewable energy industry.

1.2.2 This document does not include guidance on the assessment or management of generic workplace hazards or marine safety matters that are common to all marine vessels, except where such matters relate specifically to jack-ups and jack-up operations.

1.2.3 These guidelines apply to jack-ups of all types. For the purpose of these guidelines a jack-up is defined as any non-propelled or self-propelled marine vessel that is fitted with legs and a jacking system that provides the vessel with the capability to elevate the hull above the surface of the sea. Other industry terms used to identify jack-ups are Mobile Offshore Units (MOUs), Self elevating Platforms (SEPs) and Lift Boats.

1.2.4 These guidelines have been drawn up with care to address what are likely to be the main concerns based on the experience of the Working Group and others. This should not be taken to mean that this document deals comprehensively with all of the concerns that will need to be addressed or even, where a particular matter is addressed, that this document sets out the definitive recommendations to be followed for all situations.

1.2.5 This guidance is based upon the assumption that the user is familiar with the fundamental aspects of the marine operation of jack-ups. Parts of this document require knowledge and understanding of the engineering principles that govern jack-up design and operation. Those less familiar with jack-ups may find it useful in the first instance to acquire a basic understanding of the different types of jack-ups and the risks associated with their various operating modes through study of background reference material listed in Appendix A.

1.2.6 This document should be treated as providing guidelines for good industry practice to be followed for the selection and operation of jack-ups. The guidelines contained in this document should be reviewed in each particular case by persons responsible, to ensure that the particular circumstance is addressed in a way that is adequate and appropriate.

1.2.7 Nothing contained in these guidelines shall relieve the jack-up owners/operators, managers, or masters and crews of their responsibility for exercising sound judgement based on education, training and experience.

1.2.8 These guidelines are not intended to exclude alternative methods, new technology or new equipment, which may provide an equivalent or greater level of operational safety.

1.2.9 This is a technical guideline document that is based on well-established industry guidelines as listed in Appendix A. The content of this document has been carefully aligned with the contents of published guidelines so as to ensure a consistent approach on technical issues.

1.3 Area of application

1.3.1 These guidelines shall be deemed to apply to all jack-ups operating in the waters adjacent to England, Scotland, Wales and Northern Ireland in the area bounded by Highest Astronomical Tide (HAT) and the seaward limit of UK territorial waters, and to all areas that are located within UK Renewable Energy Zones (REZs) beyond the UK territorial waters seaward limit 12 miles offshore.

2 Legislation and Guidelines

2.1 The RenewableUK Offshore Wind and Marine Energy H&S Guidelines provide a basic introduction to the legislative requirements that govern the operations considered in these guidelines. Particular reference shall be made to:

- The Health and Safety at Work etc. Act 1974 (HSWA)
- The Management of Health and Safety at Work Regulations 1999
- The Construction (Design and Management) Regulations 2007 (CDM)
- Provision and Use of Work Equipment Regulations 1998 (PUWER)
- Lifting Operations and Lifting Equipment Regulations 1998 (LOLER).

2.2 Contractors shall ensure that they fully understand the HSWA Application outside Great Britain Variation Order 2013 (AOGB), which extends the provisions of the HSWA to work activities such as construction, repair and operation of energy structures and related structures within a Renewable Energy Zone.

2.3 In circumstances where an article or regulation does not apply, responsible duty holders should endeavour to work to the same standard that would be expected if they were working at a location where the article or regulation specifically applies.

2.4 Contractors shall ensure that they fully understand and comply with the CDM regulations when operating jack-ups engaged on projects to which these regulations apply. A guide to these regulations is contained in the Approved Codes of Practice (Managing Health and Safety in Construction) (ACoPs). Project managers and vessel managers engaged in offshore construction, maintenance or repair of renewable energy installations shall document the project organisation showing clear lines of communication and reporting between the client, CDM coordinator, designer, principal contractor and sub contractors, and with specific reference to the responsibilities and authority of each party.

2.5 The adoption of codes and standards for the design, construction and operation of jack-ups and attending vessels is governed by marine legislation promulgated by the State in which the vessel is registered (the Flag State). When operating within the United Kingdom Territorial Sea, jack-ups may also be subject to Port State Control.

2.6 The International Labour Organization (ILO) provides comprehensive rights and protection at work for the world's seafarers under the provisions of the Maritime Labour Convention (MLC) 2006. Jack-up owners/operators should be aware of the MLC and should ensure compliance for vessels to which this convention applies; however, this document specifically excludes guidance on the issues covered by the Convention.

2.7 The Maritime and Coastguard Agency (MCA) is the principal government agency responsible for monitoring the implementation of UK marine legislation. In accordance with this legislation, jack-up operators shall arrange to receive Merchant Shipping Notices (MSNs), Marine Guidance Notices (MGNs) and Marine Information Notices (MINs) issued by the MCA, and they shall heed warnings and comply with advice contained therein.

2.8 In addition, jack-ups shall comply with regulations issued by local port or river authorities and harbour masters whenever they are in transit or engaged in elevated operations in waters controlled by such authorities.

2.9 In addition, jack-ups and jack-up operations shall comply with site-specific rules and guidance issued by site owners or operators.

2.10 Jack-ups shall be designed, constructed and operated in compliance with the rules, standards and codes applicable to their flag, type, tonnage, size and manning. These rules have been adopted under the terms of the International Conventions on Maritime Safety and Marine Pollution, and subsequent protocols and amendments as produced by the International Maritime Organization (IMO):

- International Safety Management (ISM) Code 2002
- International Convention on the Safety of Life at Sea (SOLAS) 1974, or with the relevant sections of that Convention that are required under EC Regulation 336/2006 if the jack-up is engaged on a non-international voyage
- International Convention on Load Lines 1966
- Preventing Collisions at Sea Regulations (COLREGs)
- Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 1978
- Prevention of Pollution from Ships (MARPOL) 1973/78
- Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972
- Incidents by Hazardous and Noxious Substances (HNS) Protocol 2000
- Control of Harmful Anti-fouling Systems on Ships (AFS) 2001.

Jack-ups with less than 24 metres load line length shall comply with the requirements of the United Kingdom Brown Code, SCV or MGN 280, or foreign equivalent.

2.11 Jack-up owners/operators should understand the SOLAS definitions of a passenger and a passenger ship, and should be aware of the special regulatory regime that applies to the carriage of passengers. The list above includes the conventions and codes likely to apply to jack-up operations in the area considered; however, this list is not exhaustive. The responsibility for obtaining all relevant IMO documents and any latest amendments rests with the jack-up owner/operator.

2.12 The United Kingdom Health & Safety Executive (HSE) is responsible for enforcing all of the relevant Health and Safety legislation pertaining to work activity in Britain, including work activities on jack-ups operating in UK territorial waters or within the UK Exclusive Economic Zone (EEZ). Therefore, jack-up operators should obtain copies of current HSE Research Reports Information Sheets and Offshore Technology Reports relevant to jack up operations (Appendix A), and should be guided by the advice contained therein.

3 Management and Manning

3.1 Registry and class

3.1.1 Jack-ups should be officially entered on a vessel registry maintained by a recognised maritime nation.

3.1.2 Jack-ups certified to operate only within a specific trading area or within a limiting distance from a safe haven shall operate only within the limits prescribed by their Flag State as stated on the jack-up's registry certificate or certificate of seaworthiness and trading area.

3.1.3 Permanently manned jack-ups fitted with certified accommodation and jack ups exceeding 24 metres in length shall be classed and class-maintained in accordance with the rules of a recognised classification society.

3.1.4 Unmanned jack-ups not fitted with certified accommodation and not exceeding 24 metres in length that are not classed shall be certified in accordance with the MCA Small Commercial Vessel and Pilot Boat (SCV) Code as set out in MGN 280, or certified in accordance with equivalent foreign rules promulgated by the Flag State.

3.1.5 It is recommended that permanently manned jack-ups operating in unrestricted mode are classed by a member of the International Association of Classification Societies (IACS) having established rules and procedures for the classification of jack-up hulls, legs and machinery, including elevating and holding systems. Such Classification Societies can usually be identified through the class notation, which should include the term 'self-elevating' to confirm that the jack-up has been designed, constructed and maintained to operate in both floating and elevated modes.

3.1.6 It is recommended that permanently manned jack-ups fitted with certified accommodation be certified in compliance with the IMO MODU Code or with the IMO SPS Code as directed by the Flag State. In the absence of a MODU, MOU or SPS Certificate, the jack-up should, as a minimum requirement, be provided with a class certificate or statement of facts verifying the provision of adequate safety equipment for the type of vessel and for the number of personnel on board.

3.1.7 It is a fundamental requirement that the jack-up hull, machinery and equipment shall be maintained in satisfactory condition. An adequate inventory of spare parts should be carried on board, and the adequacy of the inventory should be determined by project-specific risk assessment. Particular attention should be paid to the provision of replaceable parts for critical systems, such as the jacking system, power system and propulsion system (if fitted), where failure of such parts could render the systems inoperative or unsafe.

3.1.8 It is recommended that site developers obtain an independent suitability survey or general condition survey prior to hiring a jack-up; however, the type and condition of the vessel can provisionally be assessed by review of the specifications and the registry and class certificates and survey reports (Appendix C). Particular attention should be paid to the valid dates and any outstanding items or recommendations related to the class approval of design, drawings, manuals, materials, fabrication, modification, maintenance, damage or repair as listed on the document attachments.

3.1.9 Outstanding class items or recommendations should be reviewed by a competent person in order to determine whether any listed defect or deficiency could create unusual risk or otherwise adversely affect the proposed operations. The competent person should recommend, where appropriate, that these be rectified before the jack-up is deployed. Particular attention should be paid to the structural strength and watertight integrity of the jack-up, the operability of the jacking system, and the provision of safety equipment.

3.2 Draft and leg-height marks

3.2.1 Draft marks shall be clearly marked on each side of the jack-up hull, at each end, in accordance with the rules contained in the International Convention on Load Lines 1966. Jack-ups exempted under these rules shall carry the same marks.

3.2.2 Leg-height marks shall be clearly marked on each leg at vertical intervals not exceeding one (1) metre. A fixed point at the deck level or on the jack-house or jack-frame top shall be marked as a reference point against which the leg-height marks can be read. The leg-height marks and the fixed reference points should normally be clearly visible from the jacking control position. The provision of mechanical or electronic leg-height measurement systems does not exempt the jack-up from compliance with this requirement.

3.2.3 Where the configuration of the jack-up is such that leg-height marks and reference points cannot be observed from the jacking control position and where no mechanical or electronic leg-height measurement system is fitted at the control position, then trained crew members will be required to relay leg-height information to the jacking engineer during jacking operations.

3.2.4 On jack-ups fitted with tubular truss-type legs, provision shall be made for the measurement of leg rack phase differences on individual leg chords.

3.2.5 For all elevated operations jack-ups should be maintained within the limits for longitudinal and transverse inclinations that are defined in the operating manual. Therefore, jack-ups shall be fitted with inclinometers capable of providing accurate measurement of longitudinal and transverse inclinations to within 0.2 degrees of accuracy or better. These instruments should be calibrated and their accuracy should be verified by observation of hull draft marks whenever the opportunity arises in calm water, for example during port calls. For jack-ups fitted with electronic inclinometers it is recommended that additional calibrated independent bubble-type inclinometers should also be fitted.

3.3 Certification and documentation

3.3.1 Original certificates, documents, publications and drawings listed in Appendix C should be carried on board the jack-up. Certificates for jack-ups not fitted with permanent superstructures, enclosed control rooms or accommodation may be kept on board the towing vessel or at the owner's office, and should be made available for inspection prior to vessel deployment. Holding copies of certificates and documents on board or ashore is a sensible precaution, but presentation of copies should not be accepted as proof of validity.

3.3.2 Every jack-up shall be provided with an operating manual. The operating manual should contain, as a minimum, the information listed in Appendix D of these guidelines.

3.4 Management

3.4.1 Certification or registration of jack-up owners/operators to a standard recognised by the International Organization for Standardization (ISO) is not an absolute requirement; however, in the absence of such accreditation, they should be independently audited to verify that they practise an acceptable standard of management.

3.4.2 Standards of jack-up management that are certified under the provisions of the IMO International Safety Management (ISM) Code will be deemed satisfactory. In the absence of ISM Certification, it shall be demonstrated that the jack-up is managed in accordance with a documented procedure that includes the key requirements of the ISM Code. In all circumstances a Safety Management System that adequately covers the planned and foreseeable vessel-specific and project-specific activities should be in place.

3.4.3 The safe management of jack-ups requires a wide range of technical skills:

- Structural and offshore engineering
- Vessel design and analysis
- Vessel machinery operation, maintenance and repair
- Navigation, seamanship and offshore operations
- Meteorology
- Soil investigation and analysis.

3.4.4 Where technical staff holding the relevant qualification and with the appropriate training and experience are not employed by the jack-up owner/operator then a competent person must be outsourced as appropriate.

3.5 Manning

3.5.1 Jack-ups shall be manned in accordance with the Minimum Safe Manning Certificate, if so certified. Jack-ups less than 24 metres in length shall be manned in accordance with the MCA Small Commercial Vessel and Pilot Boat (SCV) Code as set out in MGN 280 or equivalent foreign rules promulgated by the Flag State.

3.5.2 Whether certified or otherwise, jack-up masters and any licensed person authorised by the master to operate the radio equipment shall demonstrate proficiency in the English language. All emergency and external operating communications shall be conducted in the English language. In addition to the master, a sufficient number of the crew shall be proficient in English so that orders and instructions can be translated swiftly and effectively to non-English-speaking crew members or project personnel. Internal instructions may be conducted in the common language of the crew.

3.5.3 In every case, jack-up owners/operators shall man their vessels with sufficient competent crew to manage the vessels and the marine operations, making proper allowance for rest periods.

3.5.4 The following key positions are typically manned on jack-ups over 24 metres in length:

- Vessel or barge master (offshore installation manager)
- Tow master for transit and positioning (may be covered by (1) above)
- Jacking engineer (may be covered by (1) above, except where (1) is also the tow master). Two jacking engineers will be required in circumstances in which the anticipated durations of the jacking operations and level-monitoring periods do not allow proper rest periods for a single operator
- Engineer, motorman or mechanic
- Electrician (may be covered by (4) above if competent)
- Welder (may be covered by (4) above if competent)
- Crane operator(s) (for units fitted with cranes)
- Boatswain and seamen (number sufficient for the size of the jack-up)
- Deck foreman and riggers (as required for operations)
- Catering crew (as appropriate for the number of persons on board)
- Medic (may be an individual or any trained crewmember assigned to this duty).

3.5.5 The medic (or paramedic) should as a minimum hold a First Aid at Sea Certificate or Medical First Aid Certificate, and in some cases should hold a Proficiency in Medical Care Certificate (or its predecessor, the Ship Captain's Medical Certificate). For jack-ups less than 24 metres in length, reference is requested to refer to the Small Vessel Code MGN 280 Annex 3 page 118. The limitations of the basic training related to these certificates should be recognised, and in some cases a higher qualification will be appropriate. The level of training, proficiency and qualification required in each case should be determined through a risk assessment carried out considering the:

- Number of persons on board
- Proximity to the shore
- Vessel and site equipment's capacity for rapid medivac
- Access by emergency services (including Coastguard helicopter and RNLI)
- Access restrictions imposed by the jack-up configuration, weather or tide.

3.5.6 Masters and crew serving on self-propelled jack-ups shall be in possession of valid Certificates of Competence issued under the provisions of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 1978, as required by the vessel's Safe Manning Certificate, including GMDSS Operator's Certificates and DP Endorsements as appropriate.

3.5.7 Jack-ups operating in the offshore environment are defined as mobile offshore units (MOUs), and recommendations on training of personnel on these units are provided by the IMO in Resolution A.891 (21), which was adopted on 25 November 1999.

3.5.8 IMO Resolution A.891 provides an international standard for training that is aimed at ensuring adequate levels of safety of life and property at sea, and protection of the marine environment that is complementary to that required by the Seafarers' Training, Certification and Watchkeeping (STCW) Code.

3.5.9 The International Jack-up Barge Owners Association (IJUBOA) working with barge operators, other experts and the Maritime Skills Alliance has developed four National Occupational Standards (NOSs) relating specifically to jack-up operations. These have been formally adopted by the UK Commission for Employment and Skills. NOSs have long been established in both the construction and maritime industries as a way of defining clearly what people need to be able to do and what people need to know and understand if they are to do their jobs well.

3.5.10 Notwithstanding the lack of a statutory requirement, it is recommended that, in the absence of STCW 95 certification or relevant training in accordance with IMO Resolution A.891, barge masters serving on unmanned jack-ups not fitted with certified accommodation should, as a minimum, be in possession of the requisite skills and knowledge defined by the NOSs.

3.5.11 Notwithstanding the lack of a statutory requirement, it is recommended that barge masters serving on permanently manned jack-ups fitted with certified accommodation should be in possession of STCW 95 certification or relevant training in accordance with IMO Resolution A.891, or the requisite skills and knowledge defined by the NOSs, and in addition should have received formal training in jack-up operations.

3.5.12 Whether certified or otherwise, the barge master shall, as a minimum, demonstrate a satisfactory level of competence in the areas listed below. Competence may be demonstrated through Certificates of Competence issued under the provisions of STCW 95 or through other certification or accreditation, or in the absence of such documents, through documented work experience and references.

- Applicable laws and regulations

- Vessel management
- Marine operations, equipment and practices
- Marine firefighting
- Operation of survival craft and sea survival
- Pollution prevention
- The GMDSS system and operation of radio equipment
- First aid
- Meteorology for mariners
- Management of barge floating stability and jack-up elevated loads
- Jacking operations and foundation hazards.

As a minimum, they shall also be in possession of:

- GMDSS Radio Operator's Certificate
- Sea survival and firefighting training or Basic Offshore Safety Induction and Emergency Training
- First Aid Certificate (or higher qualification).

3.5.13 There is currently no statutory requirement for certification or training of jacking engineers; however, it is recommended that jacking engineers receive formal training in the marine operation of jack-ups, including the fundamentals of jack-up soil foundations. Most importantly, the jacking system shall be operated only by, or under the supervision of, persons who have been trained to operate the type of system fitted to the jack-up on which they serve.

3.5.14 Crane operators shall be in possession of a Crane Operator's Certificate appropriate for the operation of the equipment installed.

3.5.15 Jack-up marine crew shall be in possession of:

- Valid certificates of training of the type provided in the course of induction for personnel engaged in the offshore oil and gas industry, for example, UK OPITO Basic Offshore Safety Induction and Emergency Training (BOSIET) or similar merchant navy training for seafarers.
- Helicopter Underwater Egress Training (HUET) if serving on a jack-up fitted with a helideck and intending to conduct crew transfer operations by helicopter.
- Valid certificates of medical examination appropriate to service offshore or in the merchant navy (for example: Offshore Medical Certificate of Fitness to Work in the UKCS or ENG-1, or foreign equivalent).

4 Planning Jack-Up Operations

4.1 Planning site investigation for jack-up operations

4.1.1 The development of offshore renewable energy projects has exposed the hazards and uncertainties that ground conditions can present to the jack-up operations that are required for construction and maintenance. The adverse impact of such hazards and uncertainties can only be reduced through competently planned site investigation and expert interpretation of the results.

4.1.2 In response to this challenge, the Society for Underwater Technologies (SUT) Offshore Site Investigation and Geotechnics Committee is in the process of developing a guideline document for the planning and execution of site investigations for renewable energy projects. The draft document is entitled Guidance Notes for the Planning and Execution of Geophysical and Geotechnical Ground Investigations for Offshore Renewable Energy Developments (2nd draft 02/05/13), and the advice contained therein is intended to enable developers to formulate suitable strategies to mitigate the ground condition risks through the appropriate use of investigation methods.

4.2 Project planning

4.2.1 Failure to consider all the site factors likely to have an impact on the installation and operation of jack-ups at the earliest stages of project planning may severely limit the type and number of suitable jack-ups for construction and subsequent maintenance.

4.2.2 Project planning should include a competent assessment of, not only the environmental, geophysical and geotechnical conditions existing at the site, but also the layout of fixed structures, subsea cables and scour protection materials, which, if poorly planned, may prevent or hamper jack-up access and egress, and may severely limit the seabed area available for installation of jack ups throughout the life cycle of the project.

4.3 Suitability of the jack-up

4.3.1 The design of site-specific specialist structures and construction planning for the installation of these structures is a separate activity, which may form the basis of jack-up selection. This will usually predate the selection of the jack-up; however, it should be recognised that construction planning may be influenced by the type and capacity of jack-ups likely to be available at the time the plans are to be executed.

4.3.2 The suitability of a jack-up for a particular operation can only be determined if the objectives to be achieved and the operations necessary to achieve the objectives are thoroughly understood. Based on this understanding, the jack up type and operating limits must be assessed against the conditions likely to be encountered on the intended transit route and at the selected work site, in order to determine whether the jack-up is capable of undertaking the required operations safely and efficiently.

4.3.3 Jack-ups are not designed, constructed or intended for unlimited service at sea. Each stage of the proposed operations must be considered separately because different limiting environmental criteria will apply to each sequential jack-up operating mode. Jack-up operations can typically be divided into the following stages:

- Mobilisation
- Load-out
- Transit (including jacking down and refloating)
- Positioning (including jacking up and preloading)
- Elevated operations (including lifting and load transfer operations)
- Elevated storm-survival condition.

4.3.4 The suitability of a jack-up for transit will depend upon the characteristics of the sea route and the unit's seaworthiness and seakeeping capability. The suitability of a jack-up for elevated operations at any location is determined by a site-specific assessment. This assessment is a study of environmental, bathymetric and seabed soils data relevant to that location, together with a leg-footing penetration analysis and a structural assessment of the rig itself, to determine whether the unit is capable of:

- Avoiding contact with seabed obstructions or debris
- Maintaining adequate clearances between the leg footings and site installations such as surface and subsea structures, pipelines, cables, scour protection materials and port facilities
- Achieving a stable foundation in the seabed soils
- Elevating high enough to stand above the predicted extreme wave crests with an adequate safety margin and reserve leg-length
- Withstanding the static and dynamic loads imposed upon it when elevated
- Safely extracting the legs from the soil on removal from the location.

4.3.5 Preliminary site assessments based solely on information related to the site water depth and the jack-up leg-length might serve to exclude some units from consideration for proposed works at an early stage. Similarly, preliminary assessments based solely on nomograms may be useful at the tendering stage, but these should be treated with caution because they may use safety factors less than those associated with ISO 19905-1 and are usually based on assumed parameters that do not match those at the site.

4.3.6 It is stressed that the suitability of any jack-up for elevation and for the performance of the necessary elevated operations on site can only be properly judged by means of a site-specific assessment carried out in accordance with ISO 19905-1.

4.3.7 The fundamental suitability of a jack-up should be established prior to planning or executing jack-up operations. Outline guidance on suitability is included in Appendix I.

4.4 Requirement for planning

4.4.1 Jack-up transit, positioning and elevated operations should be planned in accordance with the provisions described in these guidelines. The planning should include the provision of a documented procedure (or method statement) covering each stage of the operation, and an estimated time for the conduct and completion of each stage, together with an adequate contingency for delay, incorporating:

- Departure from the present location
- Transit between locations
- Arrival and positioning at the new location
- Elevated operations to be undertaken at the new location.

4.4.2 In addition to the documented procedure, the planned operations should be subject to a documented Risk Assessment. An Emergency Response Plan and Health and Safety Plan should be developed, both of which should be available on board the vessel. The responsibilities and lines of communication should be clearly stated.

4.4.3 The procedure document should address the:

- Objectives to be achieved
- Operations necessary to achieve the objectives
- Operational procedures to be adopted
- Vessels, equipment and services required to conduct the operations
- Geophysical, geotechnical, environmental and operating constraints and limits
- Organisation and responsibilities of the parties and personnel involved
- Communications
- Contingency plans.

4.4.4 Generic procedures for lowering the hull, refloating, towing or self-propulsion, dynamic positioning, jacking, preloading and elevated operations as applicable to the routine operation of the jack-up are usually included in the vessel's operating manual.

4.4.5 Detailed procedures for the safe operation and maintenance of the jacking machinery should be provided in the form of a jacking system manual if not included as part of the operating manual. Similarly, detailed procedures for the operation of vessel equipment such as engines, bilge and ballast systems, and mooring systems should be provided in the vessel's equipment manuals. These manuals should be referred to, but may be excluded from the procedure document.

4.4.6 The operating manual and procedure documents shall be prepared in the English language.

4.4.7 All aspects of the planning shall be subject to review by a competent person. The planning and the review shall include the aspects detailed below.

4.5 Planning jack-up transit

4.5.1 The jack-up's limits afloat (including leg strength and securing arrangements) should be considered, and the aspects to be documented and reviewed shall include the:

- Defined environmental criteria and duration of the transit
- Stability calculation and watertight integrity of the jack-up
- Motion response of the jack-up in the design, sea state considered
- Strength of the cranes, deck equipment and sea fastening arrangements
- Details of the cargo and stowage plan
- Strength of the cargo together with the grillage and sea fastening arrangements
- Towing arrangement plan, towing equipment and tug specifications (towed units)
- Passage plan (all transits).

4.5.2 It should be verified that the arrangements listed above are adequate for the intended transit and sufficient to withstand the loads and motions for the jack up's condition afloat.

4.5.3 The tugs together with the towing arrangements and towing equipment should be verified as suitable for the proposed transit and in compliance with the requirements set out in these guidelines.

4.5.4 It should be verified that the transit route has been planned in accordance with the principles of good seamanship, having due regard for narrows, water depths, squat effects, tidal heights and currents, vessel traffic and separation systems, and all navigational hazards. The jack-up's air draft with legs fully raised should be considered in connection with maintaining safe clearances below overhead obstructions such as bridges and cables. It should also be verified that the provision of navigation equipment, charts, tidal data and nautical publications is

adequate to complete the transit safely.

4.5.5 The transit route should be documented and should include designated safe havens en route and/or alternative safe jacking locations. The maximum transit time between safe havens or alternative jacking locations should be considered, having due regard for the time required for jacking down, transit, positioning, preloading and jacking up to the minimum safe airgap at the next location.

4.5.6 Seabed surface and soil conditions at alternative safe jacking locations shall be investigated and documented as suitable for positioning. The selection of alternative jacking locations with very soft soils, or locations where risk of rapid leg settlement is deemed to exist, should be avoided.

4.5.7 The risk of failure of propulsion machinery or towing gear should be considered. Routes that pass rocks, shoals and other hazards to navigation should be planned with allowance, where practicable, for time to repair machinery and reconnect the tow, and for possible drift during such operations.

4.5.8 Planning jack-up transits shall include arrangements for the provision of marine weather forecasts obtained from a recognised meteorological authority, in accordance with the detailed requirements described in Section 18.3.

4.5.9 The planning should include contingency plans and emergency procedures, as detailed in Section 19.

4.5.10 Planning jack-up transits should include information on the departure location and the proposed arrival location, together with the arrangements for positioning the jack-up on location as follows.

4.6 Planning jack-up positioning

4.6.1 The planning and review shall include a site-specific assessment in accordance with ISO 19905-1: 2012 for the jack-up at the proposed arrival location.

4.6.2 The procedure document shall include or make reference to the jack-up soils assessment and the site-specific assessment. These documents shall be placed on the jack-up and shall be reviewed by the persons responsible for positioning, preloading and elevating the jack-up in advance of the move.

4.6.3 The planning should also include site-specific jacking and preloading or pre driving procedures (if any) that may have been developed in response to previously identified jack-up foundation hazards and/or recommendations (if any) contained in the site-specific assessment or the soils investigation and assessment reports.

4.6.4 The positioning of jack-ups at locations where multiple jack-up installations are anticipated should be carefully planned, having due regard for the potential for spudcan footprint interactions and adequate clearance between the spudcans and subsea pipelines or cables. This is particularly important at locations where deep leg penetrations are anticipated.

4.6.5 In considering the suitability of jack-up rig locations, due consideration should be given to site accessibility. The marine aspects of the approach to and positioning at the arrival location, such as water depth, tidal range, tidal current velocity, duration of slack water, and navigational hazards, should be considered. Particular consideration should be given to the proximity of fixed or floating installations and seabed surface hazards, such as wrecks, debris, boulders, UXO, and subsea pipelines or cables. It needs to be demonstrated in the plan that the site can be reached without incurring unusual marine risk.

4.6.6 The plan shall include details of the method to be employed and the tugs, moorings and survey equipment required to move the jack-up into position afloat

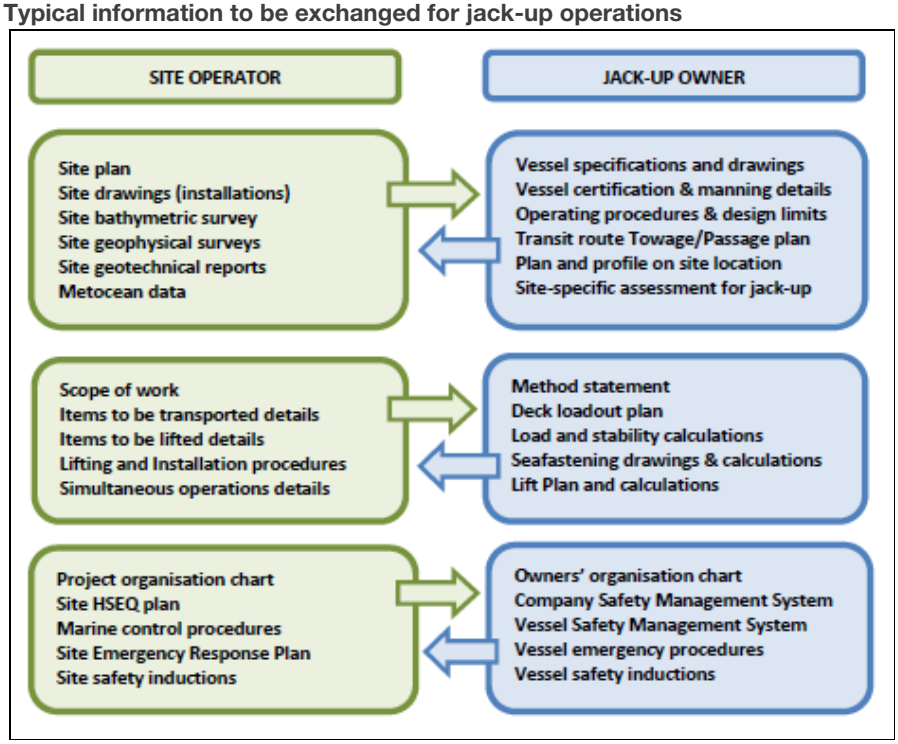
at the required geographical coordinates and on the required heading.

4.7 Information required for planning and jack-up suitability assessment

4.7.1 The safety and efficiency of any jack-up operation depends on competent planning. Planning should be based soundly on a complete understanding of the jack-up's design limits and operating procedures, coupled with detailed knowledge of the transit route and the physical conditions existing at the proposed elevated operating location.

4.7.2 The information to be assembled for planning purposes and for subsequent use during the execution of the jack-up operation is usually provided by the site operator or the main contractor and by the jack-up owner/operator. The division of responsibility for the provision of this information varies depending upon the terms of the vessel charter or contract. The principal pieces of information specific to jack-up operations that should be exchanged in a typical renewable energy project are illustrated below.

Typical information to be exchanged for jack-up operations



5 Weather-Restricted and Unrestricted Operations

5.1 Operations considered

5.1.1 Jack-up operations in the following modes are considered:

- Afloat under tow
- Moored afloat
- Partly elevated with the hull partly buoyant in leg-stabilised mode
- Elevated in the operating mode at a working airgap
- Elevated in the survival mode at an airgap greater than or equal to the minimum safe airgap.

5.1.2 Most jack-ups are required to operate in unrestricted mode (5) above, because the nature of their activity requires that they remain on location for many days or weeks, and the distance offshore and the complexity of their equipment and moving arrangements mean that they cannot be quickly or easily removed to shelter.

5.1.3 Jack-ups that are not designed or constructed to achieve the survival airgap or to withstand the stresses likely to be imposed by the 50-year storm in the elevated condition may operate safely in weather-restricted mode in accordance with the guidelines for weather-restricted operations.

5.2 Jack-up – unrestricted operations

5.2.1 Good industry practice for unrestricted operations when elevated requires that the jack-up be capable of elevating to or above the minimum survival airgap and that the unit's design meets the minimum acceptance criteria for survival elevated as defined in ISO 19905-1.

5.2.2 The site-specific assessment (Section 10) shall demonstrate that the unit is capable of remaining safely elevated on location in the prescribed 50-year extreme storm condition, or the 10-year extreme storm condition for the de manned condition (Section 10.2.4), with a limited amount of additional penetration and with all structural stresses remaining within allowable limits.

5.2.3 When operating in unrestricted mode, the hull elevation for survival mode is to be set at or in excess of a minimum elevation that provides 1.5 metres clearance above the 50-year return period wave or to just clear the 10,000-year joint probability wave crest, whichever is greatest.

5.2.4 Seasonal variations in the 50- or 10-year extremes may be considered if the jack-up is to remain on location for a limited period only during specified months.

5.2.5 Storm directionality may be considered if there is sufficient reliable evidence that the extreme wind, waves and current at the location are directional. In such cases it may be possible to orientate the jack-up on the most advantageous heading in order to achieve the required values for the checks associated with the acceptance criteria. Particular care shall be taken in making assessments where the environmental conditions are highly directional, that is, where they may change significantly over small angles.

5.3 Weather-restricted operations

5.3.1 Jack-up operations in the first four modes listed in Section 5.1.1 above may be undertaken as weather-restricted operations. In this case the jack-up's design limits for each mode of operation and the limiting weather criteria for each activity must be clearly defined in advance (see Table 5.3.1 overleaf). Planning must be in place, having due regard for the confidence in the predicted weather conditions, to remove the jack-up to shelter afloat or to an alternative safe location where the jack-up can be elevated before the onset of any weather that is forecast to exceed the specified limits for jacking down, transit, and jacking up and preloading at the safe location.

Table 5.3.1: Define limiting conditions for each activity

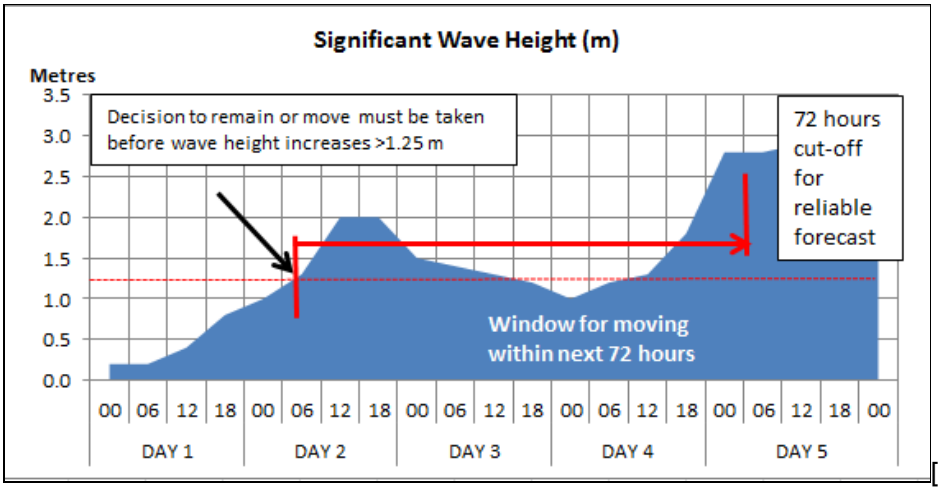
Activity	Wind Speed	Wave Height	Current Velocity	Tidal Height	Visibility Daylight Darkness
Port entry and exit					
Transit to/from site					
Location approach and positioning					
Anchor handling					
Jacking (engaging the seabed)					
Preloading					
Elevated operations					
Crane operations					
Crew transfer (jack-ups afloat)					
Crew transfer (jack-ups elevated)					

5.3.2 Caution shall be exercised in the planning and throughout the execution of a weather-restricted operation, having due regard for the risk that movement to shelter may be prevented in circumstances where even moderate weather conditions may continuously exceed safe limits for refloating the jack-up for a prolonged period that may extend beyond the period of a reliable weather forecast. Failure to take early action to remove the jack-up to shelter well before the sea state deteriorates to the point at which movement cannot be undertaken safely can lead to abandonment and total loss.

5.3.3 The conduct of a weather-restricted operation requires that detailed site specific marine weather forecasts be obtained from a recognised authority at intervals of no greater than 12 hours (Section 18.3).

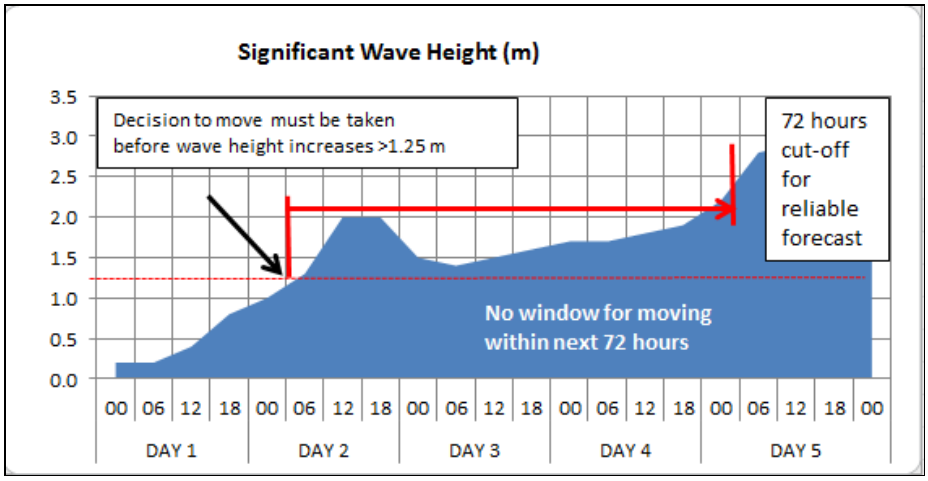
5.3.4 The planned duration of a weather-restricted operation should not normally exceed 72 hours; however, the duration may be indefinitely extended in prolonged periods of benign weather, provided that the limits for the restricted mode are never exceeded, and provided also that a future weather window suitable for moving the jack-up to the safe location is clearly and consistently identified by the duty forecaster with a high level of confidence on each weather forecast (see Figure 5.3.4).

Figure 5.3.4:
Example – Jack-up with limit for jacking Hs 1.25m and limit for elevated survival Hs 2.5m



5.3.5 If a future weather window for safe removal of the jack-up cannot be identified with a high level of confidence within the next 72 hours and risk of continued severe weather to follow is deemed to exist such that the limits for the restricted mode as defined in Section 5.3.1 could be exceeded, then the jack-up should be moved to shelter immediately before the limits for jacking down, moving off location, transit, jacking up and preloading at the safe location are approached or exceeded (see Figure 5.3.5).

Figure 5.3.5:
Example – Jack-up with limit for jacking Hs 1.25m and limit for elevated survival Hs 2.5m



5.3.6 The conduct of weather-restricted operations requires that a procedure document shall be in place containing details of the proposed work schedule with particular reference to the anticipated duration of each operation, and the time needed to suspend operations and to reach the nearest safe haven, or to reach a safe elevated location and complete positioning, jacking, preloading and elevation to the minimum safe airgap at that location. A contingency for delay caused by leg extraction problems, waiting for slack water, breakdown and other delays shall be allowed. In no case shall the total time estimated for suspension of operations, removal, transit and installation in a safe location (including the time for jacking, preloading and elevation to the minimum safe airgap, if required) exceed 48 hours including contingency for delay.

A safe jack-up location may be a port or a sheltered bay or estuary where the jack-up can remain afloat, underway or under tow or moored, or a location where the jack-up can be elevated providing that:

- The strength of the seabed soils is known to be sufficient to support the jack-up without further settlement after preloading
- The jack-up can be elevated to or above the minimum survival airgap
- The jack-up is capable of achieving the survival mode with all stresses remaining within allowable limits.

5.3.7 In circumstances in which insufficient time remains to reach a safe jack-up location before the onset of adverse weather and where the risk of remaining afloat is deemed to be greater than the risk of elevating on an unknown seabed, then consideration should be given to preloading and elevating the jack-up on the nearest location with suitable water depth. In these circumstances the guidance contained in Section 18.6 of these guidelines should be observed, and the positioning and preloading should be undertaken with extreme caution.

5.3.8 The action described in Section 5.3.7 (above) should only be attempted at the master's discretion, following receipt of advice from the designated person ashore and the Maritime Rescue Coordination Centre (MRCC). In these circumstances, and where practicable, it is recommended that all non-essential personnel should be removed prior to elevation, and consideration should be given to temporarily abandoning the jack-up as soon as it has been preloaded and elevated to the minimum survival airgap.

5.3.9 It should be recognised that the operation of a jack-up in weather-restricted mode may result in prolonged delays caused by the potential for frequent interruption of the work in order to move the jack-up to shelter to await a suitable weather window (or series of weather windows) of sufficient length to continue the proposed works. The limiting significant wave height for the movement of most jack-ups is between 0.5 and 1.5 metres. The incidence of such benign conditions may be infrequent and of short duration in many areas, particularly in the winter season.

5.3.10 It should also be recognised that the operation of a jack-up in weather-restricted mode involves higher risk than operation in unrestricted mode, and consequently the planning and execution of a weather-restricted operation requires a high level of competence. In consideration of the higher risk, jack up owners/operators, site developers or contractors may consider it appropriate to engage Marine Warranty Survey Services for review and approval of the procedures.

6 Floating Condition— Motions and Stability

6.1 Application

6.1.1 Jack-up dry transport, self-propelled jack-up ocean transit and non-propelled jack-up ocean tow are not considered in these guidelines. These guidelines apply only to jack-up location moves and field moves. Guidance on ocean towing can be found in the latest edition of Noble Denton 0030/ND, Guidelines for Marine Transportations and IMO Guidelines for Safe Ocean Towing, December 1998 (MSC/Circ.884).

6.2 Design environmental criteria

6.2.1 These guidelines assume that all transits of self-propelled jack-ups carrying project cargo and all transits of non-propelled jack-ups with or without cargo will be undertaken as weather-restricted operations, with the jack-ups essentially in field move configuration.

6.2.2 Specific environmental criteria shall be defined for a weather-restricted operation, and these shall be appropriate to the planned route and the duration of the tow.

6.2.3 The duration of the passage under power or under tow should include an allowance for encountering adverse weather and current, plus additional time for jacking and preloading on site and any standby time that may reasonably be expected as a result of delays. Planned contingencies for diversion at any point en route to reach a place of shelter should be in place.

6.2.4 The design sea state for a jack-up transit conducted as a weather-restricted operation shall be based on the significant wave height (Hs). Typically, the maximum wave height will be calculated using the conversion factor of 1.86 Hs in accordance with the advice contained in HSE Offshore Technology Report 2001/010 – Environmental Considerations. The design wind speed shall be the one-minute average velocity at 10 metres above sea level. The incident wave shall be considered to be omnidirectional.

6.2.5 The operating criteria shall be set lower than the design criteria to allow for potential inaccuracy in wave height forecasts. Typically, weather-restricted tows should not commence in sea states greater than 50% of the design maximum, as the observer will often report the significant wave heights rather than the maximum wave height.

6.2.6 Weather window requirements should be calculated using Det Norske Veritas AS – Offshore Standard Marine Operations, General, DNV-OS-H101 or similar standards, thus allowing for adequate contingency.

6.3 Motion response criteria

6.3.1 The jack-up, cargo, grillage and sea fastenings shall be designed to withstand the motions and forces resulting from the design environmental criteria. Friction shall be ignored. It is recommended that either a motion response analysis is carried out or that model tests are performed for each case.

6.3.2 The motion response analysis should utilise proven software and techniques. For both motion response analysis and/or model tests, a realistic combination of environmental loads and wave directions and periods, representing bow, stern, quartering and beam sea conditions shall be used. If required, the analysis shall be validated by correlation with model tests for similar units or by performing new model tests. Alternatively, additional analysis may be performed covering more sea states or using different software.

6.4 Default motion criteria

6.4.1 Alternatively, and subject to consideration of the length of the voyage, the risks involved and any mitigating factors for reducing the risks, the jack-up, cargo, grillage and sea fastenings shall be designed to withstand the motions and forces derived using default motion criteria listed in the latest edition of Noble Denton 0030/ND, Guidelines for Marine Transportations.

6.4.2 The standard criteria shown above should be applied in accordance with the following:

- The roll and pitch amplitudes are single amplitude values assumed to apply for a 10-second full cycle period of motion
- The roll and pitch axes should be assumed to pass through the centre of floatation
- The phasing considered should be assumed to combine, as separate load cases, the most-severe combinations of: roll ± heave; pitch ± heave.

6.5 Inland and sheltered water criteria

6.5.1 For inland and sheltered water transportation, whichever of the following has the greatest effect shall be taken into account:

- Static loads caused by an acceleration of 0.1 G applied parallel to the deck in the roll or pitch direction
- The most-severe inclination in the damage condition, as determined by the damage stability calculations including the additional heel or trim caused by the design wind.

6.6 Intact static stability

6.6.1 Jack-up stability afloat shall be calculated to demonstrate compliance with the rules published by a recognised classification society or the rules contained in the MODU Code or the rules contained in MCA – MGN 280 as applicable to type, tonnage, size and classification, or in accordance with the guidelines provided below.

6.6.2 The intact stability, or intact range of stability, is the range between 0° heel or trim and the angle at which the righting arm (GZ) becomes negative (see Figure 6.7.1).

6.6.3 The transverse metacentric height (GM) must be positive, at zero angle of heel.

6.6.4 The range of transverse static stability should normally exceed 40 degrees. Correction to values of GM to allow for free surface effects should be included in this computation.

6.6.5 The acceptability of barges with a range of static stability of between 30 and 40 degrees will be dependent on motion response predictions.

6.6.6 In the event of the range of static stability being greater than 30 degrees and less than 40 degrees, it shall be demonstrated that the maximum predicted roll angle is less than the angle at which the maximum righting lever occurs.

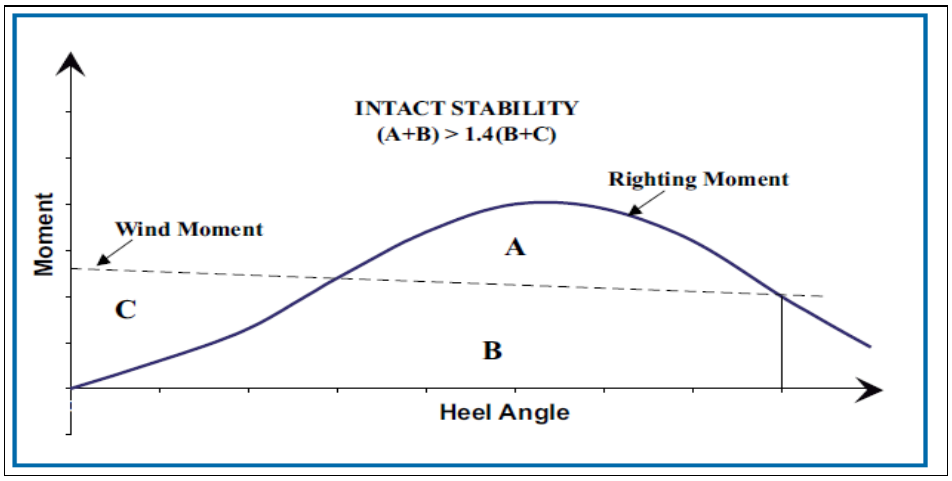
6.6.7 A range of static stability less than 30 degrees will not normally be accepted.

6.7 Intact dynamic stability

6.7.1 The areas under the righting moment curve and the wind heeling moment (or wind moment) curve should be calculated up to an angle of heel that is the lesser of:

- The angle corresponding to the second intercept of the two curves
- The angle of down flooding.

Figure 6.7.1: Intact stability requirement



6.7.2 For guidance on how to derive the wind heeling moment curve, reference is made to IMO Resolution A.749 (18), Code on Intact Stability for all Types of Ships Covered by IMO Instruments.

6.7.3 The wind velocity used to compute the wind heeling moment curve should be the one-minute mean wind speed at 10 metres height for the operation, as defined in Section 6.2.4.

6.8 Damage static stability

6.8.1 As a minimum, the jack-up should have sufficient stability and reserve buoyancy to remain afloat at a waterline below any opening where progressive flooding may occur with any one compartment adjacent to the sea flooded.

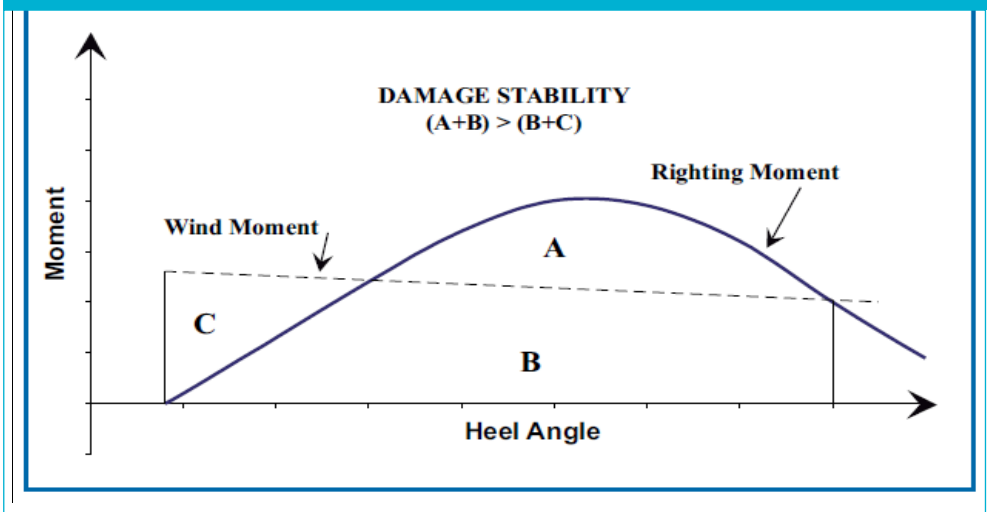
6.8.2 Damage to any compartment above the intact waterline that could lead to loss of stability should be considered when assessing damage stability.

6.8.3 The loss of water from a full compartment should be considered if it gives a more-severe result than the flooding of an empty compartment.

6.9 Damage dynamic stability

6.9.1 The area under the righting moment curve should be not less than the area under the wind heeling moment curve.

Figure 6.9.1: Damage stability requirements



6.9.2 The areas under the righting moment curve and the wind heeling moment curve should be calculated from equilibrium up to an angle of heel that is the lesser of:

- The angle corresponding to the second intercept of the two curves
- The angle of down flooding.

6.9.3 A wind velocity of 25m/s may be used to compute the overturning moment curve. However, if the design wind velocity for the operation, as defined in Section 6.2, is less than 25m/s, the design velocity should be used instead.

6.9.4 Where it is impracticable to comply with damage stability recommendations, a risk assessment should be carried out, and appropriate mitigating measures taken.

7 Grillage, Sea Fastening and Cargo Design

7.1 Loads during transportation

7.1.1 The components of load to be considered when analysing the total forces acting on the cargo, vessel, grillage and sea fastenings are those due to:

- The static weight of the cargo
- The dynamic loads that result from the vessel's motion in all six degrees of freedom
- The static component of weight that acts parallel to the barge deck when the vessel rolls or pitches
- Loads caused by heave acceleration, including the heave.sin(Θ) terms
- Wind load
- Loads resulting from immersion of any part of the cargo support frames
- Ballast distribution in the barge
- Ice, where appropriate.

7.1.2 Regarding the loads due to motions above, the combination of motions that give the highest loading in any direction shall be considered. In the absence of information to the contrary (such as a motion analysis taking account of phase relationships to compute acceleration vectors), the highest loadings resulting from the following motions shall be combined as two separate load cases:

- Roll, heave and sway
- Pitch, heave and surge.

7.1.3 Loads may normally be calculated using the assumption that all motions approximate to sinusoidal motions.

7.1.4 Structural loadings due to green water impact shall be based on the true relative motion between the structure and wave surface.

7.1.5 Account shall also be taken of any substantial loads in the grillage and sea fastenings resulting from the relative deflections of vessel and cargo, whether due to changes in ballast arrangement or due to environmental effects.

7.1.6 When using the default criteria as defined in Section 6.4, the horizontal accelerations resulting from seas from headings other than the bow, stern and beam may be resolved as applicable to the required heading. The resultant acceleration in the desired direction shall be obtained from taking the square root of the sum of the squares of the resolved accelerations. The heave acceleration will remain unchanged.

7.2 Stresses

7.2.1 The grillage and sea fastenings shall be designed in accordance with a recognised standard or code of practice. Wherever possible, the design should be carried out to the requirements of one code only.

7.2.2 The sea fastenings shall be designed such that the static stresses in all members do not exceed the allowable stresses in accordance with the AISC Manual or other acceptable code. The one third (1/3) increase in allowable stresses referred to in earlier editions of the AISC Manual may be used for stresses in cargo, grillage and sea fastenings in which the steelwork is of high quality. It should not be used for the design of grillage and sea fastening connections to the vessel or assessing the underdeck strength, except when the condition of all steelwork associated with the load path has been verified as being of high quality with full material certification.

If the AISC 13th Edition is used, the allowable stresses shall be compared against member stresses determined using a load factor on both dead and live loads of no less than:

	WSD Option	LRFD Option
SLS:	1.00	1.60
ULS:	0.75	1.20

7.2.3 Any load case may be treated as a normal serviceability limit state (SLS)/normal operating case.

7.2.4 Infrequent load cases occurring no more frequently than the maximum design wave, which are dominated by extreme environmental forces, may generally be treated as an ultimate limit state (ULS)/survival storm case. This only applies to steel of high quality that has been verified by a thorough and appropriate NDT inspection.

7.3 Grillage

7.3.1 The grillage design and layout should take account of any limitations imposed by the load transfer method.

7.3.2 The basis for the design of the grillage shall be the loads derived from the vessel motions as defined in Section 6.3 and 6.4.

7.3.3 The relative stiffness of the barge frames and bulkheads shall be taken into account when deriving the load distribution between the grillage and the barge.

7.3.4 The effects of super-position of loads shall be accommodated in the design when welds/connections are made between the grillage and barge deck following load-out.

7.4 Sea fastenings

7.4.1 The purpose of the sea fastenings is to secure the cargo during transit and positioning so that neither the cargo nor vessel suffers loss or damage as a result of the loadings derived from the vessel motions caused by the environment conditions or during preloading.

7.4.2 Sea fastenings should not in any circumstances be removed until the jack-up has completed preloading or predriving and elevating to the operating airgap. Primary sea fastenings should be designed to be removed without damage to the cargo. During and following removal of primary sea fastenings, adequate residual sea fastening should remain to safely restrain the cargo until its removal from the vessel.

7.4.3 The entire load path, including the potential sliding surfaces, should be demonstrated to be capable of withstanding the design loads.

7.4.4 Small items of cargo less than or equal to 1,000kg should be secured in accordance with good practice, using appropriate lashings or securing arrangements that are adequate to ensure they are safely secured and will not be a hazard to any person in the event of bad weather or an emergency.

7.4.5 If the sea fastenings are welded to the cargo, it is recommended that they be fitted with the vessel afloat after ballasting to the transport condition.

7.4.6 Where the same sea fastenings are to be used for multiple transits, inspection of welded sea fastenings and/or bolted connections is required prior to commencing each transit. Where practicable, locking nuts/devices should be used in preference to ordinary bolts.

7.5 Vessel strength

7.5.1 The calculated still water bending moment (SWBM) and shear force (SF) shall be checked against the allowable SWBM and SF values approved by the Classification Society. If they exceed the specified permissible loads then the Classification Society shall be informed and their acceptance obtained.

7.5.2 The legs, jack houses and hull are to be shown to possess adequate strength to resist the loads imposed during the sea passage afloat. Leg chocks, wedges and locking devices shall be considered if fitted.

7.5.3 Local vessel strength calculations shall be required at highly stressed areas of the vessel. These calculations shall take account of any corrosion from the 'as-built' scantlings.

7.6 Cargo strength

7.6.1 It shall be demonstrated that the cargo (equipment, tools, modules and wind turbine components, etc.) has adequate structural strength to be transported without damage caused by the maximum loadings resulting from the vessel's motions under the environmental conditions described in Section 6.3 or from the standard criteria as given in Section 6.4.

7.6.2 Local analysis may also be required to quantify load effects in localised highly loaded areas such as grillage supports or sea fastening connection points, and to confirm the adequacy of equipment to withstand these loads without damage.

7.6.3 The cargo structure is to be shown to have adequate strength to resist the loads imposed during the voyage combined with the additional loading caused by any overhang of the cargo over the side of the transport vessel.

7.7 Internal sea fastenings

7.7.1 Internal sea fastenings shall be provided where necessary. These may be in the form of temporary members to provide structural support during transportation, or the securing of equipment and loose items forming part of the cargo. Protection against wave slam or spray should also be provided as appropriate. Calculations may be required for major items of equipment.

7.8 Fatigue

7.8.1 Whether or not fatigue analyses are performed, all sea fastenings shall be designed for good fatigue characteristics.

8 Site Data Required for Jack-Up Site-Specific Assessments

8.1 General

8.1.1 Site survey is required for the purpose of providing data with which to define the position, boundary and characteristics of the location for the purpose of determining the suitability of the site for the installation and operation of the jack-up.

8.1.2 Geophysical data alone is insufficient to perform a site-specific assessment of the soil foundation conditions, and this should be complemented by geotechnical information as described in Section 8.7, except for jack-ups engaged in soils investigations, as provided for in Section 18.6.

8.2 Location coordinates

8.2.1 The coordinates of each jack-up location expressed in terms of degrees, minutes and seconds of latitude and longitude are required. Latitude and longitude coordinates should be given to at least two, or preferably three, decimal places of precision and must also include details of the datum and projection used.

8.2.2 It is recommended that a single uniform survey system (e.g., WGS84) be used for both site investigation and subsequent field development, so as to ensure that compatibility and conformity is achieved between the original site investigation and the operations of marine units subsequently involved in the site works.

8.3 Water depth, tidal range and storm surge

8.3.1 The water depth at each jack-up location referred to Lowest Astronomical Tide (LAT) is required. Near-shore pre-construction surveys producing results with vertical levels related to Ordnance Datum must be converted to LAT before application to jack-up marine operations.

8.3.2 The maximum tidal range and the 50-year storm surge shall be computed for the jack-up location and/or for the area of operations considered. The following data shall be provided as a minimum:

- 50-year storm surge (m)
- Highest Astronomical Tide (HAT) m
- Lowest Astronomical Tide (LAT) m.

8.4 Wind and wave, and current data

8.4.1 Meteorological extremes likely to be reached or exceeded once, on average, every 50 years, are required as listed below. The provision of one-year and 10-year extremes is also recommended. This information, together with the data in the first two bullet points in 8.3.2 above, is required for the site-specific assessment.

- Wind – 1-minute mean at level of 10 metres above MSL (m/s)
- Extreme wave height (m)
- Extreme wave crest elevation (m)
- Associated crest-to-crest wave period (sec)
- Peak period (sec)
- Significant wave height (m)
- Maximum surface current in downwind direction (m/s)
- Current profile.

8.4.2 Particular attention shall be paid to the provision of competent data for inshore sites that may be affected by:

- Shelter afforded by proximity of the coastline or shallows
- Refracted and/or reflected waves
- Breaking waves and surf zones
- High velocity tidal currents (>1.5m/s) in the vicinity of sandbanks and narrows
- Tidal bores
- Wakes from passing vessels, particularly deep-displacement ships and fast craft.

8.4.3 Special consideration is required at sites where breaking waves will occur. Calculation of hydrodynamic loads is not straightforward and a degree of judgement is required by the analyst to arrive at correct design values. Guidance on this subject can be found in ISO 19901-1: 2005(E), Part 1: Metocean Design and Operating Considerations.

8.4.4 Comprehensive metocean studies carried out in connection with near-shore and offshore wind farms do not usually take account of the specific data required for jack-up emplacement. This creates a need for interpolation, which can lead to inaccuracy and significant differences in the analyses carried out by different contractors for different jack-ups. For this reason it is recommended that such studies be reviewed by a single competent meteorological authority specialising in the provision of meteorological data for jack-up site-assessments, and that the data be presented as a jack-up Spot Location Report (SLR) in a simple unequivocal format (Appendix E).

8.5 Bathymetric survey

8.5.1 An appropriate bathymetric survey should be supplied for an area approximately 1km^2, centred on the proposed site. Line spacing of the survey should typically be not greater than 100m x 250m over the survey area. Interlining should be performed within an area 200m x 200m, centred on the proposed site. Interlining should have spacing less than 25m x 50m. Such surveys are normally carried out using acoustic reflection systems.

8.5.2 Rapid changes in bathymetry shall be anticipated in shallow areas that are subject to high-velocity tidal currents and/or areas that may have been exposed to severe storm waves. The appropriate period of validity of the survey should be considered in all cases, having due regard for the site characteristics and the anticipated rate of change indicated by earlier surveys. The survey report should include comment on the anticipated period of validity, plus the magnitude and probability of error resulting from seabed changes.

8.5.3 In circumstances where changes in seabed level are anticipated, the area to be resurveyed may be reduced from the original requirement of 1km^2 to an area that adequately covers the planned approach and egress route and the area of the standoff position (if used) and the final position on location. In every case the area surveyed should encompass the extreme limits of scour pits that may have developed around fixed structures.

8.5.4 Navigational charts published for shipping are not sufficiently accurate for positioning jack-ups; however, up-to-date corrected charts for the transit route, together with the largest available UK Admiralty Navigation charts for the site, are required to be carried on the jack-ups and attending tugs for reference. Paper charts may not be required on jack-ups that are ECDIS equipped and certified for ECDIS use only.

8.5.5 Notes and Cautions listed on Admiralty charts should be referred to. Navigation should not be attempted through or within areas marked as 'not surveyed' or areas carrying the notation 'banks and channels subject to frequent change' or similar without reference to recent bathymetric survey information.

8.6 Seabed surface survey

8.6.1 A seabed surface survey is required to identify natural features, such as sand waves, outcrops of rock or boulders, and artificial features, such as offshore installations, subsea pipelines and cables, rock dumps, scour pits, jack-up footprints, wrecks and seabed surface debris of any kind.

8.6.2 The survey should cover the approach to and the immediate area of the intended location, including the jack-up footprint area and areas to be used for the deployment of moorings and anchors (if used). The survey should be carried out using side-scan or sector-scan sonar, or other high-resolution techniques producing equivalent or better results.

8.6.3 Specialist surveys are required to reveal the presence of pipelines or cables, lost anchors and chains, wrecks, military unexploded ordnance (UXO), or other metallic debris lying on the seabed or buried below the seabed surface. The requirement for such surveys may be waived provided this could be justified during the site-specific assessment by a desktop study that includes analysis of the available evidence.

8.6.4 Site and location plans based on the seabed surface surveys should identify wrecks and important archaeological sites and/or marine conservation areas that are subject to protection. Sites where seabed or environmental disturbance should be avoided for any reason shall be identified. Specific information concerning the type of activity to be avoided and/or seasonal limits or other qualifying conditions related to these areas should be provided.

8.6.5 Seabed surface or sub-surface obstructions revealed by surveys as lying in the vicinity of the proposed jack-up approach path or installation position may require visual investigation by ROV or divers. If the obstructions cannot be avoided by maintaining safe clearances, then removal may be required in circumstances in which the obstruction presents a risk of foundation instability, damage to the jack-up leg footings or conflict with planned operations such as manoeuvring, towing, anchoring and mooring procedures.

8.6.6 The requirement to carry out a visual investigation for the purpose of positive identification of a seabed surface or sub-surface obstruction and the requirement for the removal of the object shall be based on a competent assessment of the site survey data and a documented risk assessment. This assessment should consider the probability or otherwise of a ferrous object being UXO, the estimated depth, dimensions, mass and characteristics of the object, and the distance between the object and the proposed position of the jack-up leg footings and tug towlines, or barge moorings and anchors if used.

8.6.7 The appropriate period of validity of the seabed surface survey should be considered, in all cases having due regard for the site characteristics and any surface or subsea activity carried out on site since the last survey, such as the installation of pipelines, cables, scour protection, the removal of debris, or detonation of UXO. As a general rule, the period of validity should be six months or less in uncontrolled areas and areas where no continuous system for reporting marine activity and lost objects exists.

8.6.8 The requirement to repeat the specialist surveys to reveal ferrous objects may be waived in circumstances in which there is little or no seabed mobility that could remove or reduce the depth of soil overlying such objects.

8.6.9 The discovery of seabed surface obstructions or debris at any time within or without the site area should be reported to the site operator, the Marine Coordinator (MC) or, in the absence of an MC, to the UK Hydrographic Office.

8.7 Shallow seismic survey

8.7.1 A shallow seismic survey should be performed over an area of approximately 1km^2, centred on the proposed site. Line spacing of the survey should typically be not greater than 100m x 250m over the survey area. The survey report should include at least two perpendicular vertical cross-sections passing through the proposed site, showing all the relevant reflectors and allied geological information. The equipment used should be capable of identifying reflectors of 0.5 metres and thicker to a depth equal to 30 metres, or the anticipated footing penetration plus 1.5 times the footing diameter if greater.

8.7.2 The seismic survey data should be reviewed to identify any lateral variability in soil layering or presence of sub-surface hazards such as steep-sided channels infilled with soft soils.

8.8 Geotechnical (soils) investigation

8.8.1 Site-specific geotechnical information is required except in circumstances where nearby geotechnical data is available and shallow seismic survey can be interpreted with certainty. The type and amount of data required would depend upon the particular circumstances, such as the type of jack-up, any indication of significant soil layering and/or lateral variability, and previous experience of the site, or nearby sites, for which the assessment is being performed.

8.8.2 The location and number of boreholes or CPTUs required should account for lateral variability of the soil conditions, regional experience and the geophysical investigation. A borehole or CPTU may not be required in the immediate vicinity if there are sufficient relevant historical data and/or geophysical tie lines to existing boreholes and CPTUs.

8.8.3 For sites where previous preloading and elevated operations have been performed by jack-ups, it may be sufficient to identify the location of existing jack-up footprints. In this case the details of the previous jack-up footing design, the preload actually applied and the penetration achieved by each leg should be examined by a competent person, and it should be verified that the foundation-bearing pressure applied previously was in excess of the pressure to be applied by the jack-up under consideration.

8.8.4 Site-specific geotechnical information applicable to a depth below the seafloor of 30 metres or the anticipated leg penetration plus 1.5 times the leg-footing diameter should be obtained. Any reduction in the depth of geotechnical information or offset distance between the data acquisition points and the proposed jack-up footing locations shall be justified in the foundation assessment.

8.8.5 All layers shall be adequately investigated and interpreted, including any transition zones between strata, such that the geotechnical properties of all layers are known with confidence and that there are no significant gaps in the site investigation record. Laboratory testing of soil samples may be required to determine some geotechnical properties.

8.8.6 Care must be exercised to ensure that the soil investigation is adequate in scope and detail for jack-up site-assessment. If in doubt, a qualified geotechnical engineer with appropriate experience with jack-up foundation assessments shall be consulted.

8.8.7 In virgin territory where there is no soil data available, seabed sampling may be carried out from suitable jack-ups prior to installation. In such cases appropriate precautions (Section 18.6) must be taken to ensure the safety of the jack-up during the initial period on location and until the soil investigation is complete.

8.8.8 The nature of the seabed surface soil, together with the water depth and the current and wave regimes shall be assessed to determine whether potential for scour may exist. The assessment should consider whether scour has occurred around existing fixed or temporary structures in the vicinity (if any) and records of previous scour that may have affected earlier jack-up installations. In the event that the assessment indicates that the integrity of the jack up foundation could be adversely affected, then seabed soil samples may be required and a scour analysis should be performed (Section 9.12).

8.8.9 The soil investigation must produce sufficient reliable data on which to base a competent analysis that will provide a recommended soil strength design profile, giving lower- and upper-bound strength estimates for the proposed jack up location. This will be carried forward into the jack-up site-specific assessment (Section 10).

9 Jack-Up Foundation (Soils) Assessment

9.1 Site-specific foundation assessment is required for all jack-up installations in all cases in which the jack-up is to be partly or fully supported by the legs at any stage of the proposed operations.

9.2 The scope of the assessment and the amount of data required will depend upon the particular circumstances, such as the type of jack-up, the soil conditions and variations in the soil across the site, and upon previous experience of the site, or nearby sites, for which the assessment is being performed.

9.3 The jack-up location shall be evaluated for the presence of geohazards, and the foundation assessment shall be carried out in accordance with ISO 19905 1.

9.4 For jack-up locations where there is no history of previous jack-up emplacement, a complete foundation assessment is required. The assessment shall refer to a geotechnical report containing the survey records, together with their interpretation, plus a leg penetration assessment for the proposed unit, or a unit with similar footing design and load characteristics. Where the assessment has considered a similar unit, the relevance of that assessment to the prediction of leg penetration behaviour for the unit under consideration shall be carefully evaluated. The assessment shall be carried out by a competent person.

9.5 For sites where previous preloading and elevated operations have been performed by jack-ups, it may be sufficient to identify the location of existing jack-up footprints. In this case, the details of the previous jack-up footing design, the preload actually applied and the penetration achieved by each leg should be examined, and it should be verified that the foundation-bearing pressure applied previously was in excess of the pressure to be applied by the jack-up under consideration. In the absence of such verification, a complete foundation assessment is required.

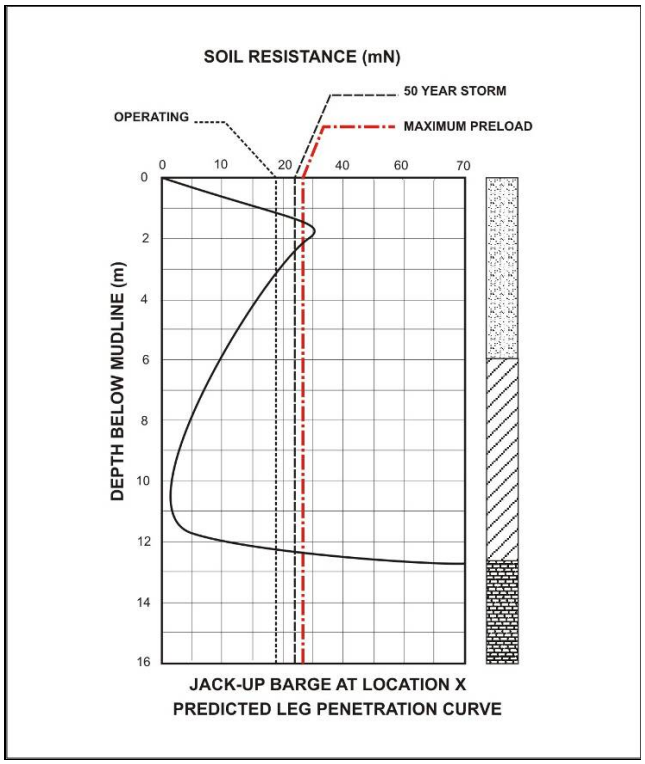
9.6 The combination of vertical and horizontal loads shall be checked against a foundation-bearing capacity envelope. The resistance factor may be taken as 1.0 when the load–penetration curve indicates significant additional capacity for acceptable levels of additional settlement. Minor settlement not exceeding the limits contained in the operating manual may be acceptable provided that:

- The jack-up can withstand the storm loading plus the effects of the inclination
- The lateral deflections will not result in contact with adjacent structures
- The jacking system will remain fully operational at the angle of inclination considered.

9.7 Consideration shall be given to the operating limits of the jacking system. The capacity of any jacking system to elevate or lower the hull may be significantly reduced or eliminated by leg guide friction (binding) caused by small angles of inclination. Additionally, some hydraulic recycling jacking systems cannot be jacked at angles of inclination greater than 1.0 degree because even this small angle can result in inability to extract or engage the fixed and working pins or catcher beams.

9.8 Extreme caution should be exercised if the soil profile reveals a risk of punch through, when it should be demonstrated that there is an adequate safety factor to ensure against punch-through occurring in both extreme (abnormal) storm events and operating conditions. Particular attention must be paid to the appropriate safety factor in cases in which the jack-up's maximum preload capacity does not produce significantly greater foundation-bearing pressure than the load to be applied in the operating or survival modes (see Figure 9.8).

Figure 9.8: Sample leg penetration curve



9.9 The utilisations should be assessed using the load and resistance factors given in ISO 19905-1. For locations where risk of punch-through is deemed to exist, the utilisation calculated in this way shall not exceed 1.0. Additionally, to guard against punch-through in the elevated in-service condition, the V–H bearing utilisations obtained using unfactored loads and unfactored resistances should not exceed 0.67 (giving a safety factor of 1.5) based on vectors from the still water reaction.

9.10 Ultimately, the assessment of punch-through risk requires a high level of expertise and the exercise of sound judgment based on experience.

9.11 Consideration should be given to the limits of maximum and minimum penetration as specified by the jack-up design or operating manual. In cases in which the limits stated in the manual are related simply to a sample elevated condition and the leg-length installed, it can be ignored provided the leg-length is sufficient to meet the survival airgap defined in ISO 19905-1: 2012. An analysis should be carried out for any case in which the limit stated in the manual is related to leg or spudcan structural strength or to the jack-up's capacity for leg extraction.

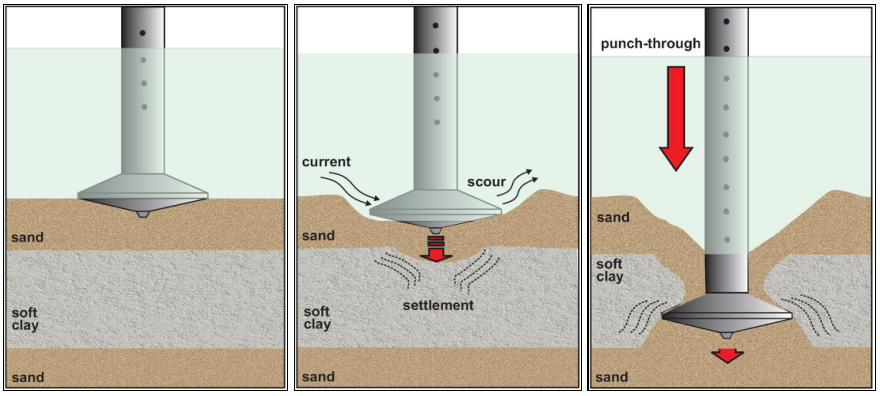
9.12 Particular consideration shall be given to the requirement for extracting the leg footings and the probable effectiveness of the leg jetting system (if fitted). Temporary inability to extract the legs from the soil may involve serious risk if the unit cannot be quickly removed to shelter and/or cannot achieve the elevated survival mode and remain on location.

9.13 For jack-ups fitted with hydraulic recycling jacking systems there is the additional risk that the jacking system may become temporarily immobilised through inability to extract fixed or working pins during the leg extraction operation. If this occurs during a rising tidal cycle then damage or flooding may result.

9.14 Operations involving leg extraction may be considerably prolonged in cases in which deep leg penetration has been achieved, particularly if the leg extraction operation is interrupted by periods of adverse weather. The onset of weather conditions exceeding the limits for refloating the unit will require the jack-up to be re-elevated and preloaded, and if this becomes necessary any progress that had been achieved with leg extraction prior to such onset will be almost entirely reversed. In addition to the risk described above, this may have a serious commercial impact in terms of costs caused by an extended delay.

9.15 The potential for seabed scour shall be considered. Special consideration shall be given to the movement of seabed soils caused by currents or waves and the potential impact this may have on the integrity of the jack-up foundation over time. In circumstances in which the jack-up is supported by a surface layer of sand, the removal of a portion of this layer through scour can result in punch-through (see Figure 9.1).

Figure 9.15: Punch-through after elevation caused by the development of scour



1. Jack-up elevated 2. Scour develops 3. Punch-through occurs

9.16 At locations where risk of scour is deemed to exist, the foundation assessment shall include an assessment of the potential depth and rate of soil removal and the effect of soil removal on foundation stability. The assessment shall include a caution to the effect that special jacking procedures may be required to mitigate the risk of foundation instability.

9.17 The importance of maintaining accurate records of each jack-up operation on marine renewable energy projects cannot be overstressed. The availability of a comprehensive record of jack-up leg position coordinates, preload applied and leg penetration achieved can be applied to improve the accuracy of future geotechnical analysis and may significantly reduce or eliminate the time required for repeating site-specific assessments for future jack-up installations throughout the life cycle of the project.

10 Elevated Operations

10.1 General requirements

10.1.1 Every jack-up shall be provided with an operating manual stating the design limits of the unit for elevated operations.

10.1.2 Every jack-up shall have adequate structural strength, overturning stability and foundation capacity to withstand any combination of environmental conditions to which the jack-up may be subjected while elevated at a specified location. Account shall be taken of the properties and characteristics of the seabed and subsoil to ensure there is adequate resistance for applied loads. If rotational foundation fixity can be justified this may be included in appropriate structural analysis.

10.1.3 No jack-up shall be elevated in weather-unrestricted mode (Section 5.2) on a location unless, prior to moving, the owner/operator of the unit has obtained from a competent person:

- A Meteorological Spot Location Report (Appendix E)
- A soils investigation and jack-up Foundation Assessment Report
- A site-specific assessment report carried out in compliance with the ISO 19905-1: 2012, confirming that the jack-up is structurally capable of remaining on location and withstanding the extreme environmental conditions with all stresses remaining within allowable limits, and that the seabed and subsoil will provide adequate resistance to withstand the loads at the footings.

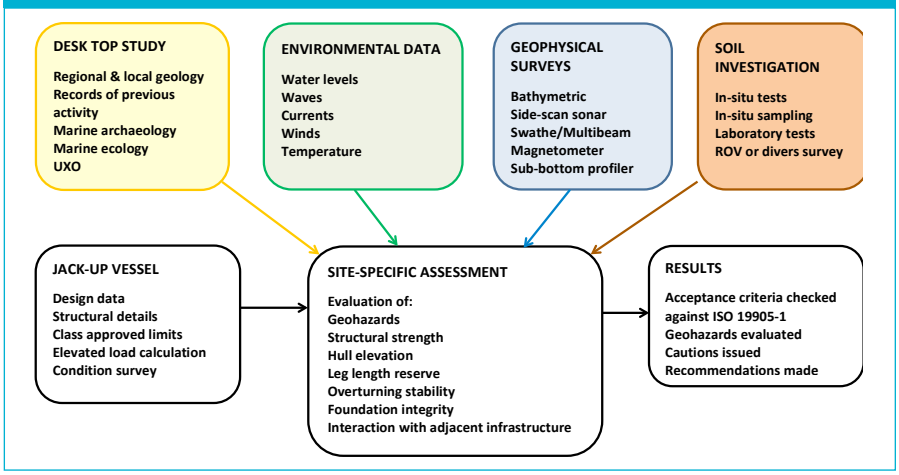
10.1.4 No jack-up shall be elevated on location in weather-restricted mode (Section 5.3) unless, prior to moving, the owner/operator of the unit has obtained from a competent person:

- Defined limiting environmental criteria for the operation
- Site-specific metocean weather forecasts (see Section 18.3)
- A soils investigation and jack-up Foundation Assessment Report (except as provided for soil investigations in Section 18.6)
- A site-specific assessment report in compliance with ISO 19905-1, confirming that the jack-up is structurally capable of remaining on location and withstanding the defined environmental criteria with all stresses remaining within allowable limits, and that the seabed and subsoil will provide adequate resistance to withstand the loads at the footings.

10.2 Requirement for site-specific assessment

10.2.1 Before installing a jack-up on any location a site-specific assessment shall be performed by a competent person. The site-specific assessment is defined as an evaluation of the stability and structural integrity of a jack-up and, where applicable, its seabed restraint or support against the actions determined in accordance with the requirements of ISO 19905-1: 2012. The information required for the assessment and the evaluation process is summarised in Figure 10.

Figure 10: Site-specific assessment for a jack-up



10.2.2 For multiple locations contained within a defined area, such as an offshore wind farm, the number of site-specific assessments for the site shall be sufficient to consider the complete range of physical, environmental and geotechnical conditions across the site. Particular attention shall be paid to any variation in the soil conditions across the site.

10.2.3 The 50-year return period extremes shall be used for the site-specific assessment for permanently manned jack-ups, unless the units are to operate in weather-restricted mode.

10.2.4 The 10-year return period may be considered where arrangements (including documented procedures) are in place for the safe removal of all personnel from the jack-up prior to the onset of weather conditions predicted to exceed the limit for safe disembarkation, having due regard for the level of confidence in the forecast weather conditions.

10.2.5 The 10-year return period should only be used for de-manned jack-ups in cases in which there is no risk to personnel and where the site developer and the jack-up owner/operator have formally assessed the consequences of catastrophic weather damage to the jack-up and the potential threat to the environment and to shipping, installations and property in the vicinity. For cases in which the reduced extremes are used, it is recommended that the hull should be raised to comply with the 50-year airgap requirements. It is also recommended that site developers consult with interested parties, such as the MCA, third-party installation owners and underwriters, and environmental agencies, in connection with the possible consequences.

10.2.6 The site-specific assessment including the assessment of the jack-up's dynamic response shall be carried out in accordance with the International Standard ISO 19905-1: 2012 Site-specific Assessment of Mobile Offshore Units, Part 1: Jack-ups, together with the guidance contained in ISO/TR 19905-2, which provides additional background to some clauses and a detailed sample 'go-by' calculation.

10.2.7 The assessment of the jack-up can be carried out at various levels of complexity, as expanded in a), b) and c) below (in order of increasing complexity). The objective of the assessment is to show that the acceptance criteria (given in Section 13) of ISO 19905-1 are met. If this is achieved at a certain complexity level there is no need to consider a higher complexity level. In all cases the adequacy of the foundation shall be assessed to level b) or c).

a) Compare assessment situations with design conditions or other existing assessments determined in accordance with this part of ISO 19905-1.

b) Carry out appropriate calculations according to the simpler methods given in ISO 19905-1 (e.g., pinned foundation, SDOF dynamics). Where possible, compare results with those from existing more-detailed/complex calculations (e.g., secant or yield interaction foundation model, time domain dynamics).
c) Carry out appropriate detailed calculations according to the more-complex methods given in ISO 19905-1 (e.g., secant, yield interaction or continuum foundation model, time domain dynamics).

10.2.8 A determination of the appropriate level of complexity (Appendix G) should be made in accordance with ISO 19905-1 Figure 5.2.1 – Flow chart for the overall extreme storm assessment.

10.2.9 The site-specific assessment shall consider the addition of wind loads on temporary accommodation modules, equipment containers, temporary crane installations and project cargo items (if any) that may not have been considered in previous assessments or design reports.

10.2.10 Assessments at all levels require verification by a competent person to confirm that the jack-up's original design report or site-specific assessment has been assessed in accordance with ISO 19905-1: 2012. It is recommended that in all cases in which a permanently manned jack-up is to remain elevated in unrestricted mode, the assessment should be undertaken or verified by an independent third party such as a Classification Society or Marine Warranty Surveyor.

11 Self-Propelled and Propulsion-Assisted Jack-Ups

11.1 Self-propelled jack-ups

11.1.1 Self-propelled jack-ups considered in these guidelines shall be defined as power driven vessels capable of undertaking sea passages within their certified trading area under their own power and without tug assistance. Such vessels shall be assigned an appropriate class notation signifying their type and capability.

11.1.2 Self-propelled jack-ups may be considered to be capable of undertaking transits and field moves under their own power; however, due consideration shall be given in each case to the need for tug assistance for port entry and departure, positioning on site, navigating in restricted waters or areas constrained by draft, and positioning in high-velocity currents and/or in deep water with the legs fully extended below the hull. In some cases national government and local port regulations may require tug assistance regardless of the vessel's own propulsion force.

11.1.3 For self-propelled jack-ups undertaking unrestricted transit between locations without tug assistance, the propulsion force of the vessel shall be sufficient to maintain control under conditions with sustained wind velocity of 20m/s, head current velocity of 0.5m/s and significant wave height of 5m. A reduction in these criteria for weather-restricted transit should be based on analysis and/or assessment of the vessel's recorded performance in conditions equivalent to or more severe than the selected limits for transit.

11.1.4 The design, construction, management, manning and operation of self propelled jack-ups are governed by Flag State and port state regulations, international codes and standards, and Classification Society rules for ocean going ships. Certified compliance with these regulations, standards and codes does not waive the requirement for these vessels to comply with ISO 19905-1: 2012.

11.2 Dynamically Positioned jack-ups

11.2.1 In addition to the definition and provisions described in Section 11.1, Dynamically Positioned (DP) jack-ups considered in these guidelines shall be defined as jack ups equipped with dynamic positioning systems that are capable of positioning and station-keeping under their own power and without tug assistance.

11.2.2 DP jack-ups shall be assigned an appropriate class notation signifying their type and capability. They will usually comply with the propulsion power requirements for unrestricted transit as defined above.

11.2.3 DP jack-ups shall comply with IMO MSC Circ. 645, Guidelines for Vessels with Dynamic Positioning Systems, which is the principal internationally accepted reference on which the rules and guidelines of other authorities and organisations, including Classification Societies, are based, and with recognised standards for DP training, which are set out in IMO MSC Circ. 738, Guidelines for Dynamic Positioning System (DP) Operator Training.

11.2.4 DP jack-ups shall be provided with a DP capability analyses report for the condition with legs fully raised and for the condition with legs lowered to the full extent below the hull baseline. A DP operating manual, Failure Mode Effect and Consequence Analysis (FMECA), trials report and DP capability plots shall also be provided.

11.2.5 DP trials should be performed outside the 500-metre zone, and a minimum of two different position reference systems should be used if moving within 50 metres of a fixed structure.

11.2.6 Approach and departure should only be undertaken during periods when the aggregate of all environmental forces is neutral or acting to move the jack-up away from any adjacent structure, subsea pipeline or cable.

11.2.7 The initial approach to location may be undertaken in joystick mode, but DP auto-positioning mode should always be engaged within 500 metres when moving towards any fixed structure. Final approach to the location should be made in steps of decreasing distance to allow the computer to refine the model by updating the increasing drag as the legs are lowered. Caution should be exercised when the legs first make contact with the seabed (pinning, tagging bottom or touchdown), having due regard for the risk that position may be lost if the DP system signals a sudden increase in thrust to counteract the sudden resistance to movement caused by pinning the legs.

11.2.8 Departure from any location should be undertaken in manual or joystick mode only. Position referencing systems and auto-positioning control should not be engaged until well clear of the fixed structure.

11.2.9 Additional guidance on dynamic positioning is contained in the IMCA publication Guidance on DP Positioned Jack-ups and Use of Dumb Barges for the Offshore Renewables Sector.

11.3 Propulsion-assisted jack-ups

11.3.1 Propulsion-assisted jack-ups considered in these guidelines shall be defined as all other jack-ups that may be fitted with propulsion equipment but that do not match the definitions listed in Sections 11.1 and 11.2, and which may require tug assistance for transit or positioning.

11.3.2 For transit of propulsion-assisted jack-ups not certified for unrestricted transit, the jack-up's propulsion capacity shall be sufficient to maintain a minimum speed over the seabed of 2 knots in the environmental condition considered.

11.3.3 For transit and positioning of propulsion-assisted jack-ups, the requirement for assisting tugs may be waived and/or a reduction in the number and power of tugs may be acceptable where it is demonstrated that effective control over the movement of the unit can be maintained in the limiting environmental conditions considered and with the legs extended below the hull to the maximum depth likely to be encountered en route and on site.

11.3.4 For transit, propulsion-assisted jack-ups as defined in these guidelines shall be considered the same as non-propelled jack-up barges with respect to the requirements described in Section 12.

12 Non-Propelled Jack-Ups

12.1 Manned and unmanned tows

12.1.1 Jack-up barges certified for manned towage under the load line rules and having certified crew accommodation should be manned by a marine crew for location and field moves.

12.1.2 Jack-up barges not certified for manned towage under the load line rules may carry a riding crew on location moves and will always be manned for field moves. Provision shall be made for embarking and disembarking riding crews whenever necessary, and sufficient means of escape, firefighting appliances and lifesaving equipment for the riding crew shall be available ready for deployment.

12.2 Ballasting

12.2.1 The ballasting system, if fitted, should be in good condition and suitable for the following:

- Correction of draft or trim
- Damage-control purposes in event of hull damage, grounding, etc.
- Modification to the draft, trim or heel if required for installation on location.

12.2.2 In cases in which the jack-up is unmanned, specifications and operating instructions for the ballast system shall be readily available and retained on board the lead tug, with details of the ballast status during the tow.

12.2.3 In cases in which the jack-up is not fitted with a permanently installed ballasting system and power source, the jack-up or the tug must carry sufficient portable pumps and equipment to carry out the operations considered in Section 12.2.1.

12.3 Watertight integrity

12.3.1 All weather deck openings shall have adequate securing arrangements to ensure watertight integrity.

12.3.2 Door openings on weather decks shall be fitted with sills, and deck hatches shall be fitted with coamings in accordance with international load line regulations. Exemptions for semi-permanently bolted closures not fitted with sills or coamings may be accepted subject to approval by the Classification Society.

12.3.3 Compartment manholes shall be properly secured with bolts and gaskets, which must be maintained in good condition. A set of tools shall be provided on board for releasing and refastening the manhole covers.

12.3.4 If manholes to critical compartments are covered by cargo, grillage or sea fastenings, care shall be taken to ensure they are properly secured before being covered.

12.4 Barge deck openings

12.4.1 Barges having low freeboards, where there is risk that a portion of the deck may become flooded in the damage stability condition considered in Section 6.7, should be provided with ‘top hats’ with suitable means of fixing to the barge deck, which can be used in an emergency to gain access through a manhole that may be awash.

12.4.2 At least one standpipe shall be provided, with suitable fittings such that it can be screwed into sounding cap holes that may be awash.

12.5 Mooring arrangements

12.5.1 This section is applicable to the general provision of moorings for jack-ups alongside quays. Moorings for jack-up operations afloat on site are covered in Section 14.

12.5.2 Mooring bitts or bollards shall be fitted on either side of the jack-up, suitably spaced in accordance with class rules if applicable. As a minimum, mooring bitts or bollards shall be fitted on each side at each end of the barge. At least four suitably dimensioned mooring ropes in good condition shall be carried on board. If the towing tug has spare mooring lines then they may be considered as a part of the barge's mooring lines.

12.6 Navigation lights and shapes

12.6.1 The jack-up shall be equipped with navigation lights (including anchor lights) and day signals, in compliance with the International Regulations for Preventing Collisions at Sea.

12.6.2 The lights shall be provided with sufficient power or fuel from an independent source to last for the duration of the voyage, plus a reserve of 50 per cent.

12.6.3 A full set of spare navigation bulbs or gas mantles (as appropriate) and shapes shall be carried on the tug or the barge. In addition, spare parts for the navigation lights, such as cables or hoses and connections (as appropriate to the system), shall be carried.

12.6.4 Where obstruction or danger to navigation is caused or is likely to result from installation of the jack-up on site, and where it is required under consents granted under the provisions of the Coast Protection Act 1949 – Consent to Locate Offshore Installations – Provision for Marking Offshore Installations, the jack-up shall be equipped with obstruction lights (white 360° Morse 'U') displayed at each corner of the jack-up, and with a fog signal.

12.6.5 Small jack-up barges operating within port limits may carry alternative obstruction lights, such as flashing orange beacons, subject to the approval of the harbour master.

12.7 Access

12.7.1 Safe ladders that extend from the manhole opening to the compartment bottom shall be provided in each compartment.

12.7.2 Ladders shall be available on each side of the jack-up, extending to the lowest waterline, to permit access when afloat. Steel ladders and adjacent protective fenders, if fitted, shall comply with class rules if applicable. Rope ladders shall comply with the rules for the construction and rigging of pilot ladders. The condition of these ladders shall be checked by the master of the jack-up or the tug master prior to commencing each jack-up transit, and they shall be checked by the person intending to use them immediately prior to each use.

12.8 Fenders

12.8.1 It is recommended that adequate fenders be provided for berthing operations.

12.9 Towing arrangements

12.9.1 The jack-up shall be towed from the forward end using a bridle of suitable construction. If two tugs are used, the bridle may be split and each tug connected to a single leg of the bridle. Alternatively, the second tug may be connected with a wire towing pennant through a closed fair-lead to a separate towing connection.

12.9.2 When assessing the strength of tow connections and fair-leads on the barge and bridle, the effect of the tug pulling at its maximum bollard pull in any direction shall be considered.

12.9.3 All towing equipment shall be in satisfactory condition. Test certificates for all the items specified in this section shall be valid and available for inspection. Certificates shall provide clear identification of the respective equipment.

12.9.4 Alternative towing configurations appropriate to operations conducted in narrow channels and confined areas may be used in inland waters and within port limits.

12.9.5 A plan or drawing of the towing arrangement, showing the configuration of the towing gear and each component and stating the breaking load (BL) of each component, shall be prepared and shall be made available on board the towing vessel.

12.10 Tow connections

12.10.1 Towline connections to the barge shall be of the quick-release type where possible. For strength purposes they shall be located over the intersections of transverse and longitudinal bulkheads, and they shall be provided with adequate backup structure. They shall also be secured against premature release.

12.10.2 The breaking (ultimate) strength of the tow connections shall conform to the following:

- At least three times the static bollard pull of the tug
- Designed to be greater than the breaking load of the bridle.

12.11 Fair-leads

12.11.1 Capped fair-leads or Panama-type fair-leads shall be fitted forward of and in line with the tow connection points, except where the towing connection is installed at the deck edge. Anti-chafe protection shall be provided along the deck edge.

12.11.2 The breaking strength of the fair-leads and their connections to the barge deck shall be greater than that of the bridle.

12.12 Towing bridle

12.12.1 The towing bridle shall consist of two legs, having an included angle at the apex of between 45° and 60°.

12.12.2 If the bridle is a chain bridle, it shall be composed of stud link chain, with enlarged open links at each end to facilitate connections. Connection should be made without removal of the stud from the stud link chain.

12.12.3 If a composite bridle is used, it shall comprise two lengths of stud link chain, extending beyond the deck edge, connected to wire pennants fitted with hard eye thimbles.

12.12.4 The bridle legs shall terminate in a shackled connection at a towing ring, triangular (Delta) plate, or other approved and certified device.

12.12.5 The breaking strength of each bridle leg and bridle terminator shall generally be at least three times the static bollard pull of the tug. Under no circumstances should the breaking strength of each leg of the towing bridle be less than the BL of the towing wire.

12.13 Intermediate tow pennant

12.13.1 For longer tows, in the transit condition an intermediate wire towing pennant shall be included between the towing bridle and the tug's main towline. The pennant shall be fitted with hard eye thimbles, and shall be at least 10 metres in length. The pennant may be shorter or may be omitted if necessary to reduce the overall length of the tow gear for in harbour or field moves.

12.13.2 The breaking strength of the wire pennant shall be not less than that of the main towline of the tug, and shall be of the same lay as the main towline.

12.14 Shackles

12.14.1 The certified safe working load (SWL) of all shackles included in the towing arrangement shall be greater than the static bollard pull of the tug to be used. Some reduction in this requirement may be allowed for a tug with a bollard pull in excess of 100 tonnes, but, in any event, their breaking load shall be greater than three times the bollard pull.

12.15 Bridle retrieving arrangements

12.15.1 A retrieval system shall be provided to recover the bridle in the event of the towline parting.

12.15.2 The retrieving wire shall be connected at the bridle apex either to the triangular plate or to an end link of the bridle leg. The wire shall be either led back to a retrieving winch, suitably via an 'A' frame or block arrangement, or an alternative system appropriate for the area of operation shall be provided.

12.15.3 The retrieving winch shall be adequately secured, and the capacity of the winch shall be sufficient to take the load of the bridle, apex connection, pennant and connections, with some reserve. The winch drum capacity shall be such that the required length of retrieval wire can be spooled.

12.16 Emergency towing arrangements

12.16.1 Emergency towing arrangements shall be provided for use in the event of loss of towline or bridle recovery system, or other unforeseen circumstances. Two systems are suggested below, although modified forms of these may be accepted:

- Two spare towing connections shall be fitted forward, located inboard of the main connections. A bridle, which may be of chain or wire and chain, with a triangular plate or towing ring at the apex, shall be attached to these connections. The towing ring or delta plate shall be secured to the barge by lashings. A pennant, with hard eye thimbles, shall be shackled to the towing ring or delta plate and clipped or lashed along the barge side, outboard of all obstructions. At the stern of the barge, a floating line with a buoy attached shall be shackled to the end of the pennant and streamed astern.
- A single spare towing connection shall be fitted, located on the barge centreline either forward or aft. If the connection is fitted forward, a pennant shall be connected to it and led aft to a floating line, as in Alternative 1). If the connection is fitted aft, the towing pennant shall be flaked on deck with the floating line connected to it.

12.16.2 The pennants and towing connections shall, in either of the above alternatives, be sized similarly to the main towing equipment and shall be led over the top of the main bridle if fitted forward.

12.17 Anchor

12.17.1 The jack-up shall have at least one operable anchor during transit. The anchor is to be of sufficient capacity and with sufficient length of mooring line available for emergency anchoring.

12.18 Safety rails

12.18.1 The perimeter of the jack-up deck shall be protected by permanently installed safety rails or removable stanchions and safety wires. These shall be designed and constructed in compliance with the applicable rules (Classification Society or MCA MGN 280). Openings in the rails or wires, allowing for temporary access for mooring lines or other equipment, shall be closed with chains or ropes when not in use.

13 Towing Vessels

13.1 General

13.1.1 The proposed tug(s) shall be in satisfactory condition. The tug(s) and towing equipment, machinery, manning and fuel requirements shall be suitable for the proposed operation. Certification and documentation required by the Flag State shall be in order, and the tug(s) shall be classed by a Recognised Class Society or certified under the provisions of the MCA Small Commercial Vessel and Pilot Boat (SCV) Code (as currently set out in MGN 280) or foreign equivalent.

13.1.2 The tug(s) shall be provided with a Bollard Pull Test Certificate stating the continuous (sustained) bollard pull based upon a bollard pull test carried out within the last ten years.

13.1.3 All towing equipment shall be in satisfactory condition. Test certificates for all items shall be valid and shall be available for inspection, with clear means of identification of the respective equipment.

13.1.4 The towing vessel shall have a spare towline that shall be similar in all respects to the main towline. Where the spare towline is not spooled on to a second winch drum, it shall be stowed in such a manner that it can be spooled on to the main towing drum by the crew at sea.

13.2 Bollard pull requirements

13.2.1 The total environmental load acting on the jack-up and cargo due to the combined effects of the following conditions shall be calculated, and the minimum towline pull required (TPR) should be calculated to hold the jack-up at zero forward speed in a fully developed gale, defined as:

- Significant wave height (Hs): 5 metres
- Wind speed: 20m/s (approx. 40 knots)
- Current: 0.5m/s (approx. 1 knot).

13.2.2 For short coastal tows and field and harbour moves, lesser criteria for calculation of TPR may be agreed. Generally these should not be reduced below 15m/s wind speed, 2.0m significant wave height and 0.5m/s current, acting simultaneously.

13.2.3 The tow should be capable of making reasonable speed with average weather conditions throughout the passage. It is recommended that the tow be capable of maintaining a minimum speed of 5 knots in conditions with significant wave height of 2.0m and wind speed of 10m/s.

13.2.4 In all cases, due consideration shall be given to the number of tugs and the TPR required to control the jack-up in the anticipated maximum current on site with the legs fully extended below the hull.

13.2.5 The TPR should be related to the continuous static bollard pull (BP) of the tug(s) proposed by:

$$TPR = \sum(BP \times Te/100)$$

Where:
Te is the tug efficiency in the sea conditions considered, %;
BP is the continuous static bollard pull of each tug;
(BP x Te/100) is the contribution to the TPR of each tug;
$\sum$ is the sum for all tugs assumed to contribute to the TPR.

13.2.6 The tug efficiency (Te) depends on the size and configuration of the tug, the sea state considered and the towing speed achieved. In the absence of alternative information, Te may be estimated according to Table 13.2.6 (below).

Table 13.2.6: Estimation of the tug efficiency

Bollard Pull	Calm	Hs = 2.0m	Hs = 3.0m	Hs = 5.0m
BP ≤ 30	80	50 + BP	30 + BP	BP
BP 30–90	80	80	52.5 + BP/4	7.5 + 0.75 x BP
BP > 90	80	80	75	75
		Hs – Significant wave height, metres BP – Continuous static bollard pull, tonnes Te – Tug efficiency, in percentage of the bollard pull		

13.3 Towing winches

13.3.1 Towing vessels shall be fitted with a suitable towing winch. Towing from a towing hook will not be accepted for open-sea passages but may be accepted for harbour moves or movements in inshore sheltered waters.

13.3.2 Two towing drums shall normally be provided. Where a second towing drum is not fitted, then means of reconnection of the spare towline shall be supplied. The spare towline shall be in good condition and of the required strength. There must be suitable means for connecting the line to the tug and making a rapid reconnection to the emergency towline on the towed barge.

13.3.3 The tow winch shall have a minimum holding power of three (3) times the static bollard pull of the tug at the inner layer on the drum.

13.3.4 All towing winches shall be fitted with an emergency-release brake mechanism.

13.4 Towline control

13.4.1 Towing pods, where fitted, shall be of adequate strength, and well faired to prevent snagging.

13.4.2 Alternative arrangements for towline control may be accepted. If gog ropes are used, they should be adjustable from a remote station. If a single gog rope system is fitted then the connection point shall be on the centreline of the vessel. A spare gog rope shall be provided.

13.4.3 Mechanical, hydraulically or manually operated stops (pins) to control the towline shall, if fitted, be well maintained, and capable of being withdrawn or removed when not in use.

13.5 Towing wire

13.5.1 For jack-up location moves, the length of the towing wire should never be less than 500 metres and shall be determined as follows: L = (BP/BL) x 1,200 (metres).

13.5.2 For harbour moves and tows in inshore sheltered waters, different towing wire lengths may be accepted.

13.5.3 The wire shall be in good condition, free from kinks and snags, and with no opening of strands. Hard eye thimbles or towing sockets shall be fitted.

13.5.4 The MBL of the towing wire shall not be less than the following values:

Bollard pull (BP)	BL
Less than 40 tonnes	3 x BP
40 to 90 tonnes	(3.8 – BP/50) x BP
Over 90 tonnes	2 x BP

13.5.5 Synthetic rope towlines shall not be used by the main towing vessel for jack-up location or field moves. Synthetic fibre towlines may be used by assisting tugs for harbour moves or tows in inshore sheltered waters.

13.6 Stretchers

13.6.1 Stretchers (if used) shall only be connected between the tug's wire and the intermediate pennant and not to the bridle apex connection. In general, a stretcher made up as a continuous loop is preferable to a single line. The breaking load shall be at least 1.5 times that of the main towline, and hard eye thimbles are to be fitted at each end. These ropes are to be in good condition.

13.7 Tailgates/stern rails

13.7.1 The tailgate or stern rail, if fitted, shall have an upper rail of radius not less than ten times the diameter of the main towline. Smaller diameters may be accepted for inland tows and harbour moves.

13.7.2 Anti-chafe gear shall be carried on the tug and fitted as necessary. The stern rail shall be well faired to prevent snagging.

13.8 Additional equipment

13.8.1 The following additional equipment shall be carried on board the towing vessel:

- Oxygen/acetylene cutting equipment
- Damage-control equipment
- Spare shackles (sized in accordance with the towing gear plus smaller sizes)
- A searchlight to illuminate the tow;
  and if the jack-up is unmanned:
- Portable radio transmitter/receivers with spare batteries, for communication
- Hand lamps or torches with spare bulbs and spare batteries
- A powered workboat, fitted with adequate means of launching and recovery (excepting small tugs less than 24m in length)
- A portable pump, equipped with sufficient length of suction hose to enable dewatering of the compartments considered in Section 6.7, and a self-contained power unit with sufficient fuel for 12 hours running.

13.9 Bunkers

13.9.1 An adequate quantity of fuel and consumables shall be on board for the proposed tow. An adequate amount of fuel at full-speed consumption shall be kept in reserve.

13.10 Manning

13.10.1 The towing vessel shall be manned by a qualified and experienced crew, in compliance with the requirements of the tug's Flag State. There should be sufficient crew to deal with contingencies such as the parting of a tow wire or the need to board the tow when the towed jack-up is unmanned.

13.10.2 For towage of unmanned jack-ups there must be sufficient accommodation and certified lifesaving capacity to accommodate the barge-riding crew (if assigned) on board the towing vessel(s).

14 Moorings for Positioning

14.1 General

14.1.1 Positioning is defined as the marine operation necessary to move the jack-up into the required position at a new location and to carry out the jacking and preloading operations necessary to install the unit on location.

14.1.2 All positioning operations are weather restricted and are to be conducted in sea states not exceeding the jack-up's design limits for going on location (engaging the bottom). This means that the operation must be completed within 72 hours, to the point where a temporary safe condition has been achieved.

14.1.3 The jack-up shall be considered to have reached a temporary safe condition when the integrity of the seabed foundation has been proven by preloading, and the unit is capable of:

- Withstanding the reduced environmental loads selected for a weather-restricted operation;

or

- Withstanding the environmental loads corresponding to the 50-year seasonal condition for an unrestricted operation.

14.1.4 A permanent safe condition for unrestricted elevated operation has been achieved when the unit can withstand the environmental loads corresponding to the 50-year all-year condition for the location and is capable of elevating to the minimum safe airgap as defined by ISO 19905-1 or above the 10,000-year wave crest, whichever is greatest.

14.1.5 Plans for positioning operations shall state the environmental limits that are not to be exceeded. The limits shall not exceed the allowable criteria for engaging the bottom and/or for jacking and preloading as prescribed in the jack-up's operating manual unless site-specific calculations have been carried out to determine alternative limits.

14.2 Positioning systems

14.2.1 When positioning close to surface or subsea structures, pipelines or cables, and whenever fine positioning tolerances are required, jack-ups relying on dynamic positioning systems shall be assigned the appropriate class notation for dynamic positioning (DP). The capacity of the DP system shall be documented to demonstrate the jack-up's capacity to operate in DP mode in the defined environmental criteria, and the system shall be function tested with acceptable results prior to commencing each positioning operation.

14.2.2 When positioning close to surface or subsea structures, pipelines or cables, and when fine positioning tolerances are required, jack-ups not equipped with DP systems and all non-propelled jack-ups shall be equipped with a suitable mooring system, except as provided in Sections 14.2.3 and 14.2.4 (below).

14.2.3 At locations where positioning tolerances are less critical and where there is low risk of contact with any proximate surface or seabed object, self-propelled jack-ups may position using their propulsion systems alone, provided that the systems are capable of controlling the jack-ups' speed and heading so as to reliably achieve a constant heading and near-zero horizontal movement relative to the seabed in the environmental conditions considered.

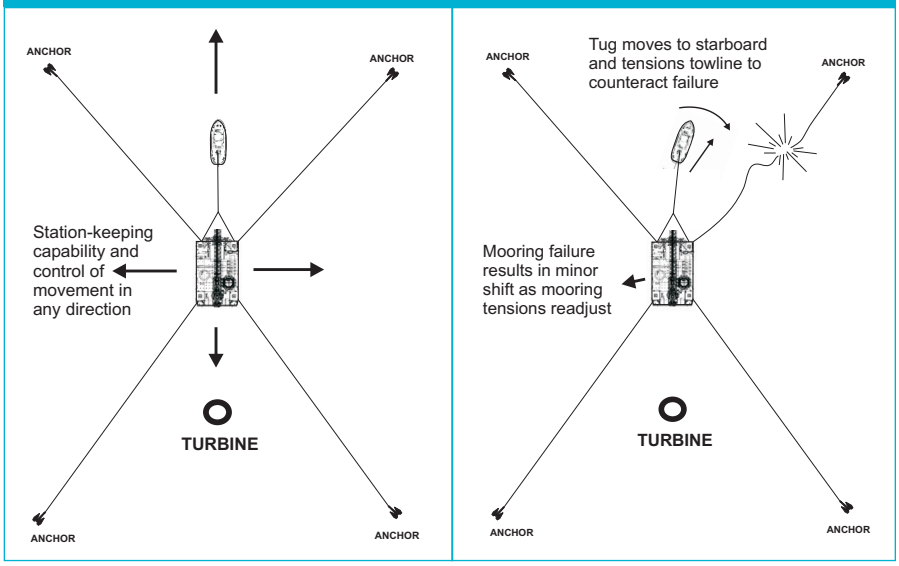
14.2.4 At locations where positioning tolerances are less critical and where there is no risk of contact with any surface or seabed object, non-propelled jack-ups may position using tugs alone provided that the towing vessels are capable of controlling the jack-ups' speed and heading so as to reliably achieve a constant heading and near-zero horizontal movement relative to the seabed in the environmental conditions considered.

14.2.5 Jack-ups and jack-up anchors and moorings shall not be moved or installed in the vicinity of offshore oil and gas installations, subsea pipelines or cables, or within exclusion zones established for the protection of such facilities, without written authority from the owners of the facilities.

14.3 Mooring equipment and procedures for positioning afloat

14.3.1 Mooring equipment for jack-ups (if fitted) will normally consist of a four-point mooring system using mooring winches, wires and anchors. Whether or not tugs are connected during the positioning operation the anchors should be deployed so as to provide station-keeping capability using the moorings alone, and in such direction that any single line failure does not cause uncontrolled movement of the jack-up towards the fixed structure (see Figure 14.3.1).

Figure 14.3.1: Conventional four-point mooring for positioning a jack-up



14.3.2 When positioning close to surface or subsea structures, pipelines or cables, a mooring layout plan shall be prepared. Additionally, a mooring analysis shall be performed if it is necessary to determine the clearances between the mooring lines and the nearby structures (see Section 14.4). Further details regarding the mooring analysis are given in Section 14.5.

14.3.3 The capacity of the mooring system, including the holding capacity of the anchors in the soil conditions on site, shall be demonstrated as sufficient to withstand the loads likely to be imposed during positioning of the jack-up in the environmental conditions considered.

14.3.4 The mooring system shall be designed, constructed and maintained in accordance with the rules of the vessel's Classification Society. The system shall be subject to regular survey and shall be maintained in good condition. The manufacturer's test data stating the safe working load of the winch, the rated pulling capacity (first wrap) and the rated brake holding capacity, together with original certificates for each mooring wire, termination socket (if fitted), shackle, anchor pennant and anchor, shall be kept on board the jack-up.

14.3.5 In cases in which the mooring winch is to be operated manually from a local control and where the operator can maintain a clear view of the winch drum, the fair-lead and the portion of the wire above the sea surface, the monitoring of line length and tension may be accomplished visually.

14.3.6 In cases in which the mooring winch is operated remotely from a central control, the equipment shall be fitted with means of displaying length and tension data at the control station. If there is no clear view of the winch drums from the control station, then either CCTV coverage shall be fitted or competent crew equipped with radios shall be stationed safely in the vicinity of each winch to monitor the spooling of wires.

14.4 Clearances during positioning

14.4.1 Sufficient clearance should be maintained between the jack-up and adjacent structures or other vessels, and between mooring lines and fixed structures or other vessels, and subsea pipelines, cables or other seabed obstructions during positioning. The direction of movement to the final position and the environmental conditions shall be considered in order to establish sufficient clearance.

14.4.2 The minimum clearance between the jack-up hull and an adjacent structure or another floating vessel during positioning should not be less than 3.0 metres at any point during the positioning operation.

14.4.3 The minimum clearance between the jack-up's leg footings and an adjacent structure should not be less than 5.0 metres at any point during the positioning operation. The minimum clearance between any part of the jack-up's leg footings and a subsea pipeline, cable or other obstruction should not be less than 10.0 metres at any point during the positioning operation.

14.4.4 Smaller clearances may be accepted following a thorough review of the characteristics of the site, the procedures to be adopted, the limiting environmental conditions, backup systems such as thrusters, lowering the legs to engage the seabed, the use of fenders and the deployment of sonar sector-scan equipment, when positioning close to subsea pipelines or cables. Due consideration shall be given to the consequences of contact and the ability to remove the jack-up from the location following completion of the operation.

14.4.5 The minimum clearances described below are based on the understanding that anchors are deployed from an Anchor Handling Tug equipped with a DGPS-based tug management system (TMS) that has been specifically calibrated for the selected site. Greater clearances shall be required where this equipment is not fitted or is not in service.

14.4.6 Greater clearances than those described in this section are usually required around 'hot' hydrocarbon installations and pressurised pipelines. Anchors shall not be deployed within designated pipeline or cable corridors or exclusion zones. Note that exclusion zones may include areas excluded in marine and environmental permits.

14.4.7 Gas and oilfield pipeline operators may have more stringent clearance requirements related to the protection of critical subsea pipelines and cables. Port authorities and other concerned parties may have specific clearance requirements related to the protection of dock structures, bridges, locks, and subsea, surface or overhead electric and communications cables. These must be complied with.

14.4.8 The clearance between a jack-up mooring line and a fixed structure or floating vessel during positioning shall not be less than 5.0 metres.

14.4.9 The horizontal clearance between a jack-up mooring line not crossing (parallel to) a subsea pipeline or cable should not be less than 50 metres. The vertical clearance between a jack-up mooring line crossing a subsea pipeline or cable should not be less than 5.0 metres. Smaller clearances may be accepted provided that it can be demonstrated that there is no risk of contact between the mooring line and the pipeline or cable.

14.4.10 The horizontal clearance between a jack-up's anchor and a fixed structure or subsea pipeline or cable shall not be less than 250 metres if laid across, or 150 metres if laid parallel to the pipeline or cable. This clearance may be reduced to 50 metres if the anchor drag sector is away from the pipeline or cable.

14.4.11 Contact between individual lines is not accepted for crossing anchor lines from two or more vessels.

14.4.12 Minimum recommended clearances are tabulated below:

Table 14.4.12: Recommended minimum clearances during positioning

Element	Direction	Fixed structure or floating vessel	Subsea Pipeline or Cable	
			Horizontal	Vertical
Jack-up hull	Any	3.0m	-	3.0m (afloat)
Leg footing	Any	5.0m	10.0m	3.0m (afloat)
Mooring line	Not crossing	5.0m	50.0m	-
Mooring line	Crossing	5.0m	-	5.0m
Anchor	Drag sector away	50m	50m	-
Anchor	Drag parallel to	150m	150m	-
Anchor	Drag sector toward	250m	250m	-

14.5 Mooring analysis

14.5.1 For positioning a jack-up in non-critical locations, a mooring layout plan shall be prepared.

14.5.2 For long-term moorings, defined as any mooring system that is deployed not solely for positioning purposes but also for the purpose of station-keeping, the mooring arrangements should comply with the guidelines contained in Section 14.4 (above) and should be analysed for the appropriate environmental conditions applicable to the season and time period for which the unit will be moored.

14.5.3 Mooring systems used for the purpose of station-keeping may, in general, be analysed by quasi-static methods, unless the unit is moored close to a fixed or floating structure or any natural hazard or obstruction that could result in contact damage, in which case dynamic analysis should be performed. The analysis should describe the possible excursions under defined environmental loads and should demonstrate that there is no risk of contact between the jack up or its mooring lines and the proximate fixed or floating structure or other obstruction, with the moorings intact and in the single line failure mode.

14.6 Anchor-handling tugs

14.6.1 Anchors should be deployed by anchor-handling tugs (AHTs). These vessels should be equipped with bow or stern rollers and winches, jaws, forks, pins, release devices and safety rails as appropriate for the safe control of the anchors and wires and to ensure proper protection for the tug crews.

14.6.2 Anchor-handling tugs engaged in deploying anchors in the vicinity of fixed structures or subsea pipelines or cables should be equipped with a DGPS-based tug management system (TMS) that has been calibrated for the selected site.

14.6.3 An anchor-handling tug carrying an anchor across a subsea pipeline or cable should carry the anchor on deck and not suspended from the stern roller.

14.7 Anchor-handling procedures

14.7.1 Anchor-handling procedures shall be documented. The procedures shall include scale anchor plans and shall describe the complete anchoring operation, the mooring equipment, and details of the method of deploying and recovering anchors. The procedure shall include contingency plans for vessel and equipment malfunction or breakage.

14.7.2 The procedure shall also include a plan showing areas where anchors may not be deployed for any reason, and shall describe the precautions to be taken to avoid contact between anchors and mooring wires and fixed structures, subsea pipelines and subsea cables, where applicable.

14.7.3 Where required to maintain the vertical clearances (Section 14.4 above) these precautions may include the deployment of line buoys (damage preventer buoys) installed at points along the length of the mooring wire to prevent it from coming into contact with subsea pipelines or cables. Additional precautions may also be necessary concerning the maintenance of tension in moorings during deployment and recovery, to ensure that slack bights of wire do not contact fixed structures, subsea pipelines and cables.

14.7.4 Where the risk of contact between mooring wires and subsea cables and/or contact with the seabed in the vicinity of cables buried to a depth of 1.0 metre or less cannot be avoided by using line buoys, then means of protecting the subsea cables, such as rock dumping, concrete/steel mattresses or bolted steel cable protectors, shall be employed.

14.7.5 Anchor plans should be reviewed and approved by the owners or operators of fixed structures, subsea pipelines and cables in the vicinity.

14.7.6 Prior to commencing anchor handling the master of the jack-up and/or the tow master (if the master is not the tow master) should arrange a meeting with the tug master(s) of the anchor-handling tugs and the survey team, to discuss the procedures to be adopted and the safety precautions to be observed. Sequential operations involving the same procedures, equipment and personnel may be addressed at a single meeting.

15 Lifting and Load Transfer

15.1 General

15.1.1 Lifting operations and lifting equipment shall comply with the Lifting Operations and Lifting Equipment Regulations 1998 (SI 1998/2307) (LOLER). These regulations are supported by the HSE's technical guidance and approved codes of practice contained in:

- Technical Guidance on the Safe Use of Lifting Equipment Offshore
- Safe Use of Lifting Equipment – Approved Code of Practice and Guidance (ACoPs).

15.1.2 Marine lifting operations shall also comply with the instructions and recommendations contained in a recognised Guideline Document, such as:

- GL Noble Denton 0027/ND, Guidelines for Marine Lifting and Lowering Operations (latest edition)
- Det Norske Veritas (DNV) – Rules for the Planning and Execution of Marine Operations, January 2000, Chapter 5: Lifting
- MCA MGN 280(M) – Small Vessels in Commercial Use for Sport or Pleasure, Workboats and Pilot Boats – Alternative Construction Standards, MS+FV Lifting Operations and Lifting Equipment Regulations 2006.

15.1.3 The documents listed above are mainly concerned with lifting operations by floating crane vessels; therefore, the following section of this document provides additional information on marine lifting operations carried out by jack ups.

15.2 Planning

15.2.1 Operational planning shall be based on the use of well-proven principles, techniques, systems and equipment, to ensure acceptable Health and Safety levels are met and to prevent the loss of or injury to human life and major economic losses.

15.2.2 All planning for load-out and offshore lifting operations is based, where possible, on the principle that it may be necessary to interrupt or reverse the operation. However, this may be impractical for some operations, and in cases in which the operation cannot be reversed, points of no return, or thresholds, shall be defined during planning and in the lifting plan. Checklists should be drawn up detailing the required status to be achieved before the operation proceeds to the next stage.

15.2.3 A comprehensive lifting plan or lifting manual shall be prepared. This manual may form part of an installation manual for the module or component to be lifted and shall include, as a minimum, details of the following:

- Description of the operation
- Time schedule
- Lift module dimensions, weight and centre of gravity (CoG)
- Details of stabbing guides and beams (if used)
- Details of auxiliary winches and tag lines
- Details of the jack-up and attending vessels (tugs, transport barges, etc.)
- Jack-up station-keeping arrangement (jacked up, leg-stabilised, moored afloat, DP)
- Transport barge station-keeping arrangement
- Specific operations (ballasting, ROV, divers, survey measurements, etc.)
- Vessel positioning procedures
- Configuration and certification of the crane
- Certification of all lifting equipment

- Crane radius curve (manufacturers/class derating of crane when afloat, if applicable)
- Proposed clearances between lifted module/crane/legs/vessels/existing structures
- Lifting equipment details, rigging weights and rigging drawings
- Limiting environmental criteria for each lift
- Plan and profile drawings
- Organisation, communications and responsibilities
- Recording procedure
- Pre-lift checklist
- Safety and contingency plans.

15.3 Documentation and design calculations

15.3.1 Each crane shall be provided with a report of inspection and a valid certificate of test, together with inspection reports and certificates related to blocks, hooks and wires. Permanently mounted cranes shall be certified by the jack-up's Classification Society, and details of annual inspections and five-year tests shall be recorded in the vessel's lifting gear register.

15.3.2 The lifting capacity of the crane shall be defined, and the basis for the load/radius curve shall be clearly described in the crane manual or similar document. When mobile cranes are used on board the jack-up, care shall be taken to determine whether the weights of crane blocks, hooks and wires have been included or excluded in the defined lifting capacity.

15.3.3 Temporary and mobile cranes not forming part of the jack-up's permanent equipment shall be certified and shall be sea fastened in accordance with the provisions of Section 7.

15.3.4 Reference is requested to the flowcharts contained in the referenced guideline documents on marine lifting (Section 15.1.2), which provide a useful summary of the stages in the design and analysis of lifts using a single crane or two cranes.

15.4 Loads and analysis

15.4.1 The module design weight (MDW) shall include adequate contingency factors to allow for the module being heavier than intended. After completion, the module shall be weighed using an approved weighing method. The as weighed weight shall be increased by 3 per cent, to account for weighing inaccuracies. Documentation should be provided to demonstrate that the equipment and procedures adopted for weighing have the required accuracy.

15.4.2 A further component, the rigging weight (RW), shall be added to the MDW. This allowance represents the weight of the lift rigging and shall include the estimated weight of all shackles, slings, lifting beams, spreaders and rigging platforms. In the final design phase the actual weight of rigging (including contingencies) shall be used.

15.4.3 The plan position of the centre of gravity shall generally be restricted for the following reasons:

- To allow for the use of matched pairs of slings
- To prevent overstress of the crane hook
- To control the maximum tilt of the object.

15.4.4 The module CoG should be kept within a specified design envelope. The length of the lifting slings/grommets shall be chosen to control the tilt of the module. For practical purposes, the tilt of the module should not exceed 2 degrees; however, some modules may require finer vertical tolerance for installation.

15.4.5 The rigging weight (RW) shall be added to the module design weight (MDW) to give the static hook load (SHL): MDW + RW = SHL. The static hook load shall be checked against the approved crane capacity curve at the maximum planned outreach.

15.4.6 Where the lifting situation may give rise to a dynamic increase in the effective load, the dynamic hook load (DHL) shall be obtained by multiplying the SHL by a dynamic amplification factor (DAF): DHL = SHL x DAF. The DAF allows for the dynamic loads arising from the relative motions of the crane vessel and/or the cargo barge during the lifting operations. The DHL shall be checked against the approved crane capacity curve at the maximum planned outreach.

15.4.7 For lifts in air, the dynamic load is normally considered to be highest at the instant when the module is being lifted off its grillage. This load, and hence the appropriate DAF, should be substantiated by means of an analysis that considers the maximum relative motions between the hook and the cargo barge, and takes account of the elasticity of the crane falls, the slings, the crane booms and the luffing gear.

15.4.8 The description of such an analysis must clearly state the assumed limiting wave heights and periods such that, if the calculated value of DAF is critical to the feasibility of the operation, those conducting the lift will be aware of the limiting sea states.

15.4.9 In the absence of a dynamic lift response analysis being carried out, the values of DAF given in Table 15.4.9 may be used for lifts in air from a jack-up.

Table 15.4.9: DAF factors for jack-up

Weight of Module	<100 tonnes	100–1,000 tonnes	>1,000 tonnes
Floating mode lifting from vessel afloat			
Lift offshore	1.50	1.40	N/A
Lift inshore	1.30	1.20	N/A
Elevated mode lifting from vessel afloat			
Lift offshore	1.15	1.10	1.05
Elevated mode lifting from leg-stabilised barge or jack-up			
Lift offshore	1.00	1.00	1.00
Elevated mode lifting from quayside			
Lift inshore	1.00	1.00	1.00

15.4.10 It should be noted that some crane capacity curves already take due account of the DAF, and care should be taken to ensure that the DAF is not considered twice in the design calculations.

15.5 Minimum clearances

15.5.1 During all phases of a lift the following minimum clearances should be maintained. Recommended clearances are given in table 15.5.1. Smaller clearances may be accepted following a thorough review of the characteristics of the lift, the procedures to be adopted, the limiting environmental conditions and the consequences of contact.

Table 15.5.1: Minimum clearances

Jack-up	Floating mode	Elevated mode
Below the lifted module	3.0m	1.0m
Between module and jack-up legs	3.0m	1.0m
Between module and crane boom	3.0m	1.0m
Between spreader bar and crane boom	3.0m	1.0m
Between module and fixed structure	3.0m	1.0m

15.6 Jack-up crane vessel stability

15.6.1 For a jack-up lifting in the floating condition, load and stability calculations shall be provided to demonstrate that the condition at each stage of the lift operation is within the limits contained in the stability book and/or the operating manual.

15.6.2 A Failure Mode and Effects Analysis (FMEA) is a requirement of class for Dynamically Positioned (DP) Jack-ups. The requirement for an additional FMEA or otherwise for a DP jack-up during lifting or positioning shall be determined in consideration of the risk to persons, DP Class, proximity of other structures or vessels, lifting configuration, operating environment and any other factor particular to the circumstances of the proposed operation.

15.6.3 For a jack-up lifting in the elevated condition, it shall first be verified that the preload operation has been carried out in accordance with the instructions contained in the operating manual and/or in accordance with any approved site-specific procedures that may have been developed for the location.

15.6.4 For a jack-up lifting in the elevated condition, load calculations shall be provided to demonstrate that the load condition at each stage of the lift operation is within the limits stated in the operating manual and that the jack up's maximum allowable elevated weight (operating) and centre of gravity remain within the specified transverse and longitudinal limits throughout the lifting operation. The calculations shall demonstrate an appropriate margin of safety to ensure that, during lifting and slewing, individual leg loads will not exceed the legs loads applied during preloading.

15.6.5 Caution shall be exercised at locations where the seabed foundation may have become altered by scour or other effects over time (see Section 18.7.8). In such cases, the jack-up preload or pre-drive sequence should be repeated prior to commencing a lift operation.

15.6.6 Jack-ups with four or more legs should ensure that the leg loads are equalised before lifting, in order to reduce the risk of further slight settlement during the lift operation. Following this test, the leg loads should be adjusted (if required) to the prescribed loads for lifting, and locking devices, fixed catches or pins should be engaged (if required) in accordance with the instructions contained in the operating manual.

15.6.7 When carrying out lifts with two cranes, documentation should be submitted to demonstrate that the jack-up can safely sustain the changes in hook load that arise from the tilt and yaw factors combined with environmental effects in the lifting calculations, specifically considering allowable cross-lead angles for the crane booms.

15.7 Environmental limits for lifting operations

15.7.1 No lifting operation shall be carried out in environmental conditions exceeding the limits stated in the jack-up operating manual or the limits stated in the site specific assessment for the elevated operating mode, whichever is lower.

15.7.2 The limiting wind speed for the jack-up elevated operating mode is based on the site-specific assessment and is related to the one-minute mean wind speed at a height of 10 metres. The limiting wind speed for the crane should be stated in the crane operating manual and in the lifting plan, and this limit may be based on a mean wind speed having a different reference period and height, such as a three-second gust at the tip of the crane boom.

15.7.3 The governing instrument for measurement of the wind speed for operation of the crane should be the anemometer that is mounted on the crane itself. The governing instrument for the jack-up in the elevating operation mode may be an anemometer mounted in a suitable unobstructed location on the windward side of the jack-up, typically on a mast or jack-house top. The wind speed limit for the jack-up and the crane are separate and distinct, and neither of these limits shall be exceeded during lifting operations.

15.7.4 It should be noted that marine weather forecasts for jack-up operations usually include predicted one-minute mean wind speeds at 10 metres height and three-second gust values at ‘deck level’ or 50 metres height. Persons reviewing forecasts for planning purposes should consider that the three-second gust at 50 or 100 metres height is likely to govern the lifting operations, whereas the forecast one-minute mean wind speed at 10 metres height will govern the jack up elevated operating mode.

15.7.5 The assessment of environmental limits in the lifting plan should take account the following:

- Jack-up elevated operating limits
- Limits specified by the crane manufacturer
- Aerodynamic characteristics of the object to be lifted
- Proposed load path and minimum safe clearances around the lifted object
- Probable duration of the lift, with contingency for delay or reversing the operation
- Limits specified by the owner of the facility
- Limits specified by the owner or supplier of the object to be lifted
- Limits applicable to special lifting equipment or load-handling devices.

16 Crew Transfer

16.1 Principal requirements

16.1.1 Equipment shall be provided to allow the crew, project personnel and visitors to safely embark and disembark and to transfer to and from offshore installations when the jack-up is:

- Moored afloat or elevated at a quayside
- Afloat
- Elevated with the hull partly immersed offshore
- Elevated offshore.

16.1.2 It should be recognised that there will be operational circumstances in which safe access cannot be provided and at which time transfer of personnel should not be attempted. The use of vertical ladders should only be considered as a last resort, and personnel transfer by any method should be subject to formal risk assessment.

16.1.3 It should also be recognised that new systems involving new equipment for personnel transfer are continuously evolving. Nothing contained in this section is intended to exclude alternative methods, new technology or new equipment, which may provide an equivalent or greater level of safety.

16.1.4 The access equipment shall comply with the following regulations and codes:

- The Merchant Shipping (Means of Access) Regulations SI 1988/1637
- The Merchant Shipping (Safe Movement Onboard Ships) Regulations 1988
- MCA Code of Safe Working Practice for Merchant Seamen
- MCA Small Commercial Vessel and Pilot Boat (SCV) Code as set out in MGN 280
- HSE Offshore Technology Report 2001/069 – Decks, Stairways, Gangways and Handrails
- British Standards (Marine Series) BS MA 39 Ships' Ladders: Steel, Sloping, Chapter 18.

16.1.5 The responsibility for ensuring that the jack-up's access equipment is fit for purpose shall be the responsibility of the jack-up owner/operator.

16.1.6 Routine access to and from the jack-up will normally be from the quayside or offshore platform (or other fixed structure), barge or from a crewboat. The term crewboat shall be deemed to include tugs, workboats and RIBs used for personnel transfer.

16.1.7 The safe condition of quaysides and quayside equipment, offshore platforms and crewboats used for the transfer of personnel to and from jack-ups shall be the responsibility of the party who owns or operates the quayside, platform or crewboat. Crewboats shall be constructed, maintained, equipped, manned, and operated in accordance with the rules laid down by their Registry and Class or in accordance with the SCV Code, as applicable.

16.1.8 The master of the jack-up, the master of the crewboat and the person supervising the transfer shall ensure that the selected method of transfer of personnel to and from the jack-up is safe in the prevailing circumstances and that equipment used for the transfer is in satisfactory condition and has been properly rigged and/or prepared for the transfer. In assessing the level of safety, the master of the jack-up should be guided by the instructions and recommendations contained in the site-specific documented transfer procedure.

16.1.9 The master of the jack-up and/or the person supervising the transfer shall also ensure that all transferees have received the required training in the selected method of transfer and that the appropriate PPE is worn for each transfer.

16.1.10 Each person using a gangway, ladder, personnel carrier or other device for transfer to/from a jack-up, offshore platform, crewboat or quayside shall individually and separately accept responsibility for their own safety. No person should attempt a transfer at any point unless they have received the appropriate training and instruction and are confident that they can accomplish the movement safely.

16.1.11 The safe operation of the jack-up and/or platform and/or crewboat is the responsibility of the owner/operator, as applicable. The individual responsibilities of the transferee, the vessel masters and the crew involved in supervising transfers, or operating equipment used for transfers, shall be clearly established and documented.

16.1.12 Specific procedures for routine personnel transfer shall be clearly established and documented. For each mode of transfer these procedures should, as a minimum, include details of the equipment to be used, equipment and transfer mode operating limits, training and PPE requirements, provision of safety equipment, communications protocols, and the instructions to be given and checks to be carried out prior to each transfer.

16.2 Transfer when a jack-up is moored afloat or elevated at a quayside

16.2.1 When a jack-up is positioned at a quayside, the transfer of personnel should be accomplished using an approved gangway and associated equipment that complies with the Merchant Shipping Regulations (Means of Access) 1988. The gangway shall be rigged in accordance with the advice contained in the UK Code of Safe Working Practice for Merchant Seamen.

16.2.2 A dock-mounted stair tower shall be provided in circumstances in which there is a significant difference in height between the jack-up deck and the quayside, such that the angle of inclination of the gangway, if used alone, would exceed its design limits.

16.2.3 Stepping over from the jack-up to/from the quayside shall be avoided, even in cases in which the gap is small and the jack-up deck and quayside are level or almost level. Scaffolding, planks and other temporary equipment shall not be used for the transfer of personnel to/from the quayside.

16.3 Transfer when a jack-up is afloat or partly elevated with the hull at draft

16.3.1 When a jack-up is afloat underway or positioned on location with the hull at draft, the transfer of personnel to/from a crewboat shall be accomplished using a fixed steel boarding ladder (if fitted) or an approved rope ladder rigged on the lee side or end of the jack-up. A rope ladder (if used) shall be constructed and rigged in accordance with the advice contained in the UK Code of Safe Working Practice for Merchant Seamen.

16.3.2 Personnel may transfer directly from the jack-up to/from the crewboat without using a ladder in cases where:

- The jack-up is pinned or underway but not making way through the water
- The crewboat has a boarding platform fitted with a safety rail
- The personnel transferring are not required to climb over the safety rail
- The height of the boarding platform is almost level with the jack-up's deck
- The vertical movement of the boarding platform in the sea state is less than or equal to 30cm
- The jack-up's boarding point has an access opening in the deck rail or bulwark
- The boarding point is manned, lit and equipped with a lifebuoy and line.

16.3.3 The jack-up's fast rescue craft (FRC), man overboard boats (MOBs), workboats, or RIBs fitted with class-approved davit launch and recovery systems may be used for the occasional transfer of trained seamen and divers. Such transfers should be subject to a specific risk assessment.

16.3.4 Transfer using personnel baskets and man-riding cranes should not be attempted while the jack-up is in the floating mode.

16.4 Transfer when a jack-up is elevated on location

16.4.1 When a jack-up is elevated to an airgap on an inshore or offshore location, the transfer of personnel to/from the jack-up can be accomplished using:

- A bridge to an adjacent fixed structure, e.g., wind/current turbine or platform (further reference is required for specific guidance and training on turbine access)
- A man-riding crane and certified personnel carrier
- Other approved mechanical device certified for man-riding
- Helicopter on units fitted with class- and type-approved helidecks.

16.4.2 The use of fixed steel ladders or rope ladders for access by personnel to elevated jack-ups requires extreme caution and should only be attempted in slight sea conditions. Plans for the use of rope ladders should be subject to special consideration and specific risk assessment.

16.4.3 The capacity of purpose-built bridges and gangways used for access shall be certified, or in the absence of a certificate, a report on the structural capacity from a competent person shall be provided.

16.4.4 Man-riding cranes shall comply with LOLER. In addition, a certificate or report shall be provided to demonstrate that the man-riding crane is equipped in accordance with the guidance provided in HSG 221.

16.4.5 Transfer of personnel by personnel basket or other carrier shall be undertaken in accordance with the guidance contained in HSE Offshore Information Sheet 1/2007: Guidance on Procedures for the Transfer of Personnel by Carriers. The type of personnel carrier used shall comply with guidance contained in HSG 221.

16.4.6 Transfer of personnel by helicopter shall be governed by the provisions stated in UK Statutory Instrument No. 16/1991 – Safety, Health and Welfare (Offshore Installations) (Operations) Regulations, 1991. Reference is requested to the following sections in Part II – Safety:

- Section 30: Helicopter Landing Officer
- Section 32: Helicopter Movements.

16.4.7 Transfer of personnel by helicopter shall only be undertaken on jack-ups that have been inspected and certified by a recognised authority, such as the Helicopter Certification Agency (HCA), to ensure compliance with the UK recognised criteria contained in CAP 437. Key areas of inspections carried out by the HCA include:

- Landing area size, surface, lighting and markings
- Helideck equipment, including rescue and firefighting arrangements
- Turbulence created by superstructure and/or exhausts
- Crew training
- Carriage of dangerous goods by air (where appropriate).

17 Marine Control for Jack-Up Operations

17.1 Marine control during transit and positioning

17.1.1 Jack-ups in transit and during positioning shall comply with the applicable marine traffic regulations promulgated by the port State controlling the waters through which the transit is made and in which the jack-up is positioned. The jack-up owner/operator shall be responsible for compliance with these regulations.

17.1.2 Jack-up transit and positioning operations usually require notices to mariners to be issued in advance, during, and on completion of each movement. Regulations also require that routine reports are made to vessel traffic services wherever applicable. The jack-up owner/operator shall be responsible for ensuring that the required notices, advisories and warnings are issued and for maintaining communication with the maritime authorities concerned.

17.1.3 Jack-ups operating within port limits shall comply with rules promulgated by local port or river authorities, pilot services and harbour masters. The jack-up owner/operator shall be responsible for maintaining communication with the marine authorities that operate or exercise control in the area through which the jack-up is transiting and in which the jack-up is operating.

17.2 Near-shore and offshore project sites

17.2.1 In addition to large-scale navigational charts, jack-ups operating at marine project sites shall be provided with large-scale drawings of the project site in both hard copy and electronic format, where such files are in use on the jack up's survey system. The drawings shall contain information plotted using a system of coordinates that is compatible with the survey system in use on the jack-up, and they shall be continuously updated to reflect both natural and man-made changes as they occur. The following information shall be included:

- Bathymetry
- Seabed surface features including UXO, debris and obstructions
- Position, dimensions and depth of any previous jack-up 'footprints'
- Position and dimensions of fixed surface and subsea structures
- Positions (as laid) of all subsea pipelines and cables, and proposed cable routes
- Positions and heights of overhead cables
- Positions of vessels and anchors of units on long-term moorings
- Clear fairways and exclusion zones
- Designated zones within the site, together with notation on the reason for zoning.

17.2.2 Jack-ups operating as single isolated units and attended only by their towing vessels (if any) require no additional marine control system. Masters of towing vessels (if any) shall be provided with the procedure document or method statement for the proposed transit and positioning operation, and they shall be briefed by the master of the jack-up in advance of the proposed movements.

17.2.3 For jack-ups operating offshore, it is recommended that a 500-metre radius exclusion zone centred on the unit's position be maintained during positioning and elevated operations. No other vessel should enter or move within this exclusion zone until clearance has been received from the master of the jack up. A lookout on the jack-up or the attending tug should be maintained throughout operations on site. Rogue vessels or small craft approaching the zone without notice should be advised by all available means to avoid this zone.

17.2.4 Where simultaneous operations involving multiple vessels are planned to take place within the same area, marine control under the authority of a Marine Coordinator is required. Coordination shall be arranged between the various contractors and vessels deployed, in order to avoid unsafe conflict between vessel movements and moorings. This is particularly important for jack-up positioning operations and to ensure the safety of the jack-up after elevation.

17.2.5 The area in which marine control applies shall be defined. All proposed vessel movements within the defined area should be reported to the Marine Coordinator in advance for planning purposes. No movement shall take place within the area until clearance has been received from the Marine Coordinator, and the completion of all movements shall be reported to the Marine Coordinator.

17.2.6 Jack-ups operating within an area subject to marine control shall be fitted with the navigation and communication equipment necessary to monitor and transmit Automated Identification System (AIS) signals and messages compatible with systems used by the Marine Coordinator.

18 Conduct of Jack-Up Operations

18.1 Sources of guidance on the conduct of jack-up operations

18.1.1 The jack-up's operating manual is the principal source of instruction and guidance on the conduct of jack-up operations. The operation of jack-ups governed under the ISM Code shall be guided by the relevant safety management manuals. The operation of the jacking system, cranes, and all machinery and equipment should be conducted in accordance with the relevant manufacturers' manuals.

18.1.2 Specific guidance contained in procedure documents should be followed. Proposed departures or deviations (if any) from the instructions and recommendations contained in the manuals referred to in Section 18.1.1 (above) should follow a management of change (MoC) procedure and should be documented at the planning stage.

18.1.3 The operation should be conducted in such a way that there is no unplanned departure from the guidance provided in the sources listed above, except in cases of emergency when the master of the jack-up deems it necessary to take different action or adopt an alternative procedure in order to avoid an unsafe condition or risk thereof. Provision for such emergencies should be identified in the MoC procedure.

18.1.4 In cases in which circumstances arise requiring a change to the existing guidance, the operation in progress should be temporarily suspended and the circumstances investigated in accordance with the MoC procedure. Alternative procedures should only be adopted when they have been reviewed, approved and signed off in accordance with the MoC procedure.

18.1.5 The use of jack-up move checklists is recommended.

18.2 Manning for operations

18.2.1 The jack-up shall be manned with a competent marine crew in accordance with the vessel's Safe Manning Certificate (if issued) or in any case with sufficient crew to manage the vessel and the marine operations, making proper allowance for rest periods.

18.2.2 Jack-ups without any propulsion units and issued with load line or load line exemption certificates for unmanned tow may carry a riding crew sufficient to manage the vessel and the operations, subject to the provision of adequate lifesaving and firefighting equipment.

18.2.3 Where a riding crew is carried, the attending tug(s) shall have sufficient certified capacity to accommodate the riding crew, and suitable provision to safely transfer all personnel from the jack-up to the tug. The maximum weather conditions for transfer of personnel from the jack-up to the attending tug(s) should be established prior to commencing the tow, and provision should be in place for the transfer of personnel from the jack-up to the tug(s) well before deteriorating weather conditions approach the level that would render disembarkation unsafe.

18.2.4 For propulsion-assisted or non-propelled jack-ups in the transit condition, the manning should be reduced as far as is practicable by the removal of non essential personnel before departure. In any event, the total complement shall not exceed 50 per cent of the total survival craft or life raft capacity for the transit mode. Manning need not be reduced for in-field moves.

18.2.5 There is no requirement to reduce manning in the transit mode for self propelled jack-ups classed for unrestricted transit through the certified trading area; however, the total number of persons on board shall not exceed the vessel's certified lifesaving capacity.

18.2.6 For all jack-ups operating in the elevated mode, the manning level including day visitors shall never exceed the jack-up's maximum certified capacity, except in cases where emergency assistance is being rendered by the jack-up to another vessel in distress.

18.2.7 Well prior to the onset of extreme storm conditions and before placing the jack up in the storm survival mode, consideration should be given to the available means of evacuation and the timely removal of all non-essential personnel.

18.3 Weather forecasts

18.3.1 The safety of most jack-up operations is dependent upon the regular receipt of reliable weather forecasts.

18.3.2 Except for UK Met Office forecasts, no reliance shall be placed upon weather information freely available to the public on the Internet, or information broadcast by commercial radio and television stations of the type that is general in nature and intended only for those engaged in non-critical leisure activities.

18.3.3 Shipping forecasts, inshore forecasts, gale and strong wind warnings, and the latest marine observations issued by the UK Met Office shall be monitored on a regular basis. Routine forecasts and warnings broadcast by the UK Met Office may be sufficient for jack-up operations conducted in harbours or within sheltered bays and estuaries.

18.3.4 For all other jack-up transit, positioning and elevated operations conducted anywhere outside sheltered harbours or outside sheltered bays and estuaries, route-specific and site-specific marine weather forecasts (as applicable) are required.

18.3.5 Route- and site-specific forecasts are required at intervals not exceeding 12 hours, and these should be broken down into four time periods (00.00, 06.00, 12.00 and 18.00 hours UT) for the following three days, plus an outlook for the following two days. Each forecast should contain the following meteorological information:

- Wind directions, speed and gusts at 10m
- Wind directions, speed and gusts at 50m
- Maximum wind, wave height and period
- Significant wind, wave height and period
- Swell wave direction, height and period
- Visibility
- Temperature
- Barometric pressure per period
- Type of weather per half-day
- Overall conditions in the form of surface pressure isobar maps
- Forecast reliability ranking for each forecast
- Contact details for the duty forecaster (to be available on a 24/7 basis).

18.4 Transit

18.4.1 Prior to commencing transit, the person responsible for conducting the operation shall be in possession of the relevant site-specific assessment report for the proposed new location and shall be familiar with the information, instructions and recommendations contained in the site-specific assessment and the documents described in Sections 18.1.1 and 18.1.2 (above).

18.4.2 A weather forecast indicating suitable conditions for the proposed transit shall be received and reviewed prior to jacking down. On-site conditions of wind, wave and current should be carefully observed and assessed, to ensure that the prevailing conditions will not adversely affect control of the movement of the jack-up on departure from the location.

18.4.3 Before jacking down, the load and stability calculations should be completed, and all equipment and cargo secured for transit. The jacking system and all main machinery and equipment should be tested, and the person responsible for the conduct of the move should be satisfied that the jack-up and the towing vessel(s) (if any) are in all respects ready for the move.

18.4.4 Before jacking down, the jack-up's position, heading and clearances between adjacent structures or obstructions should be carefully checked. Particular attention should be paid to the airgap, the water depth, the predicted rise or fall of the tide, and the individual leg penetrations. These levels should be checked against individual leg-height readings so as to ensure that the person responsible has a complete understanding of the jack-up's elevated status before jacking down.

18.4.5 Caution should be exercised when raising the legs, to avoid the risk of injury to personnel on deck caused by loose objects and marine growth breaking loose and falling from the legs.

18.4.6 For manned units, routine checks of the watertight integrity and sea fastening arrangements should be carried out during transit afloat. For unmanned units, routine inspection of the barge draft and trim can be carried out by the crew of the towing vessel using binoculars.

18.4.7 All jack-ups in transit are required to have an anchor ready for release during transit and positioning; however, to avoid accidental release, the anchor should be secured with a quick-release mechanism.

18.4.8 A schedule of regular radio contacts should be maintained between the towing vessel and manned jack-ups under tow. Weather forecasts shall be monitored and weather observations logged.

18.5 Positioning

18.5.1 To ensure that the limits prescribed in the operating manual are not exceeded during positioning, a weather forecast shall be obtained indicating that the prescribed limits will not be exceeded over the time required for positioning, plus a contingency for delay. On-site conditions of wind, wave and current shall be carefully observed to ensure that the prevailing conditions and any anticipated changes will not adversely affect control of the jack-up during the approach and positioning.

18.5.2 Tidal predictions specific to the jack-up location shall be provided, as this data will be required to assist with the calculation of leg penetration (see Appendix H).

18.5.3 Prior to approaching the proposed new location, the leg securing system (if fitted) should be disengaged, and the jacking system and all machinery and equipment to be used for the positioning operation, such as survey gear and mooring winches, should be function tested.

18.5.4 Crane booms shall remain secured for the transit condition, and all equipment and cargo sea fastenings shall be kept in place until the positioning operation is complete. The towing vessel shall remain connected to the main towing bridle until the positioning operation is complete.

18.5.5 The jacking, preloading and elevating operations shall be undertaken in accordance with the instructions and recommendations contained in the operating manual and the jacking system manual (if not included in the operating manual). Limits specified in the manuals shall not be exceeded, and all precautions described in the manuals shall be observed.

18.5.6 The jack-up's overall elevating speed, inclusive of time taken to recycle jacks, shall be sufficient to manage the planned positioning and removal operations, having due regard for the tidal range and the rate of tidal rise or fall. Special consideration for operations at locations with large tidal ranges and locations where the duration of slack water may limit the time available for changing from the floating to the elevated mode may be required.

18.5.7 Preloading shall be carried out to ensure that each leg is subjected to the load specified in the operating manual or in the site-specific assessment. The preloading operation should be carried out with the hull levelled at the lowest practicable airgap.

18.5.8 In circumstances in which a risk of rapid leg settlement exists during preloading, the level of the hull should be set, as far as practicable, at zero airgap or with the hull partially buoyant before achieving footing loads that are likely to result in rapid settlement. Operations of this type require careful planning; the rise and fall of the tide must be taken into account, and the operation can only be conducted in calm weather.

18.5.9 Complex preloading or pre-driving operations involving leg jetting or other special measures designed to achieve the safe installation of a jack-up at locations where risk of punch-through or other foundation hazards exist should not be attempted without expert geotechnical advice.

18.5.10 Particular attention shall be paid to accurate measurement of actual leg penetrations and associated footing loads during installation, so as to monitor progress against the predicted load–penetration curve. Any significant difference between the penetration of individual legs or between the predicted leg penetrations and the actual progress of the penetration during preloading should be investigated and reported to a competent person for review and approval prior to elevating the jack-up to the working airgap.

18.5.11 Following the preloading operation and before elevating the jack-up to a working airgap, the individual leg-height readings and leg-footing penetrations shall be accurately recorded (Appendix H). Leg-height and penetration measurements obtained from mechanical or electronic instruments should be verified by visual inspection of the leg-height marks against a reference point at the level of the deck or jack-house.

18.6 Deployment of jack-ups for soils investigations

18.6.1 In virgin territory, where there has been no previously recorded jack-up activity and where there is no adequate advance information on the nature of the seabed soils, the ground investigation may be carried out using equipment deployed from a jack-up operating in weather-restricted mode.

18.6.2 Compliance with the recommendations contained in this section does not relieve the jack-up operator of his responsibility for obtaining, as far as reasonably practicable, any available information on the probable characteristics of the soils likely to be encountered, before the jack-up is deployed. Particular reference is requested to the HSE Information Sheet – Jack-up (Self-elevating) Installations: Review and Location Approval Using Desktop Risk Assessments in lieu of Undertaking Site Soil Borings.

18.6.3 In the absence of reliable advance soil data, the jack-up operator must exercise extreme caution during preloading and pre-driving, and the jack-up should remain with the hull partly buoyant or elevated to the lowest practicable airgap, so that it can be refloated quickly should the investigation and analysis reveal that the foundation is unsuitable or if rapid settlement occurs.

18.6.4 A jack-up should not be elevated above the lowest practicable working airgap or to the survival airgap on any location until the soil investigation and the geotechnical assessment have progressed to the point at which the level of confidence in the integrity of the jack-up foundation has been formally declared satisfactory by a competent person. It should be recognised that on-site soil investigation alone may prove inadequate and that the results of on-shore laboratory analysis of samples may be needed, before this level of confidence is achieved.

18.6.5 The lack of adequate advance soil data means that the risk of encountering unsuitable foundation conditions cannot be reduced to a level that is as low as reasonably practicable until the soils investigation and analysis is complete. Therefore, soils investigations undertaken from permanently manned jack-ups should only be attempted with towing vessel(s) in attendance and in periods of benign weather, which will allow the jack-up to be refloated and moved to shelter or an alternative safe elevated location at any time.

18.6.6 For unmanned jack-ups, where the crew are routinely accommodated on shore between shifts, the requirement to remove the jack-up before conditions for jacking and refloating are exceeded can be waived if the following conditions are complied with:

- It has been established by a competent person through review of the desktop study and/or the progress of the soils investigation that the risk of encountering unsuitable foundation conditions is low
- A repeated preload operation has exposed no problems, and leg penetrations are approximately even
- The jack-up is capable of withstanding the 10-year storm (foundation-bearing capacity assumed to be adequate), and the hull is raised to comply with the 50-year airgap requirement
- Site-specific weather forecasts stating a high level of confidence are being monitored, and all personnel are removed from the jack-up prior to the onset of weather conditions predicted to exceed the limit for safe disembarkation
- There is no risk to personnel, and the consequences of catastrophic weather damage to the jack-up and the potential threat to the environment and to shipping, installations, and property in the vicinity have been formally assessed by the site developer and the jack-up owner/operator.

18.7 Elevated operations

18.7.1 Elevated operations shall not begin until preloading has been completed and the unit has been elevated to the working airgap in accordance with the provisions of Section 18.5 of these guidelines.

18.7.2 Receipt and review of weather forecasts (Section 18.3) shall be continued throughout the period elevated on location.

18.7.3 The progress of elevated operations shall be closely monitored to ensure that weather conditions do not exceed the prescribed limits and to ensure that there is adequate time remaining to implement contingency plans for removal of the jack-up or for placing the unit in the elevated survival mode before the onset of adverse weather, as applicable.

18.7.4 The elevated load condition shall be calculated, and any changes in weight attributable to material loaded, discharged or consumed shall be recorded in such a manner that the individual leg loads for all stages of the elevated operation are known.

18.7.5 Hull inclination, leg penetration and leg loads shall be monitored and logged on a frequent and regular basis, by observation of jack pressures on units elevated by means of hydraulic jacks or by pinion load monitoring systems (if fitted) on jack-ups fitted with rack and pinion jacking systems. Elevated operations should be suspended in the event of:

- Hull inclination (longitudinal or transverse) exceeding allowable limits
- Unexplained change in leg loads
- Increase in leg penetration until such time as the cause has been investigated and the change in condition is understood or has been rectified.

18.7.6 Consideration shall be given to the potential impact of seabed scour on the integrity of the jack-up foundation over time. Particular consideration shall be given to the potential for movement of seabed soils caused by currents or waves. Where risk of such conditions is deemed to exist, the jack-up foundation analysis shall include an assessment of the level of change that may affect foundation stability. The integrity of the foundation is to be tested by repeating the preload operation, following a storm or other event that may have adversely affected the strength of the soil supporting the jack-up.

18.7.7 At locations where potential for seabed scour exists, an increase in leg penetration, inclination and/or loss of hydraulic jack pressure or reduction of pinion load may occur. Scour effect may create a requirement for frequent operation of the jacking system, as adjustments to leg heights become necessary to maintain elevated stability. In such cases, a suitable ‘bedding-in’ period must be allowed for, and elevated operations should not be attempted until the leg penetration has reached a depth at which the rate of additional penetration caused by scour has reduced to a manageable level.

18.7.8 For jack-ups fitted with tubular truss-type legs, the uneven removal of soil below the spudcans through scour may create eccentric loadings, and for this reason it is essential to monitor RPD on a frequent and regular basis and to take corrective action to relieve leg stress if necessary.

18.7.9 If any unexpected increase in leg penetration or inclination occurs during elevated operations, then all operations should be suspended immediately and expert geotechnical advice should be obtained. Jacking of the unit should only be undertaken after consultation with experts. Subject to the provision of expert advice, the hull may be lowered to the lowest practicable airgap until the cause of the settlement has been investigated and rectified. After the jack-up has been stabilised, the preload operation must be repeated.

18.7.10 Sea fastenings for cargo (particularly modules subject to high wind loads) should not be removed until lift rigging is connected and lifting operations are ready to proceed.

18.7.11 Prior to commencing heavy-lift operations, the elevated load condition of the unit should be checked by calculation and, for units elevated by means of hydraulic jacks, by equalising the jack pressures or, for units fitted with rack and pinion systems, by equalising pinion torques. In all cases, it shall be verified that the heavy-lift operation will not cause the centre of gravity offset limits to be exceeded at any point during the lifting, or cause individual leg loads to approach or exceed the allowable operating load or the load applied during preloading, with an appropriate margin of safety.

19 Emergencies and Contingencies

19.1 Lifesaving appliances, firefighting appliances and radio installations

19.1.1 Jack-ups shall be fitted with lifesaving and firefighting appliances and radio installations in accordance with their registry, class and certification. Typically, the following standards will be applied as appropriate.

- IMO MODU Code for the Construction and Equipment of Mobile Offshore Drilling Units, Consolidated Edition, 2009
- IMO International Convention on the Safety of Life at Sea (SOLAS), 1974
- MCA Small Commercial Vessel and Pilot Boat (SCV) Code (see MGN 280).

19.1.2 Whether required by statutory regulation or otherwise, permanently manned jack-ups fitted with certified crew accommodation, including modular accommodation that is occupied by project personnel or visitors, shall, as far as practicable, be fitted with survival craft and means of evacuation and escape complying with the IMO MODU Code, Chapter 10.

19.1.3 In the case of a jack-up on which, due to size or configuration, lifeboats and launching arrangements cannot be fitted, liferafts complying with the requirements of IMO SOLAS 74 Regulations III/39 or III/40, served by launching devices complying with the requirements of Regulations III/48.5 or III/48.6, shall be fitted, and these shall be of such aggregate capacity as will accommodate the total number of persons on board if:

- All of the life rafts in any one location are lost or rendered unusable
- All of the life rafts on any one side, any one end or any one corner of the unit are lost or rendered unusable.

19.1.4 If two widely separated fixed steel ladders extending from the deck to the waterline when the unit is elevated cannot be installed, then alternative means of escape, with sufficient capacity to permit all persons on board to descend safely to the waterline, shall be provided.

19.2 Emergency procedures, training and drills

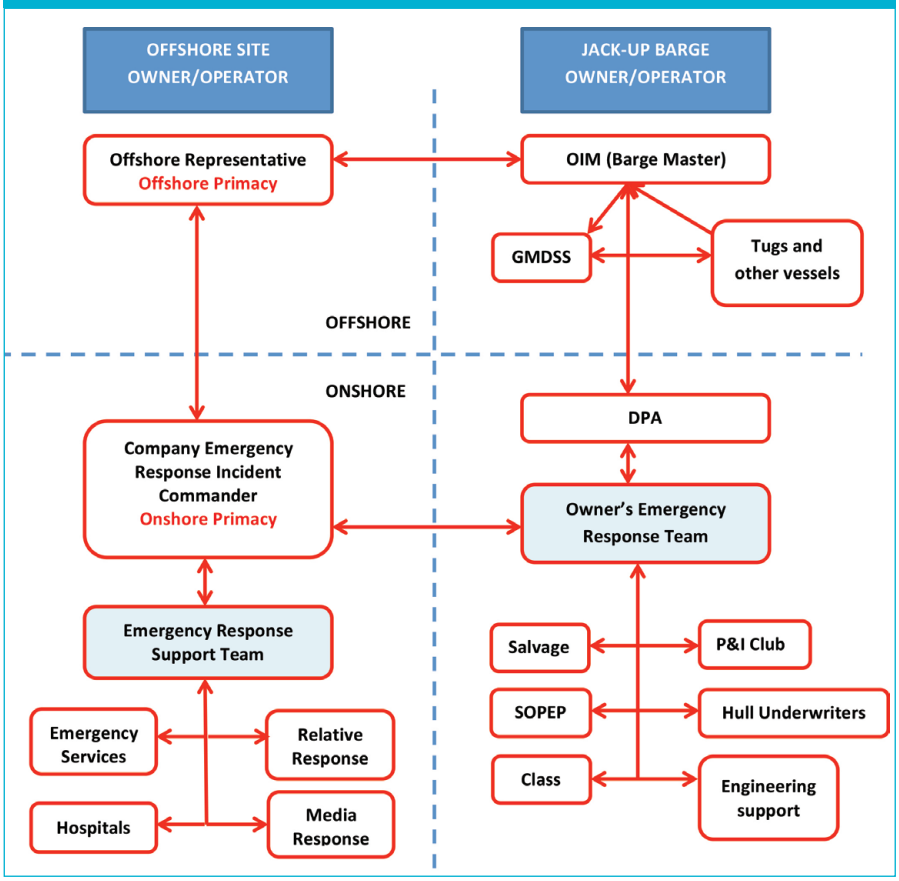
19.2.1 Whether required by statutory regulation or otherwise, all jack-ups fitted with permanent crew accommodation and/or modular accommodation that are occupied by project personnel or visitors shall comply with the provisions contained in the IMO MODU Code with respect to the following (chapters and section numbers refer to numbering in the MODU Code):

- Emergency procedures (Chapter 14, Section 14.8)
- Emergency instructions (Chapter 14, Section 14.9)
- Training manuals (Chapter 14, Section 14.10)
- Practice musters and drills (Chapter 14, Section 14.11)
- On-board training and instructions (Chapter 14, Section 14.12)
- Records (Chapter 14, Section 14.13).

19.3 Site-specific Emergency Response Plan

19.3.1 Site-specific Emergency Response Plans (ERPs) shall be developed for jack-ups operating on site. Emergency Response Plans are likely to involve local emergency services such as the coastguard, RNLI, fire, police, ambulance, harbour master, and local towage, salvage and pollution response services. Contact should be made with these services to coordinate plans prior to mobilising the jack-up. Following mobilisation, joint exercises should be conducted if practicable. A typical ERP organisation chart is shown in Figure 19.3.1.

Figure 19.3.1: Typical organisation of an Emergency Response Plan



19.3.2 Guidance can be found in MCA MGN 371 – Offshore Renewable Energy Installations (OREIs) Guidance on UK Navigational Practice, Safety and Emergency Response Issues and the supporting note Offshore Renewable Energy Installations Emergency Response Cooperation Plans (ERCoP) for SAR Helicopter Operations.

19.3.3 Flow charts describing the actions to be taken in response to specific types of emergency are included in RenewableUK's Guidelines for Health & Safety in the Wind Energy Industry Sector – Appendix 1.

19.3.4 Plans should be based on the results of a documented HAZID and should be developed following consultation with local emergency services to cover all foreseeable emergency situations including, but not limited to:

- Extreme storms
- Evacuation and escape
- Medical aid and evacuation of individuals
- Man overboard
- External response to jack-up emergencies (common perils such as fire, collision, flooding, breaking adrift, punch-through, settlement, etc.)
- External response to pollution (in addition to the jack-up's SOPEP)
- Notifications, contact details and incident reporting.

19.4 Route- and site-specific contingency plans for transit and positioning

19.4.1 Contingency plans specific to the proposed transit and positioning operations shall be contained in the Procedure Document and should include:

- Forecast of or unexpected onset of adverse weather worse than or equal to prescribed criteria
- Motions afloat approaching prescribed limits
- Failure of or damage to sea fastenings and grillage

- Deviation to designated safe havens en route
- Tug breakdown
- Towing equipment failure
- Jacking system machinery and/or power failure
- Mooring equipment failure
- Survey equipment failure
- Unexpected installation behaviour (leg penetration not as anticipated)
- Pollution response (for units not provided with a Shipboard Oil Pollution Plan (SOPEP))
- Communications equipment failure
- Notifications, contact details and incident reporting.

19.5 Site-specific contingency plans for elevated operations

19.5.1 Contingency plans specific to the proposed elevated operations shall be contained in the Procedure Document and should include:

- Forecast or unexpected onset of adverse weather worse than or equal to prescribed criteria
- Jacking system failure
- Main power failure
- Settlement of leg footings and/or leg misalignment and binding
- Removal of the jack-up to a safe haven
- Crane structural or machinery failure with lift suspended
- Notifications, contact details and incident reporting.

19.6 Ship emergency response

19.6.1 Under the provisions of the ISM Code, self-propelled jack-ups (as ships) are required to have in place a ship emergency response service contactable on a 24/7 basis through the designated person ashore (DPA). This service may be provided by a company's competent person (naval architect or specialist) or by an external company. The service is intended to provide the vessel's master with a swift and effective response in the form of practical advice, support and backup technical services in the event of unexpected incidents such as grounding, collision, flooding, fire or explosion. Consideration should be given to the provision of a similar response service for all jack-up operations, whether required by statutory regulation or otherwise.

20 Hazard Identification and Risk Assessment

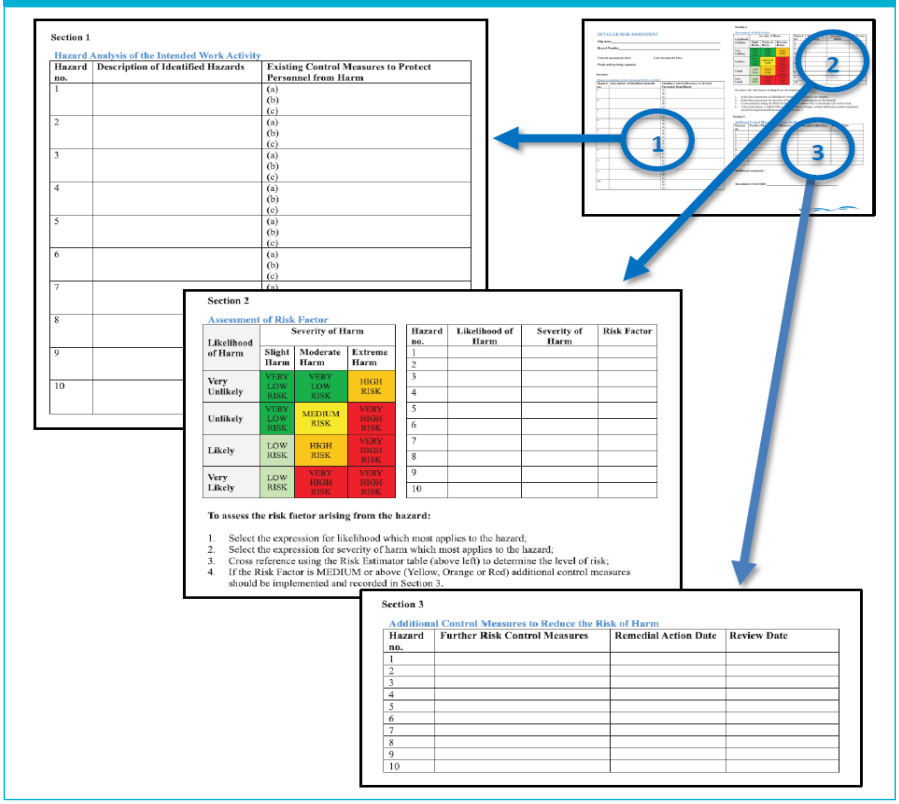
20.1 Modern safety legislation places responsibility on site developers, contractors and jack-up owners/operators to identify and manage the risks associated with their equipment and operations, and to demonstrate that they are doing so in a safe and effective manner. This has led to the use of formal risk assessment procedures as the start of the risk management process.

20.2 The structure and discipline of the risk assessment technique will vary depending upon characteristics of the equipment and the complexity of the proposed operation. The assessment may involve a Hazard Identification Study (HAZID), a Hazard and Operability Study (HAZOP) or any other suitable process that has been jointly agreed upon and is formally recorded by the parties involved. Comprehensive guidance in the conduct of this process is widely available elsewhere and is not covered in this document. Whatever technique is used, there is a fundamental requirement to understand the particular risks that are specific to the operation of jack-ups.

20.3 The purpose of this final section of the guidelines is to identify common hazards that are specific to the operation of jack-ups. The potential consequences of an encounter with these hazards are listed, together with existing control measures that can be implemented through compliance with the technical guidance contained in the previous sections.

20.4 The form that has been used for this purpose is the interactive form available from the UK MCA entitled Detailed Risk Assessment, which can be downloaded at www.dft.gov.uk/mca/annex1.3-3.pdf (See Figure 20.1). There is no specific requirement to use this particular form, and similar formats in regular use by most site developers, contractors and jack-up operators are equally suitable.

Figure 20.1: UK Detailed Risk Assessment



Section 1

Hazard Analysis of the Intended Work Activity

Hazard no.	Description of Identified Hazards	Existing Control Measures to Protect Personnel from Harm
1		(a) (b) (c)
2		(a) (b) (c)
3		(a) (b) (c)
4		(a) (b) (c)
5		(a) (b) (c)
6		(a) (b) (c)
7		(a)
8		
9		
10		

Section 2

Assessment of Risk Factor

Likelihood of Harm	Severity of Harm		
	Slight Harm	Moderate Harm	Extreme Harm
Very Unlikely	VERY LOW RISK	VERY LOW RISK	HIGH RISK
Unlikely	VERY LOW RISK	MEDIUM RISK	VERY HIGH RISK
Likely	LOW RISK	HIGH RISK	VERY HIGH RISK
Very Likely	LOW RISK	VERY HIGH RISK	VERY HIGH RISK

Hazard no.	Likelihood of Harm	Severity of Harm	Risk Factor
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

To assess the risk factor arising from the hazard:

1. Select the expression for likelihood which most applies to the hazard;
2. Select the expression for severity of harm which most applies to the hazard;
3. Cross reference using the Risk Estimator table (above left) to determine the level of risk;
4. If the Risk Factor is MEDIUM or above (Yellow, Orange or Red) additional control measures should be implemented and recorded in Section 3.

Section 3

Additional Control Measures to Reduce the Risk of Harm

Hazard no.	Further Risk Control Measures	Remedial Action Date	Review Date
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

20.5 The hazards, potential consequences and existing controls listed in the following examples for Section 1 of this form of risk assessment are specific to jack-up operations. The list is not exhaustive and should be used only as a guide. Duty holders should develop a complete risk assessment that accounts for all the hazards that are common to all types of vessel and to each task undertaken.

20.6 In the following tables an incident frequency range from reasonably probable to remote has been considered, with the consequences in each case listed from serious to reasonably credible, based on actual industry experience.

20.7 When considering the additional control measures that should be implemented it is important to remember that the Health and Safety at Work Act etc. (HSWA) requires that the risk has been reduced to a level that is as low as reasonably practicable (ALARP).

20.8 The risk of personal injury has not been specifically addressed at this level, but such risk is self-evident from inspection of the possible consequences in each case. Every care should be taken to ensure that risk assessments are fully developed to include an assessment of criticality, together with calculation of risk factors and recommendations for additional control measures where necessary.

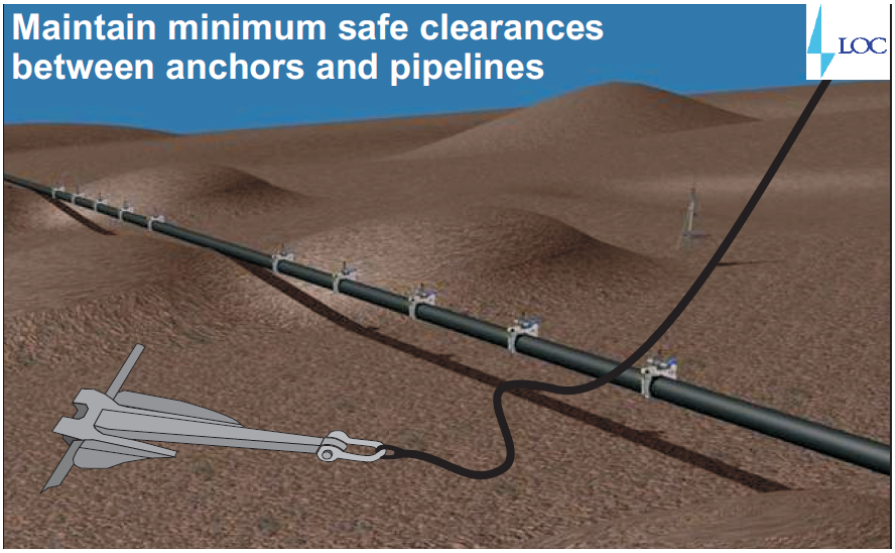
Activity being assessed: TRANSIT AFLOAT
Section 1: Hazard analysis of the intended activity

Hazard No.	Description of identified hazards and potential consequences	Existing control measures
1	Deteriorating weather conditions	
	• increased and accelerated motions • pounding and slamming • waves breaking on deck • shifting equipment and liquid spills	(a) Class-approved design limits for transit afloat (b) Method statement stating limits for transit (c) Route-specific high-resolution weather forecasts (e) Securing of all loose gear and equipment
2	Gale-force winds and rough seas	
	• increased and accelerated motions • damage to project deck cargo • failure of equipment and cargo sea fastenings • shifting cargo damages hatches or tank vents • loss of watertight integrity	(a) All controls listed above (b) Strength calculations for transport motions (c) Competent sea fastening design and inspection (d) Limit for transit set lower than design criteria (e) Closing all watertight doors, ports and hatches
3	Storm conditions	
	• increased and accelerated motions • breakage or loss of survival craft • leg structural failure • hull structural failure in way of leg guides • progressive flooding, capsize and sinking	(a) All controls listed above (b) Alteration of course to reduce motions (c) Passage plans with shelter points en route (d) Shelter points identified en route (e) Compliance with jack-up stability criteria

Activity being assessed: POSITIONING AFLOAT USING TUGS AND MOORINGS

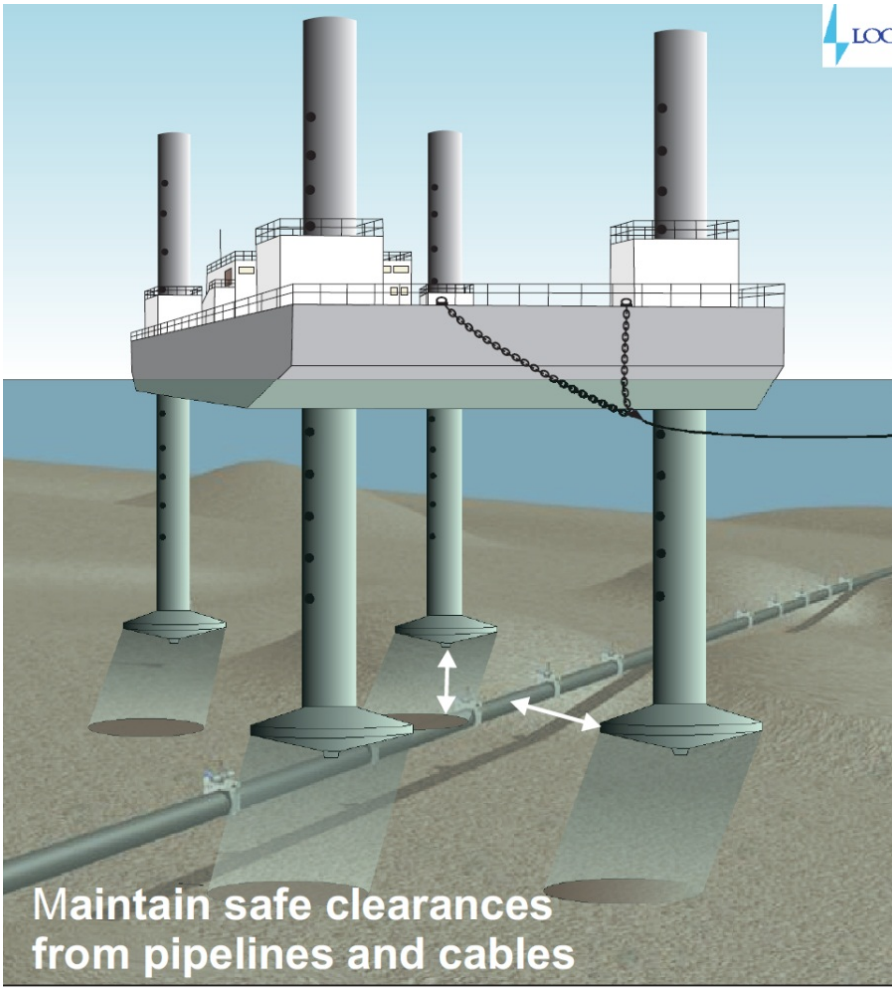
Section 1: Hazard analysis of the intended activity

Hazard No.	Description of identified hazards and potential consequences	Existing control measures
1	Jack-up collision with surface structure	
	• Damage to surface structure (turbines, etc.) • Damage to structure foundation • Damage to jack-up	(a) Suitable tugs and towing arrangements (b) Safe anchor-handling procedures (c) Certified & experienced tow master & tug masters (d) Compliance with mooring guidelines (e) Compliance with minimum safe clearances (f) Calibrated DGPS navigation survey system (g) Environmental limits set for positioning (h) Competent planning for approach and positioning
2	Leg-footing contact with pipelines or cables	
	• Damage to pipelines or cables • Breakage of oil pipelines resulting in pollution • Damage to jack-up legs and spudcans	(a) All controls listed above (b) Site drawings verified accurate as built (c) Recent bathymetric and side-scan survey (d) Pipeline and cable exclusion zones identified (e) Continuous monitoring of overall leg draft (f) Use of echo sounders
3	Anchors/moorings contact with pipelines	
	• Damage to pipelines or cables • Breakage of oil pipelines resulting in pollution • Loss of mooring wires and anchors	(a) All controls listed above (b) Competent mooring plans (c) Mooring catenary analysis (d) Use of line buoys (damage preventer buoys) (e) Tug Management System (TMS) (f) Anchor position and drag monitoring



Activity being assessed: POSITIONING AFLOAT – SELF-PROPELLED JACK-UP
Section 1: Hazard analysis of the intended activity

Hazard No.	Description of identified hazards and potential consequences	Existing control measures
1	Collision with surface structure	
	• Damage to surface structure (turbines, etc.) • Damage to structure foundation • Damage to jack-up	(a) DP system approved by Classification Society (b) Masters and deck officers with DP endorsements (c) DP Operating Manual and FMEAC report (d) DP trials prior to approach (e) Compliance with minimum safe clearances (f) Calibrated DGPS navigation survey system (g) Environmental limits set for positioning (h) Competent planning for approach and positioning
2	Collision with subsea pipelines or cables	
	• Damage to pipelines or cables • Breakage of pipelines causing pollution • Damage to jack-up legs and spudcans	(a) All controls listed above (b) Site drawings verified accurate as built (c) Recent bathymetric and side-scan survey (d) Pipeline and cable exclusion zones identified (e) Continuous monitoring of overall leg draft (f) Anchor position and drag monitoring



Activity being assessed: TRANSIENT CONDITION – JACKING AND PRELOADING

Section 1: Hazard analysis of the intended activity

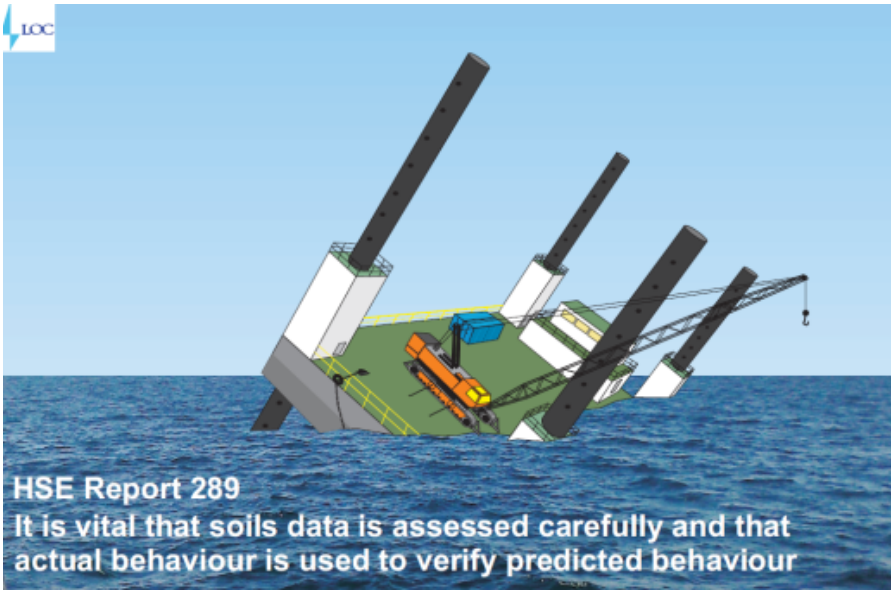
Hazard No.	Description of identified hazards and potential consequences	Existing control measures
1	Contact with footprint, slope or scour pit	
	• Sliding, as footings engage seabed • Leg damage through eccentric footing loads • Leg misalignment and binding • Leg and guide damage through misalignment • Jacking system failure caused by leg misalignment	(a) Competent site assessment (b) Recent bathymetric and sonar survey (c) Plotting seabed gradients and scour pits (d) Plotting previous jack-up footprints (e) RPD monitoring (truss-type legs) (f) Calibrated DGPS navigation survey system
2	Contact with pinnacle rocks, reefs or boulders	
	• Sliding, toppling, as footings engage seabed • Damage to spudcans dented by boulders	(a) All controls listed above (b) Investigation by ROV or divers' survey (c) Avoidance procedure and minimum safe clearance (d) Boulder removal procedure
3	Contact with seabed debris, including UXO	
	• Damage to legs and spudcans • Catastrophic damage caused by explosion	(a) All controls listed above (b) Gradiometer survey and interpretation (c) Desktop study and UXO risk assessment (d) Avoidance procedure and min. safe clearance (e) Object investigation and removal procedure
4	Leg impact on seabed	
	• Leg damage through impact on seabed • Loss of jacking capability	(a) Class-approved limits for engaging the seabed (b) Limits based on leg/bottom impact analysis
5	Jacking system mechanical or power failure	
	• Cannot elevate above the wave crests • Cannot raise legs and move to shelter	(a) IACS Class notation 'self-elevating' (b) Class approval for design and Class surveys (c) Planned maintenance system (d) Routine inspections and tests (e) Provision of manuals and instructions (f) Compliance with the operating manual (g) Experienced jacking engineers (h) Hull motion monitoring (i) Leg load and hull inclination monitoring
6	Punch-through	
	• Sudden uncontrolled inclination • Heavy items break loose • Structural damage to legs and hull • Collision with adjacent fixed structure • Loss of jacking capability • Inclination prevents launch of survival craft • Inclination prevents helicopters landing • Flooding, capsize and sinking	(a) Geophysical survey fit for purpose (b) Geotechnical investigation fit for purpose (c) Competent load–penetration assessment (d) Lowest practicable airgap for preloading (e) Compliance with operating manual instructions (f) Competent and experienced jacking engineers (g) Adequate length of weather window (h) Leg load and hull inclination monitoring (i) Comparison of actual vs predicted leg penetration (j) Availability of competent geotechnical advice

Activity being assessed: ELEVATED OPERATIONS

Section 1: Hazard analysis of the intended activity

Hazard No.	Description of identified hazards and potential consequences	Existing control measures
1	Storm overload	
	• Loss of airgap • Sliding off location • Settlement and inclination • Structural failure • Overturning	(a) Geophysical survey fit for purpose (b) Geotechnical investigation fit for purpose (c) Meteorological extremes correctly identified (d) Class approval for jack-up design survival limits (e) Competent site-specific assessment (ISO 19905-1) (f) Compliance with site assessment recommendation (g) Compliance with operating manual instructions (h) Capability to place the jack-up in survival mode (i) Daily leg load calculations (j) Continuous monitoring of inclination
2	Foundation instability caused by scour	
	• Uncontrolled settlement and inclination • Instability caused by loss of footing reaction • Stress caused by displacement of leg footing • Leg misalignment and binding • Unable to jack due to leg misalignment	(a) Site survey records on seabed change over time (b) Competent geotechnical assessment of scour (c) Scour monitoring and management procedure (d) Continuous monitoring of leg loads & penetration (e) Repeating preload after storm or delay
3	Punch-through resulting from scour	
	• Sudden inclination causes falls and injury • Heavy items break loose • Structural damage to legs and hull • Collision with adjacent fixed structure • Loss of jacking capability • Inclination prevents survival craft launch • Inclination prevents helicopters landing • Flooding, capsize and sinking	(a) All controls listed above (b) Effect of scour on soil bearing capacity assessed (c) Suspend operations during spring tidal currents (d) Adoption of a weather-restricted operation (e) Removal before foundation is compromised
4	Jacking system or leg structural failure	
	• Leg structural damage • Loss of jacking capability • Difficult recovery operation • Potential for collapse and total loss	(a) IACS Class notation 'self-elevating' (b) IACS Class approval for design and Class surveys (c) Planned maintenance system (d) Routine inspections and tests (e) Provision of jacking system manuals (f) Compliance with operating manual instructions (g) Competent and experienced jacking engineers (h) Leg load and hull inclination monitoring
5	Collision/impact by other vessel underway	
	• Leg structural damage • Loss of jacking capability • Difficult recovery operation • Potential for collapse and total loss	(a) Site marine control procedures (b) Notices to Mariners (c) Establishment of 500-metre safety zone (d) Competent planning of SIMOPS* (e) AIS signal transmitting (f) Navigation lights displayed and deck floodlights on (g) MOU obstruction lights displayed (h) Fog signal operating in reduced visibility (i) Radar watch and visual lookout maintained (j) VHF radio warnings transmitted

***SIMOPS: Simultaneous Operations, such as turbine installation and cable lay operations, being undertaken concurrently in the same location**


LOC
HSE Report 289
It is vital that soils data is assessed carefully and that
actual behaviour is used to verify predicted behaviour

Appendix A

Reference Documents

PLEASE CHECK FOR AMENDMENTS, REVISIONS AND LATEST EDITIONS

RenewableUK

H&S Guidelines: Offshore Wind and Marine Energy H&S – March 2013

H&S Guidelines: Vessel Safety – April 2012

Background Information on Jack-ups

Aberdeen College of Further Education
The Marine Operations of Self-elevating Platforms (Jack-up Barges)

Oilfield Publications Ltd
Oilfield Seamanship Series, Volume 2 – Jack-up Moving

Bennet & Associates and Offshore Technology Development Inc.
Jack-up Units: A Technical Primer for the Offshore Industry Professional

UK Government

The Health and Safety at Work etc. Act 1974

The Management of Health and Safety at Work Regulations 1999

The Construction (Design and Management) Regulations 2007 (CDM)

Provision and Use of Work Equipment Regulations 1998

Lifting Operations and Lifting Equipment Regulations 1998 (LOLER)

HSE Information Sheets

Jack-up (Self-elevating) Installations: Rack Phase Difference
www.hse.gov.uk/offshore/infosheets/is4-2007.pdf

Jack-up (Self-elevating) Installations: Floating Damage Stability Survivability
www.hse.gov.uk/offshore/infosheets/is6-2007.pdf

Jack-up (Self-elevating) Installations: Review and Location Approval Using Desktop Risk Assessments in lieu of Undertaking Site Soils Borings
www.hse.gov.uk/offshore/infosheets/is3-2008.pdf

The Safe Approach, Set-up and Departure of Jack-up Rigs to Fixed Installations
www.hse.gov.uk/foi/internalops/hid/spc/spctosd21.htm

Guidance on Procedures for the Transfer of Personnel by Carriers

HSE Health and Safety Guidance

Technical Guidance on the Safe Use of Lifting Equipment Offshore 2007

Safe Use of Lifting Equipment – Approved Code of Practice and Guidance

HSE Research Reports – OTO Series

SNAME 5-5B WSD 0: Comparison with SNAME 5-5A LRFD and the SNAME 5-5A North Sea Annex
www.hse.gov.uk/research/otopdf/2001/oto01001.pdf

Self-elevating Installations (Jack-up Units)
www.hse.gov.uk/research/otohtm/2001/oto01051.htm

Stability of Jack-ups in Transit
www.hse.gov.uk/research/otopdf/1995/oto95022.pdf

Environmental Considerations
www.hse.gov.uk/research/otohtm/2001/010

HSE RR series

Review of the Jack-ups Safety in Transit (JSIT) Technical Working Group
www.hse.gov.uk/research/rrhtm/rr049.htm

Guidelines for Jack-up Rigs with Particular Reference to Foundation Integrity
www.hse.gov.uk/research/rrhtm/rr289.htm

International Maritime Organization

MODU Code for the Construction and Equipment of Mobile Offshore Drilling Units 2008

International Safety Management (ISM) Code 2002

Safety of Life at Sea (SOLAS 1974)

International Convention on Load Lines 1966

Preventing Collisions at Sea Regulations COLREGS

Standards of Training, Certification and Watchkeeping for Seafarers (STCW) 1978

Prevention of Pollution from Ships MARPOL 1973/78

Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972

Incidents by Hazardous and Noxious Substances 2000 (HNS Protocol)

Control of Harmful Anti-fouling Systems on Ships (AFS) 2001

IMO MSC Circ. 645 *Guidelines for Vessels with Dynamic Positioning Systems*

IMO MSC Circ. 738 *Guidelines for Dynamic Positioning System (DP) Operator Training*

Marine and Coastguard Agency

MCA Code of Safe Working Practice for Merchant Seamen

MCA Small Commercial Vessel and Pilot Boat (SCV) Code (as currently set out in MGN 280)

MCA MGN 371, *Offshore Renewable Energy Installations (OREIs): Guidance on UK Navigational Practice, Safety and Emergency Response Issues*, and supporting note

MCA, *Offshore Renewable Energy Installations: Emergency Response Cooperation Plans (ERCoP) for SAR Helicopter Operations*

Society of Naval Architects and Marine Engineers

Society of Naval Architects and Marine Engineers (SNAME) Technical and Research Bulletin TR5-5A

Guidelines for Site-specific Assessment of Mobile Jack-up Units, Including the Recommended Practice and Commentary

International Organization for Standardization

ISO 19901-1: 2005(E), Part 1: MetOcean Design and Operating Considerations

ISO 19905-1: 2012, Site-specific Assessment of Mobile Offshore Units – Part 1: Jack-ups

GL Noble Denton

General Guidelines for Marine Projects
0001/ND Rev. 0 – June 2013

Seabed and Sub-seabed Data for Approvals of Mobile Offshore Units/MOU
0016/ND Rev. 7 – June 2013

Guidelines for Site-specific Assessment of Jack-ups
0009/ND Rev. 7 – June 2013

Guidelines for Marine Transportations
0030/ND Rev. 5 – June 2013

Guidelines for the Approval of Towing Vessels
0021/ND Rev. 9 – June 2013

Guidelines for Marine Lifting and Lowering Operations
0027/ND Rev. 0 – June 2013
A further update (to correct a typo) is imminent

Guidelines for Moorings
0032/ND Rev. 1 – June 2013

Guidelines for Offshore Wind Farm Infrastructure Installation
0035/ND Rev. 0 – June 2013

Det Norske Veritas

Det Norske Veritas (DNV) Rules for the Planning and Execution of Marine Operations:
- Load Transfer Operations (issued 1996)
- Towing (issued 1996)
- Special Sea Transports (issued 1996)
- Offshore Installation (issued 1996)
- Lifting (issued 1996)
- Subsea Operations (issued 1996)
- Transit and Positioning of Mobile Offshore Units (issued 2000)

Det Norske Veritas (DNV) Classification Notes Section 8: Foundation of Jack-up Platforms

Det Norske Veritas AS – Offshore Standard Marine Operations, General, DNV-OS-H101

Lloyds Register

Code for Lifting Appliances in a Marine Environment 2008

International Jack-up Barge Owners Association (IJUBOA)

IJUBOA Code of Practice

UK Offshore Operators Association

Guidelines for Safe Movement of Self-elevating Offshore Installations (Jack-ups)
April 1995, issue no.1

International Marine Contractors Association (IMCA)

Guidance on the Transfer of Personnel to and from Offshore Vessels
IMCA SEL 025, IMCA M 202

Guidance for the Positioning of Dynamically Positioned (DP) Jack-up Vessels on and off the Seabed
26 April 2013

North Sea Lifting (NSL)

Suitability of Cranes for Man-riding

UK Civil Aviation Authority

CAP 437: Standards for Offshore Helicopter Landing Areas (7th edition), May 2012

Appendix B

Definitions, Terms and Abbreviations

Airgap	Vertical distance between the bottom of the rig hull and the water surface
Airgap related to LAT	Vertical distance between the bottom of the hull and the level of LAT
Centroid of the legs	Point on a three-legged jack-up that is horizontally equidistant from each leg centre
Certified Accommodation	Permanent or temporary certified crew accommodation comprising sleeping cabins with sanitary facilities, galley, mess room and recreation spaces, intended for occupation by the crew and project workers. This specifically excludes temporary or permanent containerised or modular units installed on the jack-up to provide limited shelter, feeding and sanitary facilities for personnel that are not routinely accommodated on board.
Chart Datum	The datum to which the soundings (water depths) are reduced on the location bathymetric chart and to which must be added the tidal height to obtain the actual depth of water at any point in time
Class Notation	Series of symbols, letters and numbers assigned by the Classification Society to indicate the details of the class assigned to the vessel (for example, ABS Self-elevating ✠A1, Lloyds ✠100A1, etc.)
Competent Person	A person having suitable and sufficient experience in the fields that they work in to understand the hazards and risks involved with the work, the operating environment and the type of people they need to work with, and having sufficient training to be able to communicate the results of their assessment to all the people necessary (in writing if necessary) in a clear and comprehensible manner. The Management of Health and Safety at Work Regulations 1999 require every employer to appoint one or more competent persons to assist with putting measures in place to ensure legal compliance. The competent person can be either an individual or a company providing these services. The person is regarded as competent if they have sufficient training and experience or knowledge and other qualities to properly assist the employer to meet his safety obligations. A competent person is likely to be a corporate body rather than an individual because of the necessary requirement to have access to a wide variety of technical expertise and specialist services. One indication of competence is accreditation and certification.

Contingency Plan	Pre-considered response to a deviation from an intended course of action
Dynamic Amplification Factor	The factor by which the ‘gross weight’ is multiplied, to account for accelerations and impacts during the lifting operation
Elevated Operation	Jack-up marine operation conducted after the unit has been jacked, preloaded and elevated to a working airgap
Extreme Wave Crest Elevation	The maximum elevation of the storm wave crest above LAT for the return period specified
Field Move	A jack-up move undertaken in the vicinity of a work site, which can be completed within the period covered by a single reliable weather forecast (commonly 12–24 hours)
Freeboard	The vertical height of the assigned deck line above a vessel’s waterline
Flag State	Nation operating the registry of vessels in which a jack-up has a valid listing
Footprint	Sea floor depression that remains when a jack-up is removed from a site
Foundation	Soil supporting a jack-up spudcan or leg
Foundation Fixity	Rotational restraint offered by the soil to the spudcan
Foundation Stability	Ability of the foundation to provide sufficient support to remain stable when subjected to actions and incremental deformation
Geohazard	Regional or local seabed or subsoil conditions or features capable of causing difficulty during jack-up installation and/or causing the jack-up to become unstable after installation and/or causing damage to a jack-up
Gog Line (or Rope)	System used for the control of the towline to reduce the risk of girding. Commonly a line led from a winch drum or fixed connection through a deck fitting aft of the towing winch and connected to the towing wire so as to control the point at which any transverse load imposed by the towline angle acts upon the towing vessel
Grillage	The temporary structural members that support the module and distribute the vertical static and dynamic loads over the barge or vessel framing
Gross Weight	The calculated or weighed weight of the structure to be lifted, including a reserve factor
Harbour Move	Jack-up move conducted within port limits
Hook Load	The hook load is the ‘lift weight’ plus the ‘rigging weight including dynamic factor’

Jack Frame	Jack-up structure at each leg, containing the jacking system (also called the 'jack-house')
Jacking	Operation of the jacking system
Jacking down	Lowering the rig hull when in the elevated mode
Jacking up	Elevating the rig hull when in the elevated mode
Jacking legs down	Jacking the rig hull up
Jacking hull down	Jacking the legs up.
Raising legs	Jacking legs up when in the floating mode
Lowering legs	Jacking legs down when in the floating mode
Leg handling	Jacking legs up or down in the floating mode
Jack-up	Ship or barge fitted with legs and jacking machinery, providing the capability to self-elevate the vessel above the sea surface
Leg Bind or Leg Binding	Excessive friction between the leg chords and leg guide, usually caused by the rig being out of level and/or by the legs being bent or inclined
Leg Braces	Horizontal or diagonal tubular members of the leg structure, connecting the leg chords
Leg Chords	Vertical tubular members of the leg structure of braced-type legs
Leg Footing Penetration Curve	Graphic representation based on geotechnical analysis, showing the predicted leg footing load vs depth of leg penetration
Leg Footing Reaction	Equal to the portion of the jack-up's elevated weight, including environmental loads, imposed on any one leg, plus the leg and footing weight minus the leg buoyancy
Leg Load	Portion of the jack-up's elevated weight, including environmental loads, supported by a particular leg
Location Approval	Certificate and report providing location details and certifying Warranty Approval for installation of a rig at a specific location
Location Move	Jack-up move not falling into the definition of an ocean tow or a Field Move, and generally undertaken with the unit in field move configuration as a Weather-restricted Operation within the period of a reliable weather forecast; or, A move between two locations, which cannot be completed within the period covered by a single forecast but which can safely be undertaken with the unit in field move configuration, having due regard for the availability of standby locations or shelter points en route
Marine Coordinator	Person appointed by the site owner to monitor and control marine traffic operating on or in transit through a work site

Marine Warranty Surveyor	Marine surveyor assigned to review procedures and to attend marine operations, commonly to satisfy an insurance warranty clause that states that the operation shall be approved by and conducted in accordance with the recommendations issued by a named Warranty Surveyor
Medivac	Evacuation of a sick or injured person
Metocean Study	Meteorological study of a specific area, carried out to determine the probable range of environmental conditions for specific return periods
Minimum Breaking Load	Minimum allowable value of 'breaking load' for a particular lifting operation
Mobile Offshore Unit	For the purposes of this document, the term includes non-drilling mobile jack-ups such as accommodation, construction and lifting barges
MODU Code	Code for the Construction and Equipment of Mobile Offshore Drilling Units, Consolidated Edition 2008
Module	A unit of cargo such as a jacket, integrated deck, topside components, pre-assembled units and items of equipment or parts thereof
Net Weight	The calculated or weighed weight of a structure, with no contingency or weighing allowance
Nomogram	Graphic representation indicating a jack-up's capacity to withstand defined environmental conditions in a range of water depths and with a range of leg penetrations
Permanently Manned Jack-up	Jack-up permanently manned by a crew (and project workers, if applicable) in which some or all personnel, both on-shift and off-shift, are accommodated on board and are not routinely transported to and from the shore at each shift change
Positioning (Jack-up)	Jack-up marine operation commencing from the time of arrival at a new location and continuing until the unit has completed jacking, preloading and elevating to the working airgap on a new elevated location or until the unit is safely moored afloat at a new location
Preloading	Installation of the leg footings or spudcans by vertical loading of the soil beneath a jack-up leg, with the objective of ensuring sufficient foundation capacity under assessment situations through to the time when the maximum load is applied and held. Note: three-legged jack-ups preload by taking water ballast on board. Jack-ups with four or more legs typically achieve foundation preload by carrying the hull weight on pairs of legs in turn. This procedure is known as pre-driving and generally does not require the addition of water ballast. For the purposes of these guidelines, no distinction is made between preload and pre-drive.

Punch-through	Rapid, uncontrolled vertical leg movement due to soil failure in strong soil overlying weak soil. Punch-through is a term often incorrectly applied to any event whenever significant vertical footing settlement is observed over a relatively short period of time. During these events differential footing penetrations usually occur, which cause inclination and may dramatically affect the stability of the jack-up. Punch-through can result in structural failure and even total loss.
Rack Chocks	Leg fixation device engaged to form a strong connection between the rig hull and legs for units fitted with rack and pinion jacking systems
Rack Phase Difference	Difference in vertical height between individual chords on one leg, on units with braced-type leg structures
Recognised Classification	Member of the International Association of Classification Societies (IACS), recognised by the European Union and with recognised and relevant competence and experience in jack-ups, and established rules and procedures for classification and certification of such installations used in petroleum-related activities
Recognised Maritime Nation	A nation with maritime laws, which maintains a Registry of Ships and has adopted the IMO Conventions listed in Section 2.6
Reflected Waves	Wind- or swell-generated waves that have been reflected through direct impact with obstructions such as cliffs or breakwaters
Refracted Waves	Wind- or swell-generated waves that have been influenced in direction by the geophysical characteristics of the coastline or seabed
Riding Crew	Marine crew assigned to an unmanned barge during a tow
Rig Mover	Person appointed to be in charge of the planning and execution of a jack-up move
Scour	The process by which currents and waves cause the removal of sediments that surround seabed obstructions, where the soil removal rate exceeds that of replenishment. Sea floor soils comprising granular material (i.e., silts and sands) are susceptible to the process of scour where suitable current and wave conditions exist.
Sea Fastenings	In general, the temporary structures or tie-downs that secure the module for transportation and berthing forces

Settlement	The settlement of jack-up leg footings into the seabed soil
Slow settlement	Leg settlement in which the rate at which one or more legs are penetrating is less than the rate at which the hull can be maintained in a level condition by lowering the hull on the other legs
Rapid settlement	Rapid uncontrolled leg settlement in which the rate at which one or more legs are penetrating exceeds the rate at which the hull can be maintained in a level condition by lowering the hull on the other legs
Slight settlement	Leg settlement in which the resulting inclination is less than one degree (1°)
Significant settlement	Leg settlement in which the resulting inclination is more than one degree (1°)
Significant Wave Height	Statistical measure of the height of waves in a sea state. The significant wave height was originally defined as the mean height of the highest one-third of the zero upcrossing waves in a sea state. In most offshore data acquisition systems the significant wave height is currently taken as $4\sqrt{m0}$ (where m0 is the Zeroth spectral moment; see ISO 19901-1: 2005, Definition 3.31) or 4σ, (where σ is the standard deviation of the time series of water surface elevation over the duration of the measurement, typically a period of approximately 30 minutes)
Site-specific Assessment	Evaluation of the stability and structural integrity of a jack-up and, where applicable, its seabed restraint or support against the actions determined in accordance with the requirements of ISO 19905-1: 2012
Spudcan	Very robust tank-like structure attached to the bottom of a jack-up rig's leg and forming the leg footing
Squat	Temporary increase in vessel's hull draft caused by change of trim when proceeding in shallow water above a certain speed
Survival Mode	Elevated condition achieved by a jack-up in which it is capable of remaining on location in extreme storm conditions, with all stresses remaining within allowable limits in accordance with the RP
Tidal Window	Period during a tidal cycle in which the tidal height provides adequate depth of water and/or current velocity not exceeding a prescribed value for a particular operation
Tow Master	Person, usually holding a Marine Certificate of Competency, assigned to control the towage, navigation and positioning of the rig afloat
Transit (Jack-up)	Jack-up marine operation commencing from the moment when lowering of the hull commences on departure from an elevated location, or when the last mooring line is recovered on departure from a location afloat, and continuing until arrival in the vicinity of a new location

Tug Management System	DGPS navigation survey system and telemetry that allow the positions of tugs, anchors and mooring lines to be displayed in real time on remote monitors
Unaccounted Weight	Portion of the vessel's total weight that has not been accounted for in the load calculations. The amount is calculated by subtracting the calculated displacement from the actual displacement, obtained by reading the hull draft marks with the rig afloat.
Unmanned Jack-up	Non-propelled jack-up barge that carries no permanent crew accommodated on board, which is not fitted with certified accommodation, and on which the crew and project workers are routinely transported to and from the shore at the end of each shift
Unrestricted Mode	A jack-up engaged on an unrestricted operation
Unrestricted Operation	A marine operation that cannot be completed within the limits of a favourable weather forecast (generally less than 72 hours). The design weather conditions must reflect the statistical extremes for the area and season.
Variable Load	Portion of a jack-up's elevated weight that is variable, i.e., not forming part of the fixed structure and machinery. This includes fuel, lubricants, fresh water, ballast, drilling materials and equipment, crew and stores.
Visitors	Personnel on board the unit that do not form a part of the vessel's crew
Weather-restricted Operation	A marine operation that can be completed within the limits of a favourable weather forecast (generally less than 72 hours), taking contingencies into account. The design weather conditions need not reflect the statistical extremes for the area and season. A suitable factor should be applied between the design weather conditions and the operational weather limits.
Weather Window	Forecast period of generally benign weather, with wind and waves not exceeding the prescribed limits for a particular operation

ABBREVIATIONS

ACoPs	Approved Codes of Practice (UK HSE)
AFS	Anti-fouling Systems
AIS	Automatic Identification System
AISC	American Institute of Steel Construction
ALARP	As low as reasonably practicable (with reference to risk reduction)
AOGB	Area outside Great Britain
BL	Breaking Load
BP	Bollard Pull
CCTV	Closed Circuit Television
CDM (Regulations)	Construction Design and Management Regulations
CPT	Cone Penetrometer Test
DAF	Dynamic Amplification Factor, applied to lifted weights to account for the dynamic motion of vessels in marine lifting operations
DGPS	Differential Global Positioning System
DP	Dynamic Positioning
DPA	Designated Person Ashore
ECDIS	Electronic Chart Display and Information System
EEZ	Exclusive Economic Zone
ENG-1	UK Seafarers Medical Certificate
ERP	Emergency Response Plan
FMEA	Failure Mode and Effects Analysis
FMEAC	Failure Modes and Effects and Consequences Analysis
GMDSS	Global Maritime Distress and Safety System
HAT	Highest Astronomical Tide
HAZID	Hazard Identification Study
HAZOP	Hazard and Operability Study
HNS	Hazardous and Noxious Substances
Hs	Significant Wave Height
HSE	United Kingdom Health and Safety Executive
HSWA	Health and Safety at Work etc. Act
HUET	Helicopter Underwater Egress Training
IACS	International Association of Class Societies
IAPP	International Air Pollution Prevention
IJUBOA	International Jack-up Barge Owners Association
NOS	National Occupational Standard (United Kingdom)
ILO	International Labour Organization
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
IOPP	International Oil Pollution Prevention
ISM	International Safety Management (ISM Code)
ISPS	International Ship and Port Security
LAT	Lowest Astronomical Tide
LRFD	Load Resistance Factor Design
MC	Marine Coordinator
MCA	Maritime and Coastguard Agency (UK)
MDW	Module Design Weight
MGN	Marine Guidance Notices
MIN	Marine Information Notices
MLC	Maritime Labour Convention
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MOU	Mobile Offshore Unit

MSL	Mean Sea Level
MSN	Merchant Shipping Notices
OIM	Offshore Installation Manager, the person in charge of the jack-up
OPITO	Offshore Petroleum Industry Training Organisation
PPE	Personal Protective Equipment
PUWER	Provision and Use of Work Equipment Regulations 1998
RCS	Recognised Classification Society
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
RPD	Rack Phase Difference
RW	Rigging Weight, for lifting operations
SAR	Search and Rescue
SCV	Small Commercial Vessel Code (awaiting publication)
SF	Shear Force
SHL	Static Hook Load
SLR	Spot Location Report
SOLAS	Safety of Life at Sea (IMO Convention)
SOPEP	Shipboard Oil Pollution Emergency Plan
SPS	Special Purpose Ship
STCW 95	Standards of Training, Certification of Watchkeeping 1995
SWBM	Still Water Bending Moment
TPR	Towline Pull Required
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
UXO	Unexploded Ordnance
WGS 84	World Geophysical Survey 1984
WLL	Working Load Limit (same as SWL – Safe Working Load)

Appendix C

Jack-up Certificates, Manuals, Publications, Logs and Records

Certificates Required

Ref.	Certificate	Self-prop. Jack-up Ships	Permanently Manned and/or Classed Jack-ups	Unmanned Jack-ups with No Classification
	Registry	✔	✔	✔
	Flag State Inspection Report or MCA Inspection	✔	✔	✔
	ISM Certificate and Document of Compliance	✔	✘	✘
	Minimum Safe Manning Certificate	✔	✘	✘
	Builders Certificate	✔	✔	✔
	International Tonnage Certificate	✔	✔	✘
	International Load Line Certificate (or Exemption)	✔	✔	✔
	Annual Load Line Survey Report/ Endorsement	✔	✔	✘
	Certificate of Class (and Annual Endorsement)	✔	✔	✘
	Safety Construction Certificate	✔	✘	✘
	MOU Certificate or Safety Equipment Certificate Or: Safety Equipment – Class Statement of Facts	✔	✔	✘
	IOPP Certificate	✔	✔	✘
	IAPP Certificate	✔	✘	✘
	ISPS Certificate	✔	✘	✘
	Safety Radio Certificate	✔	✔	✘
	Radio License (GMDSS)	✔	✔	✔
	Radio Certificate of Shore-based Maintenance	✔	✔	✘
	Fast Rescue Craft Certificate	✔	✔	✘
	Lifeboats (Rigid Survival Craft) Certificates	✔	✘	✘
	Lifeboats Davits and Launching Gear Certificates	✔	✘	✘
	Inflatable Life Raft Service Certificates	✔	✔	✔
	Life Raft Launching Davit Certificates (if fitted)	✔	✔	✔
	Fixed Firefighting Appliances Certificate	✔	✔	✘
	Portable Firefighting Appliances Certificate	✔	✔	✔
	Crane Test Certificate Lifting Appliances Register – Annual inspection and Quadrennial Test	✔ ✔ ✔	✔ ✔ ✔	✔ ✔ ✔
	Sewage Plant Certificate	✔	✔	✘
	Garbage Management Certificate	✔	✔	✘
	Medical Drugs Certified Inventory	✔	✔	✘
	Deratisation or Deratisation Exemption Certificate	✔	✔	✘

A = Self-propelled Jack-up Ships
B = Permanently Manned and/or Classed Jack-up Barges
C = Unmanned and Non-classed Jack-up Barges

Safety and Security	**A**	**B**	**C**	**IMO and Other Publications**	**A**	**B**	**C**
Emergency Station Bills posted	✔	✔	✘	IMO SOLAS (1986 Consolidated)	✔	✔	✘
Safety Equipment Plans posted	✔	✔	✘	IMO Load Line Regulations (1986/81)	✔	✔	✘
Safety Equipment Signs posted	✔	✔	✔	IMO MERSAR Manual IMO Ship Routeing	✔	✘	✘
Evacuation and Escape Route Signs posted	✔	✔	✘	IMO Standard Marine Navigation Vocabulary	✔	✘	✘
Emergency Muster Points marked	✔	✔	✘	IMO Collision Regulations (1990)	✔	✘	✘
Survival Craft Launching Instructions posted	✔	✔	✔	IMO Bridge Procedures Guide	✔	✘	✘
Lifejacket Donning Instructions posted	✔	✔	✔	IMO Annex I: to MARPOL 73/78 (Oil)	✔	✔	✘
Health, Safety & Environmental Policy	✔	✔	✔	IMO Annex II: to MARPOL 73/78 (Noxious Subst.)	✔	✔	✘
Drug and Alcohol Policy	✔	✔	✔	IMO Annex III: Pollution by Harmful Substances	✔	✔	✘
Record of Emergency Drills	✔	✔	✘	IMO Annex IV: Pollution by Sewage from Ships	✔	✔	✘
Safety Manual	✔	✔	✔	IMO Annex V: to MARPOL 73/78 (Garbage)	✔	✔	✘
PPE Signs posted	✔	✔	✔	IMO IMDG Code (Consolidated Supplement)	✔	✔	✘
Accident/Incident Reports	✔	✔	✔	IMO ISPS Code	✔	✘	✘
Near-miss Reports	✔	✔	✔	MCA Code of Safe Working Practice	✔	✔	✔
Hazard Identification/Observation Reports	✔	✔	✔	**Bridge/Navigation Publications**			
Risk Assessments conducted/ recorded	✔	✔	✔	Navigation Charts	✔	✔	✘
Safety Meetings conducted/recorded	✔	✔	✔	Chart Correction Log	✔	✔	✘
Tool Box Talks conducted/recorded	✔	✔	✔	Pilot Books & Supplements	✔	✘	✘
Permits to Work posted	✔	✔	✘	Guide to Port Entry	✔	✘	✘
Visitors' Safety Briefing record	✔	✔	✘	List of Lights	✔	✘	✘
Tag Card System	✔	✔	✘	Admiralty List of Radio Signals (Vols. 1–6)	✔	✔	✘
Ship Security Plan	✔	✘	✘	International Code of Signals (1987)	✔	✔	✘
Gangway Crew/Visitors' Log	✔	✘	✘	Notices to Mariners	✔	✔	✘
Medical Log	✔	✔	✘	Flag State Marine Notices and Guidance Notes	✔	✔	✘
Plans, Manuals and Reports				Tide Tables	✔	✔	✘
Operating Company QA System	✔	✔	✔	Tidal Current Tables/Charts	✔	✔	✘
Company Instructions/Procedures	✔	✔	✔	Nautical Almanac	✔	✘	✘
Ship Safety Management System Manuals	✔	✔	✔	Navigation Tables	✔	✘	✘
Non-conformance & Corrective Action	✔	✔	✔	RPM/Speed Data	✔	✘	✘
Vessel Operating Manual	✔	✔	✔	Manoeuvring Data	✔	✘	✘
General Arrangement Plan/Capacity Plan	✔	✔	✔	Deck Log Book	✔	✔	✘
Crew Training Manuals/Records	✔	✔	✔	Rough Log	✔	✔	✘
Approved Stability Book	✔	✔	✔	Radio Log	✔	✔	✘
Stability Plan for Current Voyage/ Operation	✔	✔	✔	Night Order Book	✔	✘	✘
SOPEP Manual	✔	✔	✘	Passage Plans	✔	✘	✘
Garbage Management Plan	✔	✔	✘	Master/Pilot Exchange Form	✔	✘	✘
Engine Room and Machinery				Vessel Checklists (Arrival, Departure)	✔	✘	✘
Engine Log	✔	✔	✘	Operations Checklists (Jacking)	✔	✔	✔
Bunker Checklists	✔	✔	✘	Operations Checklists (DP, if DP vessel)	✔	✔	✘
Oil Record Book/Waste Oil Disposal	✔	✔	✘	Equipment Operation and Maintenance Manuals	✔	✔	✔
Machinery Operation & Maint. Manuals	✔	✔	✘	Complete Set of Drawings	✔	✔	✔

Appendix D

Jack-up Operating Manual (Recommended Contents)

Operating manuals containing guidance for the safe operation of the unit should be provided on board and be readily available to all concerned.

The manual should, in addition to providing the necessary general information about the unit, contain guidance on and the procedures for the operations that are vital to the safety and integrity of the unit.

The manual should be concise and be compiled in such a manner that it is easily understood. The manual should be provided with a contents list, an index and, wherever possible, be cross-referenced to additional detailed information in the forms of drawings, manufacturers' manuals and other readily available information for the safe and efficient operation of the unit. Detailed information contained in manufacturers' manuals (such as the Jacking System Manual) need not be repeated in the operating manual.

The operating manual should include the following information:

1) Description, particulars and principal dimensions

2) Organisation and responsibilities

3) General Arrangement Plan and Capacity Plan showing the location and centres of gravity of all tanks and stowage spaces

4) Plan showing the location of watertight and weather-tight boundaries, the location and type of all watertight and weather-tight closures, and the location of down flooding points

5) Limiting design data for the Floating Mode and the Elevated Mode

6) Operational limits and procedures, and guidance for the transition between the Floating Mode and the Elevated Operating Mode, and between the Operating Mode and the Elevated Survival Mode

7) Information and guidance on the preparation of the unit to avoid structural damage afloat and during the setting or retraction of the legs on or from the seabed

8) Information and guidance on jacking and preloading

9) Information and guidance on the preparation of the unit to withstand the extreme environmental limits associated with the limiting design data for the Elevated Mode described in (5) above

10) Lightship data, together with a list of inclusions and exclusions of semi-permanent equipment, and guidance for the recording of light weight changes, together with weight data and centre of gravity offset limits, including:

    Light weight
    Weight of movable items (cranes, pile gates/grippers, etc.)
    Weight of legs and leg footings
    Maximum allowable variable load afloat, jacking, preloading, operating and survival
    Maximum allowable displacement afloat

Maximum allowable elevated weight and maximum leg load for jacking
Maximum allowable elevated weight and centre of gravity limits for preloading
Maximum allowable elevated weight and centre of gravity limits for elevated operations
Maximum allowable elevated weight and centre of gravity limits for survival

11) Tank Sounding Tables showing capacities, vertical, longitudinal and transverse centres of gravity in graduated intervals, and free surface data for each tank

12) Stability information, including Hull Hydrostatic Properties and GZ Curves

13) Allowable Vertical Centre of Gravity Curve

14) Sample Stability and Trim Calculations, and guidance for maintaining stability afloat

15) Sample Elevated Load Calculations, and guidance for maintaining leg loads within design limits including leg load limits and/or centre of gravity limits for lifting operations

16) Acceptable structural deck loads

17) A plan and description of the towing arrangements for non-propelled vessels, together with guidance on safe towing operations

18) A description, schematic diagram and guidance for the operation of the bilge and ballast system (if fitted), together with a description of its limitations, such as draining of spaces not directly connected to the systems

19) Fuel oil storage and transfer procedures

20) Description and capacity of Main and Emergency Power Systems

21) Personnel transfer procedures

22) Limiting conditions for crane operations

23) Guidance on damage control for incidents of flooding and unexpected settlement.

Appendix E

Typical Spot Location Report (SLR)

Weather Consultancy
United Kingdom
Telephone No.
Facsimile No.
Email.

TYPICAL WEATHER CONSULTANCY

LOCATION REPORT

Report Reference:	TWC/SS/0000/R.01	Date:	19 June 2013
Descriptive Area:	Offshore Wind Farm	Latitude:	50° 04′ 33.35″ North
Return Period:	1, 10 & 50 years	Longitude:	005° 19′ 21.04″ West
Season:	All Year	Water Depth:	10.3 metres @ L.A.T.

The extremes likely to be reached or exceeded once, on average, every 10 & 50 years during the specified season are as follows:

WINDS	1 Year	10 Year	50 Year
1 minute mean at 10 m (m/sec)	30 m/s	36 m/s	42 m/s
3 second gust (m/sec)	36 m/s	40 m/s	53 m/s
WAVES			
Extreme Height (m)	8.2 m	9.3 m	10.5 m
Associated crest to crest period (secs)	6.0 s	6.8 s	7.5 m
Peak Period	6.4 s	6.9 s	7.8 s
Significant Height (m)	4.6 m	5.0 m	5.7 m
WATER LEVELS			
Wave crest elevation (m)	6.1 m	6.5 m	7.4 m
Tidal Rise (H.A.T.)	5.8 m	5.8 m	5.8 m
Storm Surge (m)	2.2 m	2.2 m	2.4 m
CURRENT			
Maximum surface current in downwind direction	1.4 m/s	1.4 m/s	1.4 m/s

The information contained in this report is believed to be correct and is issued in good faith, but Weather Consultancy cannot accept responsibility for any consequential loss or damage arising from any use that may be made of it.

Stormy Stan

For: Typical Weather Consultancy

Appendix F

Foundation Risks: Methods for Evaluation and Prevention
Source: ISO 19905-1: 2012

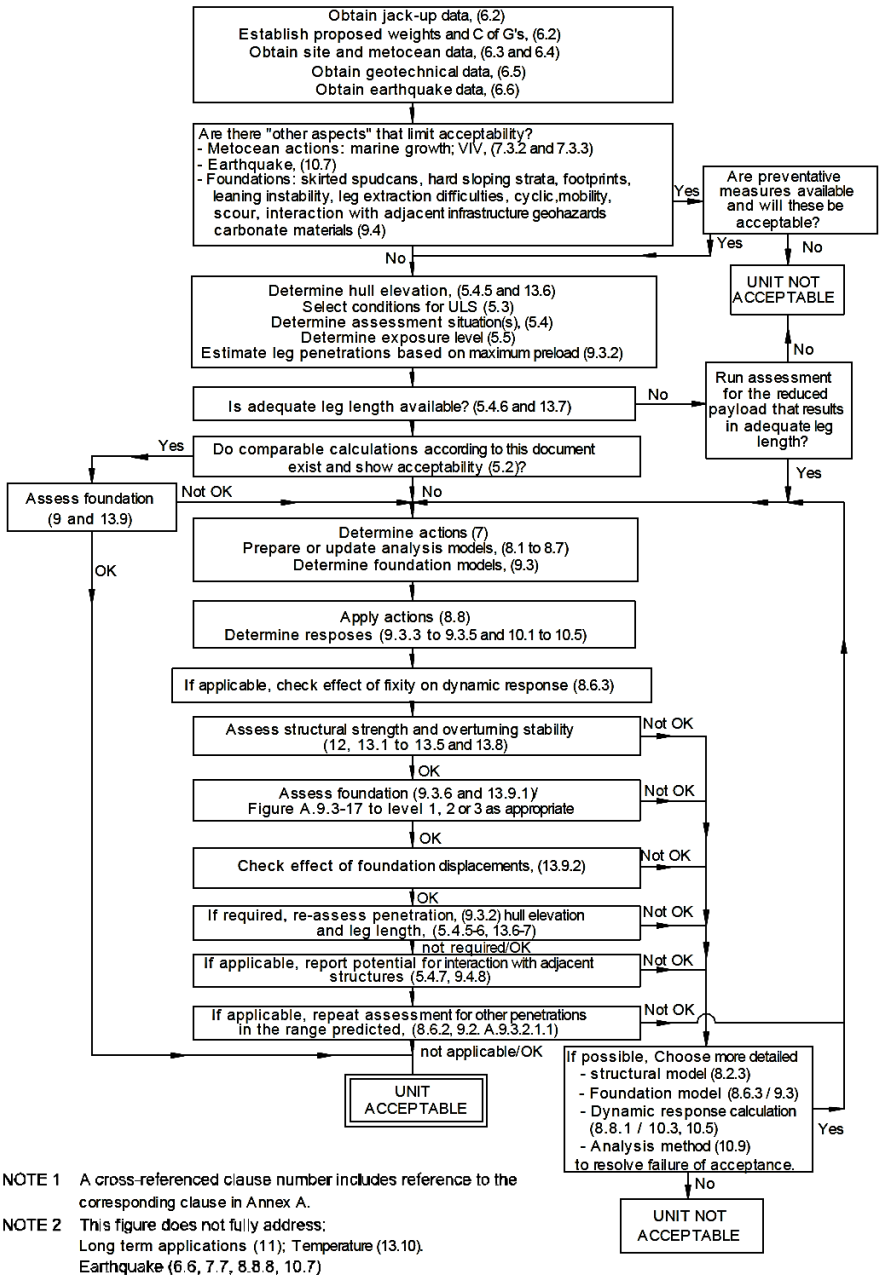
Table A.6.5-1 — Foundation risks, methods for evaluation and prevention

Risk	Methods for evaluation and prevention	Subclause
Installation problems	Bathymetric survey	A.6.5.1.2
	Sea floor survey	A.6.5.1.3
Punch-through	Shallow seismic survey	A.6.5.1.4
	Soil sampling and other geotechnical testing and analysis	A.6.5.1.5, A.9.3.6
Settlement/bearing failure	Shallow seismic survey	A.6.5.1.4
	Soil sampling and other geotechnical testing and analysis	A.6.5.1.5, A.9.3.6
	Ensure adequate jack-up preload capability	A.9.3.6
Sliding failure	Shallow seismic survey	A.6.5.1.4
	Soil sampling and other geotechnical testing and analysis	A.6.5.1.5, A.9.3.6
	Increase vertical spudcan reaction	
	Modify the spudcans	
Scour	Bathymetric and sea floor survey (identify sand waves)	A.6.5.1.2
	Surface soil samples and sea floor currents	A.6.5.1.3
	Inspect spudcan foundation regularly	
	Install scour protection (gravel bag/artificial seaweed) when anticipated	A.9.4.7
Geohazards (mudslides, mud volcanoes etc)	Sea floor survey	A.6.5.1.3
	Shallow seismic survey	A.6.5.1.4
	Soil sampling and other geotechnical testing and analysis	A.6.5.1.5
Gas pockets/shallow gas	Shallow seismic survey	A.6.5.1.4
Faults	Shallow seismic survey	A.6.5.1.4
Metal or other object, sunken wreck, anchors, pipelines etc.	Magnetometer and sea floor survey	A.6.5.1.3
Local holes (depressions) in sea floor, reefs, pinnacle rocks, non-metallic structures or wooden wreck	Sea floor survey	A.6.5.1.3
	Diver/ROV inspection	
Leg extraction difficulties	Soil sampling and other geotechnical testing and analysis	A.6.5.1.5, A.9.4.5
	Consider change in spudcans	
	Jetting/Airlifting	A.9.4.5
Eccentric spudcan reactions	Bathymetry, sea floor & shallow seismic surveys	A.6.5.1.2, A.6.5.1.3, A.6.5.1.4
	Shallow seismic survey (buried channels or footprints)	A.6.5.1.4
	Soil sampling and other geotechnical testing and analysis	A.6.5.1.5, A.9.4.2
	Seabed modification	
Seabed slope	Bathymetry, sea floor & shallow seismic survey	A.6.5.1.2, A.6.5.1.3, A.6.5.1.4
	Seabed modification	A.9.4.2
Footprints of previous jack-ups	Evaluate field records	A.6.5.1.1, A.6.5.1.2, A.6.5.1.3
	Prescribed installation procedures	A.9.4.3
	Consider filling/modification of holes as necessary	A.9.4.3

Appendix G

ISO 19905-1 Flow Chart for Jack-up Site Assessment
Source: ISO 19905-1: 2012

A.2.2 Overall analysis FLOWCHART as given in Figure 5.2-1 of ISO

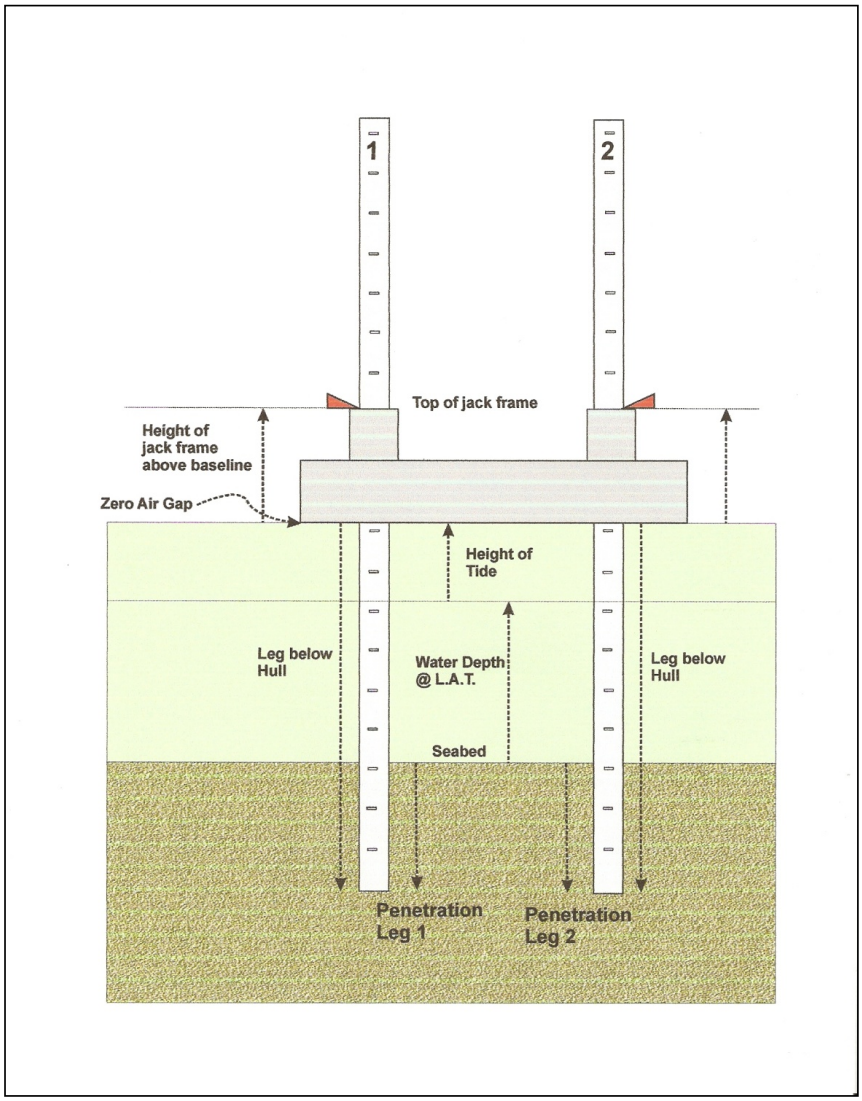


NOTE 1 A cross-referenced clause number includes reference to the corresponding clause in Annex A.

NOTE 2 This figure does not fully address:
Long term applications (11); Temperature (13.10).
Earthquake (6.6, 7.7, 8.8.8, 10.7)

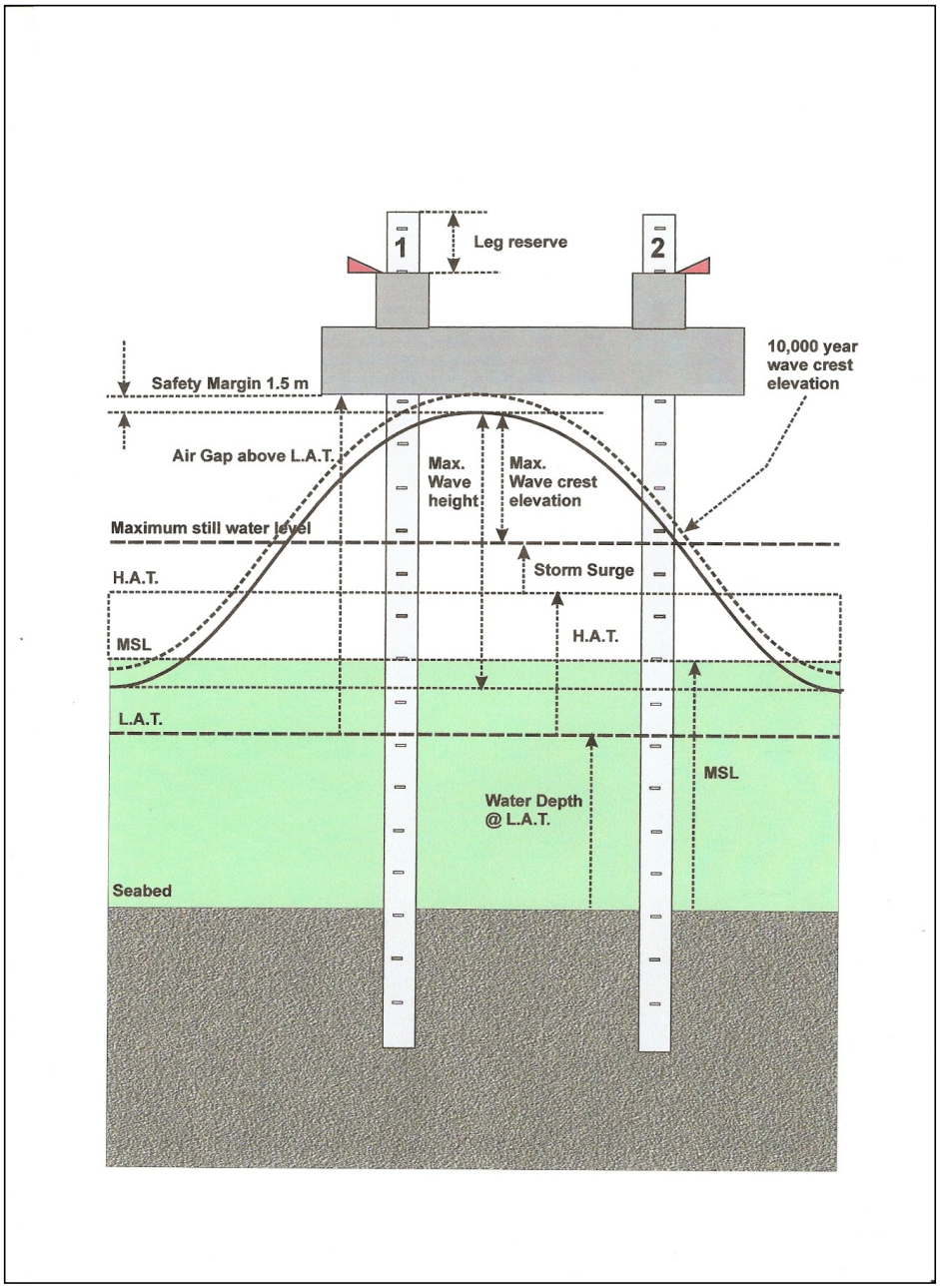
Appendix H

Airgap Calculation



Level the hull at zero airgap immediately after preloading, to check the individual leg penetrations and to define the level of the hull above LAT

Leg Number	1	2	3	4	5	6
Leg-height mark at top of jack frame						
– Jack-frame height above hull baseline						
= Leg below hull						
– Height of tide						
– Water depth at LAT						
= Leg penetration						



Minimum (Survival) Hull Elevation

A or B, whichever is greatest

A) LAT + HAT + Surge + Wave crest elevation + 1.5m
B) To clear the 10,000-year return period wave crest

Appendix I

Checklist for Jack-up Suitability Assessment

Note:

This Checklist presently comprises approximately sixty questions that are intended to provide an outline assessment of a jack-up's suitability for a proposed operation. Negative or uncertain responses to checklist items suggest issues that may require clarification and/or a more-detailed independent assessment by consultants with experience of jack-up operations.

Ref	Jack-Up Suitibility Assessment	Check
1	**Management and Manning**	
1.1	Is the jack-up owner/operator (the Contractor) an established marine contractor with experience of the management and operation of the type of jack-up commonly deployed for the type of work required?	
1.2	Does the Contractor a) employ civil or structural engineers capable of carrying out jack-up-related analyses associated with structural capacity, site-specific assessments, vessel motion response, sea fastening design and heavy lifts, or b) routinely engage third-party engineering services to undertake the required analyses?	
1.3	Does the Contractor a) employ a geotechnical engineer capable of performing soils assessments for jack-up site-specific assessments, or b) routinely engage recognised soils experts to undertake the required assessments?	
1.4	Does the Contractor employ a Competent Person having the requisite qualifications, skills and experience to conduct a jack-up site-specific assessment and/or to verify that the site assessment has been conducted in accordance with ISO 19905-1: 2012? If not, are recognised Marine Consultants with experience of jack-up operations routinely engaged to conduct or to verify the assessments?	
1.5	Does the Contractor a) Employ Master Mariners and/or Marine Engineers for planning and preparation, production of procedure documents, and execution of jack-up operations, or b) routinely engage third-party services to undertake these tasks?	
1.6	Is the Contractor capable of planning jack-up operations in accordance with the provisions described in Section 4 of these guidelines?	
1.7	Does the Contractor understand the regulatory requirements and guidelines for the operation of jack-ups in UK waters, as described in Section 2 of these guidelines?	
1.8	Is the jack-up manned in accordance with Section 3 of these guidelines?	

2	Offshore Jack-ups with Accommodation – Unrestricted Operations	Check
2.1	Is the jack-up entered on a vessel registry of a Recognised Maritime Nation (the Flag State)?	
2.2	Have outstanding Flag State recommendations (if any) been cleared?	
2.3	Is the jack-up classed in accordance with the rules of a Recognised Classification Society and a member of the International Association of Class Societies (IACS)?	
2.4	Does the Class Notation a) include the term 'self-elevating', or b) otherwise definitively cover the design, construction and survey of the unit's capacity for safe elevation? (Some classifications relate solely to the design as a floating vessel.)	
2.5	Do the Class Status Report and/or the Class Certificates confirm that the jack-up is currently class maintained?	
2.6	Have all outstanding Class recommendations, defects or deficiencies that may have an impact on the proposed operations been rectified or complied with?	
2.7	Are the certificates and documentation in accordance with these guidelines Appendix C?	
2.8	Is the jack-up provided with a Class-Approved Operating Manual?	

3.	Small Unmanned Inshore Jack-ups – Weather-restricted Operation	Check
3.1	Is the jack-up entered on a small vessel registry of a Recognised Maritime Nation (the Flag State)?	
3.2	Have any outstanding Flag State recommendations been cleared?	
3.3	Have the unit's design limits for floating and elevated operations been clearly stated by the vessel manufacturer in a Design Report or the operating manual?	
3.4	Has the Design Report or operating manual been verified by an independent authority?	
3.5	If the jack-up is not classed or not covered under MCA MGN-280, is there an independent Survey Report confirming that the unit is in satisfactory condition with no outstanding defects or deficiencies?	
3.6	Are the certificates and documentation in accordance with these guidelines Appendix C?	
3.7	Is the jack-up provided with an operating manual, and does the operating manual include the information suggested in Appendix D?	

4	Suitability of the Jack-up for Transit to Site	Check
4.1	If the proposed work site is in coastal waters or an offshore area, is the jack-up designed and certified for transit afloat on its own hull beyond port limits?	
4.2	Does the vessel's Certified Trading Area include the whole of the proposed transit route and the operating site?	
4.3	Has the limiting sea state for transit afloat been defined?	
4.4	Will the limiting sea state for operations afloat unreasonably restrict the jack-up's capability to undertake the transit efficiently in the predicted seasonal conditions?	
4.5	If project cargo and equipment are to be transported on the deck of the jack-up, can the total displacement (including variable load plus deck load), the trim and the allowable VCG be maintained within the allowable limits for the floating condition?	
4.6	Does the jack-up meet the intact and damage stability requirements for the loaded condition as described in these guidelines Section 6?	
4.7	In the loaded condition, is the total elevated weight and the centre of gravity within the allowable limits for the a) jacking mode, b) elevated operating mode (including lifting operations) and c) elevated survival mode?	
4.8	If project cargo and equipment are to be transported on the deck of the jack-up, will the grillage and sea fastening arrangements meet the requirements described in Section 7 of these guidelines?	
4.9	If project cargo and equipment are to be transported on the deck of the jack-up, can the cranes be stowed and sea fastened with the booms lowered in the cradles?	
4.10	If the jack-up is self-propelled and/or fitted with a dynamic positioning system, does the unit comply with the provisions of these guidelines Section 11?	
4.11	If the jack-up is non-propelled or propulsion assisted, is the unit capable of complying with the arrangements as specified in these guidelines Sections 11 and 12?	
4.12	If the jack-up is non-propelled or propulsion assisted, will it be towed by suitable towing vessels that meet the requirements of these guidelines Section 13?	

5.	Suitability of the Jack-up for Positioning and Elevating	Check
5.1	Has the site geophysical data been obtained as described in Section 8 of these guidelines, and the survey reports been delivered to the Contractor?	
5.2	Has the site meteorological data been obtained and delivered to the Contractor in the form of a Spot Location Report (Appendix E)?	
5.3	Has a site soils investigation been carried out and the results delivered to the Contractor?	
5.4	Has the Contractor reviewed the site survey and soils investigation reports and confirmed that the data received is adequate and sufficient to complete a site-specific assessment for the jack-up, in accordance with ISO 19905-1: 2012?	
5.5	Is the jack-up fitted with a station-keeping system (DP or 4-Point Mooring System) in accordance with these guidelines Section 14?	
5.6	Can the Contractor devise an approach and/or a mooring plan that will allow jack-up to be moved into the required position while maintaining the minimum clearances prescribed in these guidelines Section 14?	
5.7	Are the water depths and tidal levels in the approach to and on site sufficient to allow the jack-up to be moved always afloat on to the location?	

5.8	In areas where high-velocity tidal currents flow, is the duration of slack water periods of adequate length to allow safe positioning and subsequent removal of the jack-up?	
5.9	Based upon the information received, is the Contractor satisfied that there are no significant or unusual marine hazards in the approach to or on site that could have an impact on jack-up positioning?	
5.10	Based upon the information received, is the Contractor satisfied that there are no significant or unusual seabed surface features or soil foundation hazards for jacking and preloading, and for subsequent elevated operations?	
5.11	If seabed surface and/or foundation hazard(s) have been identified, is the Contractor confident that procedures can be developed for safe jacking, preloading and elevated operations?	
5.12	Have the foundation hazard(s) and the proposed procedures been assessed and found suitable by independent geotechnical engineers and jack-up move experts?	
5.13	Based upon the information received, has the Contractor determined through site-specific assessment that the jack-up is capable of operating on site in a) Weather-restricted Mode, or b) Unrestricted Mode?	
5.14	If the jack-up is capable of operating only in Weather-restricted Mode, will this unreasonably restrict the jack-up's capability to operate efficiently in the elevated mode on site in the expected seasonal conditions?	
5.15	Is the jack-up capable of complying with the arrangements for mooring and positioning on site, as described in Section 14 of these guidelines?	

6.	**Suitability of the Jack-up for Elevated Operations**	**Check**
6.1	Has the Contractor fully understood the objectives to be achieved?	
6.2	Are the Contractor's personnel capable of planning and executing the operations necessary to achieve the objectives without engineering assistance from third-party services?	
6.3	Is the jack-up a suitable platform for the execution of the operations with respect to size, configuration, deck height, deck strength, accommodation and facilities?	
6.4	Based upon the site-specific assessment, is the jack-up's leg length sufficient to allow elevation to the extreme storm-survival airgap (see Appendix H)?	
6.5	If the leg length is not sufficient to achieve the survival airgap, is it sufficient to allow elevation to a working airgap?	
6.6	Based upon the site-specific assessment, is the jack-up capable of remaining elevated on location in the seasonal 50-year extreme storm condition, with all stresses remaining within allowable limits in accordance with the RP?	
6.7	If the jack-up cannot achieve the minimum survival airgap and/or cannot safely withstand the extreme storm condition, can the proposed elevated operations be completed safely by the jack-up as a weather-restricted operation, in accordance with these guidelines Section 5?	
6.8	If the jack-up is operating in Weather-restricted Mode, will the operating restrictions that apply and the potential need to often remove the unit to shelter have an unreasonable adverse impact on the proposed works in the seasonal weather considered?	
6.9	If a weather-restricted operation is proposed, can the elevated operations be suspended and the jack-up removed to a safe standby location or to shelter within 48 hours?	
6.10	Is the Contractor in possession of, and familiar with, at least one of the Guideline Documents for Marine Lifting Operations listed in these guidelines Section 15.1.2?	
6.11	Are the crane and the lifting gear capable of performing the proposed lifting operations (if any) in accordance with the specified guidelines and with these guidelines Section 15?	

The Working Group: Version 2 (2013)

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Mr Bill Hodges	Global Maritime	Key Consultee
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RenewableUK is the UK's leading renewable energy trade association, specialising in onshore wind, offshore wind, and wave & tidal energy. Formed in 1978, we have a large established corporate membership, ranging from small independent companies to large international corporations and manufacturers.

Acting as a central point of information and a united, representative voice for our membership, we conduct research, find solutions, organise events, facilitate business development, advocate and promote wind and marine renewables to government, industry, the media and the public.

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