



GUIDE FOR

CERTIFICATION OF LIFTING APPLIANCES
APRIL 2019

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

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1701 City Plaza Drive
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Foreword (2018)

The 2018 edition of the *Guide for Certification of Lifting Appliances* is an updated version of the 2016 edition of the subject Guide. Individual chapters of the Guide have been updated in accordance with the latest industry standards as well as ABS plan review and survey practice. The particular changes made to the Guide are as follows:

- **Chapter 2, Guide for Certification of Cranes:**

- i) 2-2/5.15 – Aligned the Guide requirements for the allowable stresses for pedestals in extreme conditions of seismic loads or extreme winds with API Specification 2C.
- ii) 2-2/5.23 – Limited the applicability of the requirement to offshore cranes, in line with API Sec.2C/6.4.
- iii) 2-3/11 – Clarified the correct application of the use of “Z” grade steel, in line with 5A-3-1/2.5.1 of the *ABS Rules for Building and Classing Marine Vessels* (CSR for Bulk Carrier and Oil Carriers).
- iv) 2-4/1 – Allowed the use of the rotation resistant and fiber core ropes for boom hoisting on shipboard cranes, in line with API 9A.
- v) 2-5/1.1 – Clarified the proof load test requirements for hooks and blocks. Referred to the *ABS Guide for the Certification of Offshore Containers* for structure, loose gear, and/or containers used solely for shipping or transferring equipment to offshore units.
- vi) 2-5/1.5 – Required that hook curves be provided.
- vii) 2-7/5.3 – Modified testing requirements for cranes that can only lift the proof test load by luffing the boom, cranes that are not designed to slew the proof test load, and large cranes limited on movement based on stability restrictions. Allowed reduction in minimum number of lifts for cranes that have ABS approved test procedures.

- **Chapter 5, Guide for Certification of Shipboard Elevators:**

- i) 5-4/5.1 – Clarified that three panel hoistway doors are acceptable, in line with ASME A17.1-2013 Part 1, Section 1.3.
- ii) 5-4/5.9 – Accepted alternative arrangements considered equivalent to the current requirement.
- iii) 5-4/5.15 – Accepted alternative arrangements considered equivalent to the current requirement.
- iv) 5-5/17.11 – Incorporated requirements of ASME A17.1-2013 2.14.1.5.1(f) & 5.8.1.5 and ISO 8383-1985 10.5 & 10.6 with consideration of additional safety factors.

This Guide will become effective on 1 January 2018 and supersedes the existing Guide.

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

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



GUIDE FOR

CERTIFICATION OF LIFTING APPLIANCES

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CHAPTER 1 Scope and Conditions of Certification

SECTION 1 Certification

1 Process

The term certification, as used herein, indicates that a lifting appliance and its equipment have been designed, constructed, installed and surveyed in compliance with this Guide, existing Rules and Guides or other acceptable standards.

The continuance of certification is dependent on the fulfillment of requirements for surveys after construction.

The certification process consists of:

- a) The development of Rules, Guides, standards and other criteria for the design, construction, installation and maintenance of lifting appliances and their equipment;
- b) The review of the design and survey during and after construction to verify compliance with such Rules, Guides, standards or other criteria;
- c) The assignment and registration of certification when such compliance has been verified, and;
- d) The issuance of a renewable certificate, with annual endorsements, valid for five years.

The Rules, Guides and standards are developed by the ABS staff and passed upon by committees made up of naval architects, ocean and marine engineers, shipbuilders, engine builders, steel makers, process engineers and by other technical, operating and scientific personnel associated with the worldwide maritime industry. Theoretical research and development, established engineering disciplines, as well as satisfactory service experience are utilized in their development and promulgation. ABS and its committees can act only upon such theoretical and practical considerations in developing Rules and standards.

For Certification, the lifting appliance and its equipment are to comply with the applicable requirements of this Guide and all applicable Rules.

3 Certificates and Reports

Review of design documentation and surveys during and after construction are conducted by ABS to verify to itself and its committees that an item of material, equipment or machinery is in compliance with this Guide and is to the satisfaction of the attending Surveyor. All reports and certificates are issued solely for the use of ABS, its committees, its clients and other authorized entities.

5 Representations as to Certification

Certification is a representation by ABS as to the structural and mechanical fitness for a particular use or service, in accordance with its Rules, Guides and standards. The Rules and Guides of the American Bureau of Shipping are not meant as a substitute for the independent judgment of professional designers, naval architects, marine engineers, owners, operators, masters and crew, nor as a substitute for the quality control procedures of ship and platform builders, engine builders, steel makers, suppliers, manufacturers and sellers of marine vessels, materials, system components, machinery or equipment. ABS, being a technical society, can only act through Surveyors or others who are believed by it to be skilled and competent.

ABS represents solely to the Lifting Appliance manufacturer or other clients of ABS that when certifying, it will use due diligence in the development of Rules, Guides and standards, and in using normally applied testing standards, procedures and techniques as called for by the Rules, Guides, standards or other criteria of ABS. ABS further represents to the Owner or other Clients of ABS that its certificates and reports

evidence compliance only with one or more of the Rules, Guides, standards or other criteria of ABS, in accordance with the terms of such certificate or report. Under no circumstances whatsoever are these representations to be deemed to relate to any third party.

The user of this document is responsible for ensuring compliance with all applicable laws, regulations and other governmental directives and orders related to a vessel, its machinery and equipment, or their operation. Nothing contained in any Rule, Guide, standard, certificate or report issued by ABS shall be deemed to relieve any other entity of its duty or responsibility to comply with all applicable laws, including those related to the environment.

7 Scope of Certification

Nothing contained in any certificate or report is to be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator, other entity or person of any duty to inspect or any other duty or warranty expressed or implied. Any certificate or report evidences compliance only with one or more of the Rules, Guides, standards or other criteria of the American Bureau of Shipping, and is issued solely for the use of ABS, its Committees, its clients or other authorized entities. Nothing contained in any certificate, report, plan or document review or approval is to be deemed to be in any way a representation or statement beyond those contained in 1-1/5. ABS is not an insurer or guarantor of the integrity or safety of a vessel or of any of its equipment or machinery. The validity, applicability and interpretation of any certificate, report, plan or document review or approval are governed by the Rules, Guides and standards of the American Bureau of Shipping, who shall remain the sole judge thereof. ABS is not responsible for the consequences arising from the use by other parties of the Rules, Guides, standards or other criteria of the American Bureau of Shipping, without review, plan approval and survey by ABS.

The term “approved” is to be interpreted to mean that the plans, reports or documents have been reviewed for compliance with one or more of the Rules, Guides, standards or other criteria acceptable to ABS.

This Guide is published with the understanding that responsibility for reasonable handling and loading operations, beyond the limit specified in the lifting appliance design basis, does not rest upon the Committee.

9 Class Notations (1 July 2016)

9.1 CRC (Crane and Lifting Appliances Register Certificate) Notation

A vessel or unit classed by ABS for which an ABS Register of Lifting Appliances is issued under the provisions of this Guide will be distinguished by the additional class notation **CRC(SC, OC, HC, SP, MRW, RMP)**, as follows:

SC	signifies that the vessel or unit has an installed Shipboard crane designed, constructed and tested in accordance with the respective requirements of this Guide
OC	signifies that the vessel or unit has an installed Offshore crane designed, constructed and tested in accordance with the respective requirements of this Guide
HC	signifies that the vessel or unit has an installed Heavy Lift crane designed, constructed and tested in accordance with the respective requirements of this Guide
SP	signifies that the vessel or unit has an installed Special Purpose crane (i.e., a davit, monorail hoist/ engine room overhead crane, provision crane, or union purchase) designed, constructed and tested in accordance with the respective requirements of this Guide
MRW	signifies that the vessel or unit has an installed base-mounted Man Riding Winch designed, constructed and tested in accordance with the respective requirements of this Guide
RMP	signifies that the vessel's or unit's installed stern, bow and sideport ramps and moveable platforms (decks) are designed, constructed and tested in accordance with the respective requirements of this Guide

For personnel lifting, the above notations may be supplemented with the **PL**, **PL+**, or **PL++** notations (e.g., **CRC(SC-PL)**, **CRC(OC-PL+)**, **CRC(SC-PL++)**, **HC-PL+**), etc.), as follows:

PL	signifies that the vessel or unit has an installed crane that is intended to be used for personnel lifting that is designed, constructed and tested in accordance with the provisions of this Guide including the respective requirements for personnel lifting, and is fitted with an Emergency Recovery System in compliance with 2-9/13.3 of this Guide.
PL+	signifies that the vessel or unit has an installed crane that is intended to be used for personnel lifting that is designed, constructed and tested in accordance with the provisions of this Guide including the respective requirements for personnel lifting, and is fitted with an Emergency Recovery System in compliance with 2-9/13.5 of this Guide.
PL++	signifies that the vessel or unit has an installed crane that is intended to be used for personnel lifting that is designed, constructed and tested in accordance with the provisions of this Guide including the respective requirements for personnel lifting, and is fitted with an Emergency Recovery System in compliance with 2-9/13.7 of this Guide.

For subsea lifting, notations **OC** and **HC** may also be supplemented with the **Subsea** notation (e.g., **CRC(OC-PL++-Subsea)**, **CRC(HC-Subsea)**, etc.).

9.3 CGSU (Cargo Gear Self Unloading) Notation

A vessel or unit classed by ABS for which an ABS Register of Cargo Gear for Great Lakes Vessels is issued under the provisions of this Guide will be distinguished by the additional class notation **CGSU** (Cargo Gear Self Unloading).

9.5 SElev (Shipboard Elevator) Notation

A vessel or unit classed by ABS having an installed shipboard elevator certified by ABS in accordance with Chapter 5 of this Guide, will be distinguished by the additional class notation **SElev** (Shipboard Elevator).

11 Existing Lifting Appliances (1 July 2016)

11.1 Existing Lifting Appliances without Register

For existing lifting appliances that do not have a Register issued by a recognized classification society, or a recognized cargo gear organization, submission of information as required in the respective chapters of this Guide, with verification of material, is required.

Existing lifting appliances may be certified subject to satisfactory plan review, conditional survey, operational tests including luffing, slewing, test of safety devices, and proof testing of the lifting appliances as units as required in the respective chapters of this Guide. The conditional survey shall include inspection for excessive wear, damage, corrosion, and fractures. Nondestructive testing or verification of materials may be required at the discretion of the Surveyor. In addition, all crane hooks are to be examined using magnetic particle or other suitable crack detecting inspection methods to the satisfaction of the attending Surveyor. All mechanical, electrical and piping systems and components are to be examined as deemed necessary by the attending Surveyor.

11.3 Existing Lifting Appliances with Register

For lifting appliances having a Register issued by a recognized classification society or a recognized cargo gear organization, evidence of previous design approval and survey under construction is to be submitted. Suitable evidence of the design approval would be drawings of the arrangement and details which bear the approval stamp of the losing authority or which are specifically covered by an approval letter from the authority issuing the previous register or the previous register itself. An ABS Register of Lifting Appliance

may be issued after review of above data and a proof test and examination in accordance with the requirements of the respective chapters of this Guide.

CHAPTER 1 Scope and Conditions of Certification

SECTION 2 Suspension and Termination of Certification

1 Suspension of Certification (*1 July 2016*)

Certification will be suspended and the Certificate of Lifting Appliance will become invalid from the date of any use, operation or other application of any lifting appliance and its equipment for which it has not been approved and which affects or may affect certification or the structural integrity, quality or fitness for a particular use or service.

Certification will be suspended and the Certificate of Lifting Appliance will become invalid in any of the following circumstances:

- i) If recommendations issued by the Surveyor are not carried out by their due dates and no extension has been granted,
- ii) If the periodical surveys required for maintenance of certification, other than Annual, Quadrennial or Retesting Surveys, are not carried out by the due date and no Rule-allowed extension has been granted, or
- iii) If any damage, failure or deterioration repair has not been completed as recommended.

Certification may be suspended, in which case the Certificate of Lifting Appliance will become invalid, if proposed repairs have not been submitted to ABS and agreed upon prior to commencement.

Certification is automatically suspended and the Certificate of Lifting Appliance is invalid in any of the following circumstances:

- i) If the Annual Survey is not completed by the due date,
- ii) If the Quadrennial or Retesting Survey is not completed by the due date.

Any damage, failure, deterioration, or repair to lifting appliances covered by this Guide, which affects or may affect the certification, is to be submitted by the Owners or their representatives for examination by a Surveyor at first opportunity. All repairs found necessary by the Surveyor are to be carried out to the Surveyor's satisfaction.

3 Lifting of Suspension (*1 July 2016*)

Certification will be reinstated after suspension for overdue surveys upon satisfactory completion of the overdue surveys. If the survey becomes overdue by three months or more, a retesting survey will be required, in addition to the other Cargo Gear surveys that are overdue, to reinstate Certification. Such surveys will be credited as of the original due date or a new cycle can be started upon completion of a Renewal Survey. Certification will be reinstated after suspension for overdue recommendations, upon satisfactory completion of the overdue recommendations.

5 Termination of Certification

The continuance of the Certification of the Lifting Appliance and its equipment is conditional upon the Guide requirements for periodical, damage and other surveys being duly carried out. ABS reserves the right to reconsider, withhold, suspend or terminate the certificate of any lifting appliance and its equipment for non-compliance with the Guide and Rules, for defects reported by the Surveyors which have not been rectified in accordance with their recommendations or for nonpayment of fees which are due on account of Lifting Appliances Surveys. Suspension or termination of certification may take effect immediately or after a specified period of time.

7 Notice of Surveys

It is the responsibility of the Owner to ensure that all surveys necessary for the maintenance of certification are carried out at the proper time. ABS will give proper notice to an Owner of upcoming surveys. This may be done by means of a letter, a quarterly status report or other communication. The non-receipt of such notice, however, does not absolve the Owner from his responsibility to comply with survey requirements for maintenance of certification.

CHAPTER 1 Scope and Conditions of Certification

SECTION 3 Requirements for Certification

1 Applications (1 July 2016)

This Guide contains provisions for the certification of lifting appliances installed aboard vessels and/or offshore floating/fixed units classed by ABS.

If specifically requested by the Owner, this Guide can also be used as a basis for acceptance or certification under the requirements of Administrations. Owners who desire to have a lifting appliance evaluated for compliance with National Regulations should contact ABS.

3 Scope (1 July 2016)

This Guide provides requirements for certification of lifting appliances installed on vessels and offshore floating and/or fixed units classed by ABS, including but not limited to:

- Pedestal and tub mounted rotating heavy lift, gantry, shearleg, stiffleg and “A” frame type cranes operating in harbors and offshore
- Base-mounted manriding winches
- Shipboard personnel and passenger elevators, including their systems, of traction and winding drum type driven by electric or hydraulic motors, direct-plunger hydraulic type, roped hydraulic type and rack and pinion type.
- Self-unloading cargo gear on Great Lakes Vessels
- Stern, bow and sideport ramps and moveable platforms

5 Alternatives

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

The Committee will consider special arrangements or design for details of lifting appliances and their equipment which can be shown to comply with standards recognized in the country in which the lifting appliance and its equipment are designed or built, provided these are not less effective than the requirements contained in this Guide.

7 Effective Date of Change of Requirement

7.1 Effective Date (1 May 2017)

This Guide and subsequent changes to this Guide are to become effective on the date specified by ABS.

7.3 Implementation of Rule Changes

In general, until the effective date, plan approval for designs will follow prior practice, unless review under the latest Guide is specifically requested by the party signatory to the application for certification. If one or more systems are to be constructed from plans previously approved, no retroactive application of the subsequent Rule changes will be required, except as may be necessary or appropriate for all contemplated construction.

9 ABS Type Approval Program (1 July 2016)

9.1 Type Approval (1 July 2016)

Products that are used as components for lifting appliances and can be consistently manufactured to the same design and specification may be Type Approved under the ABS Type Approval Program. The ABS Type Approval Program is a voluntary option for the demonstration of compliance of a system or product with the Rules, Guides or other recognized standards. It may be applied at the request of the designer or manufacturer.

Specific requirements and details regarding the ABS Type Approval Program can be found in 1-1-4/7.7 and Appendix 1-1-A3 of the *ABS Rules for Conditions of Classification (Part 1)*.

9.3 Unit-Certification

Unit-Certification is a review of individual materials, components, products and systems for compliance with ABS Rules, Guides or other recognized standards. This allows these items to be placed on a vessel, marine structure or system to become eligible for classification. Certification is a “one-time” review. The process is:

- i) A technical evaluation of drawings or prototype tests of a material, component, product or system for compliance with the ABS Rules, Guides or other recognized standards.
- ii) A survey during manufacture for compliance with the ABS Rules, Guides or other recognized standards and results of the technical evaluation.
- iii) Alternatively, a certificate of type approval will expedite the requirements of and above.
- iv) Products found in compliance are issued “Individual Unit Certification”.
- v) There is no requirement for subsequent reviews or surveys.

11 Other Regulations

11.1 International and Other Regulations

While this Guide covers the requirements for the certification of lifting appliances and their equipment, the attention of Owners, designers and builders is directed to the regulations of international, governmental and other authorities dealing with those requirements in addition to or over and above the classification requirements.

Where authorized by the Administration of a country signatory thereto and upon request of the Owners of a certified lifting appliance or one intended to be certified, ABS will survey for compliance with the provision of International and Governmental Conventions and Codes, as applicable.

11.3 Governmental Regulations

Where authorized by a government agency and upon request of the Owners of a new or existing lifting appliance, ABS will survey and certify a classed lifting appliance or one intended to be classed for compliance with particular regulations of that government on their behalf.

11.5 Other Rules

Where the vessel on which the lifting appliances are installed is built in accordance with 1-1-4/7.5 of the *Rules for Conditions of Classification (Part 1)*, ABS will consider the lifting appliances constructed to the satisfaction of the ABS Surveyors in accordance with the plans that have been approved to the Rules/Guides of another recognized classification society with verification of compliance by ABS.

13 Submission of Plans

Each Chapter of this Guide identifies a list of lifting appliance components that are required for the certification of lifting appliance. In most cases, manufacturer's component and system related drawings, calculations and documentation are required to be submitted to substantiate the design of the system or component. In these cases, upon satisfactory completion of ABS review of the manufacturer's submittal, ABS Engineers will issue a review letter. This letter, in conjunction with the submitted package, will be used and referenced during surveys and subsequently issued reports by attending ABS Surveyors.

Upon satisfactory completion of all of the required engineering and survey processes, ABS will issue the Certificate to the lifting appliance.

15 Notification and Availability for Survey

The Surveyors are to have access to certified lifting appliances and their equipment at all reasonable times. For the purpose of Surveyor monitoring, monitoring Surveyors are also to have access to certified lifting appliances and their equipment at all reasonable times. Such access may include attendance at the same time as the assigned Surveyor or during a subsequent visit without the assigned Surveyor. The Owners or their representatives are to notify the Surveyors for inspection on occasions when the vessels/units on which the lifting appliances are installed are in dry dock or on a slipway.

The Surveyors are to undertake all surveys on certified lifting appliances and their equipment upon request, with adequate notification, of the Owners or their representatives, and are to report thereon to the Committee. Should the Surveyors find occasion during any survey to recommend repairs or further examination, notification is to be given immediately to the Owners or their representatives so that appropriate action may be taken. The Surveyors are to avail themselves of every convenient opportunity for carrying out periodical surveys in conjunction with surveys of damages and repairs in order to avoid duplication of work.

17 Units

This Guide is written in three systems of units: SI units, MKS units and US customary units. Each system is to be used independently of any other system. Unless indicated otherwise, the format of presentation of the three systems of units in this Guide is as follows:

SI units (MKS units, US customary units)

19 Fees

Fees in accordance with normal ABS practice will be charged for all services rendered by ABS. Expenses incurred by ABS in connection with these services will be charged in addition to the fees. Fees and expenses will be billed to the party requesting that particular service.

21 Disagreement

21.1 Rules and Guides

Any disagreement regarding either the proper interpretation of Rules and Guides or the translation of Rules and Guides from the English language edition is to be referred to ABS for resolution.

21.3 Surveyor

In case of disagreement between the Owners or builders and the Surveyors regarding the material, workmanship, extent of repairs or application of the Rules and Guides relating to any system classed or proposed to be classed by ABS, an appeal may be made in writing to the Committee, who will order a special survey to be held. Should the opinion of the Surveyor be confirmed, expense of this special survey is to be paid by the party appealing.

23 Limitation of Liability

The combined liability of the American Bureau of Shipping, its committees, officers, employees, agents or subcontractors for any loss, claim or damage arising from its negligent performance or nonperformance of any of its services or from breach of any implied or express warranty of workmanlike performance in connection with those services, or from any other reason, to any person, corporation, partnership, business entity, sovereign, country or nation, will be limited to the greater of a) \$100,000 or b) an amount equal to ten times the sum actually paid for the services alleged to be deficient.

The limitation of liability may be increased, up to an amount twenty-five times the sum paid for services, upon receipt of Client's written request at or before the time of performance of services, and upon payment by Client of an additional fee of USD 10.00 for every USD 1,000.00 increase in the limitation.

Under no circumstances shall American Bureau of Shipping be liable for indirect or consequential loss or damage (including, but without limitation, loss of profit, loss of contract, or loss of use) suffered by any person as a result of any failure by ABS in the performance of its obligations under these Rules. Under no circumstances whatsoever shall any individual who may have personally caused the loss, damage or expense be held personally liable.

25 Hold Harmless

The party requesting services hereunder, or his assignee or successor in interest, agrees to release ABS and to indemnify and hold harmless ABS from and against any and all claims, demands, lawsuits or actions for damages, including legal fees, to persons and/or property, tangible, intangible or otherwise which may be brought against ABS incidental to, arising out of or in connection with this Agreement, the work to be done, services to be performed or material to be furnished hereunder, except for those claims caused solely and completely by the negligence of ABS, its agents, employees, officers, directors or subcontractors. The parties agree that for the purposes of the Convention on Limitation of Liability for Maritime Claims, 1976, ABS is a person for whose acts the shipowner is responsible.

Any other individual, corporation, partnership or other entity who is a party hereto or who in any way participates in, is engaged in connection with or is a beneficiary of, any portion of the services described herein shall also release ABS and shall indemnify and hold ABS harmless from and against all claims, demands, lawsuits or actions for damages, including legal fees, to persons and/or property, tangible, intangible or otherwise, which may be brought against ABS by any person or entity as a result of the services performed pursuant to this Agreement, except for those claims caused solely and completely by the negligence of ABS, its agents, employees, officers, directors or subcontractors.

27 Time Bar to Legal Action

Any statutes of limitation notwithstanding, Owner's right to bring or to assert against ABS any and all claims, demands or proceedings whether in arbitration or otherwise shall be waived unless (a) notice is received by ABS within ninety (90) days after Owner had notice of or should reasonably have been expected to have had notice of the basis for such claims; and (b) arbitration or legal proceedings, if any, based on such claims or demands of whatever nature are commenced within one (1) year of the date of such notice to ABS.

29 Arbitration

Any and all differences and disputes of whatsoever nature arising out of services under these Rules shall be put to arbitration in the City of New York pursuant to the laws relating to arbitration there in force, before a board of three persons, consisting of one arbitrator to be appointed by ABS, one by the Client, and one by the two so chosen. The decision of any two of the three on any point or points shall be final. Until such time as the arbitrators finally close the hearings either party shall have the right by written notice served on the arbitrators and on an officer of the other party to specify further disputes or differences under these Rules for hearing and determination. The arbitration is to be conducted in accordance with the rules of the Society of Maritime Arbitrators, Inc. in the English language. The governing law shall be the law of the

State of New York, U.S.A. The arbitrators may grant any relief other than punitive damages which they, or a majority of them, deem within the scope of the agreement of the parties, including, but not limited to, specific performance. Awards made in pursuance to this clause may include costs including a reasonable allowance for attorney's fees and judgment may be entered upon any award made hereunder in any court having jurisdiction.

31 ABS Surveyor's Safety and ABS Occupational Health and Safety Management Systems (OHSMS) Manual (1 July 2016)

In addition to 1-1/1 and 1-3/15, it is the responsibility of the shipyard, ship repairer, manufacturer, Owner or their representatives or other client to have established health and safety procedures in accordance with any governmental and/or local regulatory administrations.

ABS Surveyors will conduct surveys, provided that the client's established health and safety procedures are not less effective than those contained in the ABS Occupational Health and Safety Management Systems (OHSMS) Manual and its associated procedures.

If ABS Surveyors encounter conditions or procedures that may compromise the safety of the Surveyors, they may stop their survey immediately until corrective actions are taken.

Nothing in the latest revision of the ABS OHSMS Manual (including its associated procedures) is intended to replace or supersede any governmental or local authority's regulations or requirements for the implementation of or content of a premises safety plan, provided such plan is not less effective than the safety policies contained therein.

CHAPTER 2 Guide for Certification of Cranes

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CHAPTER 2 Guide for Certification of Cranes

SECTION 1 General (1 July 2016)

1 Scope (1 July 2016)

This Guide sets forth requirements for the certification of pedestal mounted rotating, heavy lift, gantry, shear leg, stiffleg and “A”-frame type cranes installed aboard vessels, and/or floating/fixed structures classed by ABS, operating in harbors and offshore.

3 Submission of Plans and Design Data

3.1 General (2011)

Plans showing the arrangements and details of the crane are to be submitted for review before fabrication begins. These plans are to clearly indicate the scantlings, materials, joint details and welding. Plans should generally be submitted electronically to ABS. However, hard copies will also be accepted.

3.3 Information to Be Submitted (1 July 2016)

The following plans and supporting data are to be submitted for review and approval where appropriate.

3.3.1 Crane Structure

- i) General arrangement, assembly plans and description of operating procedures and design service temperature.
- ii) Applicable in-service and out-of-service loads, including dead, live and dynamic loads, environmental loads including the effects of wind, snow and ice, load swing caused by non-vertical lifts, loads due to list and/or trim of the vessel or structure, loads due to vessel's or unit's motions, etc.; along with supporting calculations, including details for crane stiffness, relative velocities and vertical distances from boom tip to the deck of the vessel or unit supporting the lifted load, etc.
- iii) Details and drawings of all primary structural members and crane supporting structure.
- iv) Stress diagram, stress and fatigue analysis and other supporting calculations, suitably referenced. Where computer analysis is used for the determination of scantlings, details of the programs describing input and output data and procedures are to be included together with the basic design criteria.
- v) Wire rope specifications.
- vi) General arrangement drawings and specifications for sheaves.
- vii) List of the assembled loose gear specifying the Safe Working Load for each component.
- viii) Material specifications.
- ix) Welding details and a plan indicating extent and locations of nondestructive inspection of welds for crane structure, pedestal and foundation.
- x) Crane capacity rating charts (load charts) and corresponding wire rope reeving diagrams.
- xi) Crane pedestal and foundation (where required as per 2-2/5.15) drawings together with calculations indicating the maximum reactions and overturning moments, identifying the portions of each coming from the hoisted load and counterweight if fitted.
- xii) Swing circle assembly drawings and details, including, as applicable:
 - a) Hold down bolt size with calculations, arrangement of bolts, material, grade and pretensioning, together with the method used for pretensioning.

- b) Slewing ring drawings, along with static strength calculations and details, which are to include material specifications of raceways and rollers or balls, hardness and heat treatment details of raceways and rollers, number and diameter of rollers or balls, raceway static capacity, specified planarity (flatness) tolerances and surface finish of bearing and supporting flanges, bearing wear tolerances.
- c) Procedure for wear down measurement of slewing ring (“rocking test”).
- xiii) Documentation identifying proof load testing weights, locations and conditions, in accordance with 2-7/5.3.
- xiv) For union purchase conditions, plans are to be submitted showing the configuration of the lifting gear, vang and preventer details and locations, hatch opening, coaming height, deck at side, bulwark height, vessel’s maximum beam and the boom head location over the hatch and over the side of the vessel.

3.3.2 Crane Machinery, Piping and Electric System

- i) Description and general details of safety devices and features, such as limit switches, anti-two blocks, etc.
- ii) Detailed diagrammatic plans of piping system accompanied by lists of materials, giving size, wall thickness, maximum working pressure and material (including mechanical properties) of all pipes and the type, size, pressure rating and material of pumps, hoses, manifolds, valves and fittings.
- iii) Detailed diagrammatic plans of electrical wiring systems including complete feeder lists, type of wire or cable, rating or setting of circuit breakers, rating of fuses and switches, interrupting capacity of circuit breakers and fuses.
- iv) Documentation for computer-based systems, as per 4-9-1/7 of the *ABS Rules for Building and Classing Marine Vessels (Marine Vessel Rules)*, as applicable by other sections of this Guide.
- v) Details of accumulators, heat exchangers and lift and telescoping cylinders indicating shell, heads, pistons, piston rods, lug attachments, tie rod dimensions and threading details, as applicable with material specifications (including mechanical properties).
- vi) Details of swing circle mechanism and luffing and hoisting winches, including all torque-transmitting components such as drums, brakes, clutches, shafts, reduction gears and coupling bolts and foundation arrangements, as applicable.
- vii) Design justification including component strength calculations, stress analysis, material specifications, weld procedure specifications and the extent of nondestructive examination as considered necessary are to be submitted for items 2-1/3.3.2.v. and 2-1/3.3.2.vi. above.
- viii) Details of all prime movers such as diesel engines, motors and generators.
- ix) A list/booklet identifying all equipment of the crane in hazardous areas and the particulars of the equipment, including manufacturers’ names, model designations, rating (flammable gas group and temperature class), the method of protection (flameproof, intrinsically safe, etc.), any restrictions in their use, and document of certification.
- x) A declaration for the absence of Asbestos in the manufacture or packaging of all materials, components, equipment, machinery, piping systems and electrical installations.
- xi) Personnel lifting and personnel emergency recovery operational procedures, including conditions, precautions and limitations for lifting of personnel.

The above items 2-1/3.3.2i) through 2-1/3.3.2viii) need not be submitted for small davits/cranes, including Monorail Hoists/Engine Room Overhead Cranes, with SWL of less than 98 kN (10 tf, 22050 lbf) and without powered slewing systems or powered luffing systems.

5 Loading, Handling and Securing

This Guide is published on the understanding that responsibility for control of Safe Working Loads, crane handling during lifting and setting loads, avoidance of improper weight distributions while lifting a load, securing of the crane on the vessel or unit when not in use, maintenance of the crane, and handling and stability of the vessel or unit during operation of the crane, rest with the Operator/Owner.

7 Definitions

7.1 Active Heave Compensation System (1 July 2016)

A system that uses motion sensors and external energy in order to maintain the vertical position of the live load at a predetermined location within a fixed frame of reference.

7.3 Active Rope Tensioning System (1 July 2016)

A system that uses tension measurement devices and external energy in order to maintain the tension on the load hoisting rope at a preset value.

7.5 Boom (1 July 2016)

An arm used for supporting the hoisting tackle at the required outreach.

7.7 Boom Angle (1 September 2012)

The angle to the horizontal of the longitudinal axis of the boom base section.

7.9 Boom Foot Pin (Heel Pin) (1 July 2016)

The pin supporting the boom at its pivot point.

7.11 Boom Head (1 September 2012)

The outer end of the top section of the boom.

7.13 Boom (Luffing) Hoist (1 September 2012)

A hoist drum and rope reeving system used to raise and lower the boom.

7.15 Computer-Based System (1 July 2016)

A computer-based system is a system of one or more microprocessors, associated software, peripherals and interfaces. Programmable Logic Controllers (PLC), Distributed Control Systems (DCS), PC or server-based computation systems are examples of computer-based systems.

7.17 Control System (1 July 2016)

An assembly of devices interconnected or otherwise coordinated to convey the command or order.

7.19 Dead Load

Dead Load is the weight of the crane components not included in the live load.

7.21 Design Service Temperature (DST) (1 July 2016)

The *Design Service Temperature (DST)* is the minimum anticipated temperature at which the crane will operate, as specified by the Owner, crane manufacturer or builder.

7.23 Drum (1 September 2012)

A cylindrical member around which a rope is wound for lifting and lowering the load or boom.

7.25 Dynamic Loads (1 September 2012)

Loads introduced into the crane or its components by forces in motion.

7.27 Fail-safe Arrangement

A system is considered to be arranged as fail-safe if failure of a mechanical component will result in the braking or slowing and controlled release of the load. A fail-safe device is a device fitted for such purposes.

7.29 Gantry, Mast or “A-frame” (1 September 2012)

A structural frame, extending above the revolving upper structure to which the boom support ropes are reeved.

7.31 Heavy Lift Cranes (1 July 2016)

In general, *Heavy Lift Cranes* are lifting appliances mounted on barges, semi-submersibles or other vessels, used for lifting and moving loads of not less than 1570 kN (160 tf, 352800 lbf) in operations such as for construction, shipbuilding, or salvage operations within a harbor or sheltered area or at open sea in very mild environmental conditions; or other environmental conditions specified by the designer. Refer to 2-2/11. See also 2-1/Figures 1 through 6 for sketches of typical heavy lift cranes.

7.33 Hoist Mechanism (1 September 2012)

A hoist drum and rope reeving system used for lifting and lowering loads.

7.35 Hook, Latch-type (1 September 2012)

A type of hook with a mechanical device to close the throat opening of the hook.

7.37 Jib (1 September 2012)

An extension attached to the boom head to provide added boom length for lifting specified loads. The jib may be in line with the boom or offset at various angles to the boom.

7.39 Kingpost (1 July 2016)

A vertical post that acts as a centerline of rotation for the revolving upper structure and as the connective member to the platform.

7.41 Live Load (LL) (1 July 2016)

Live Load is the load that is suspended from the boom head, i.e., the sum of the SWL, the weight of the gear (hook, block, wire, etc.) and any other connected component undergoing the same motion as the hook load.

7.43 Load Block, Lower (1 September 2012)

The assembly of hook or shackle, swivel, sheaves, pins, and frame suspended by the hoisting ropes.

7.45 Load Block, Upper (1 September 2012)

The assembly of sheaves, pins and frame at the boom head.

7.47 Lock Valve (1 July 2016)

A valve, such as a counter-balance valve, capable of holding pressure and requiring positive pressure in order to release.

7.49 Loose Gear (1 July 2016)

Any gear by means of which a load can be attached to a lifting appliance, but which does not form an integral part of the lifting appliance or the load.

7.51 Offboard Lift (1 September 2012)

A lift by a crane from, or to, anywhere not on the vessel/unit upon which the crane is mounted.

7.53 Offshore Cranes (1 July 2016)

In general, *Offshore Cranes* are lifting appliances mounted on a bottom-supported or floating unit or vessel, used in oil drilling and production operations, as well as for lifting and moving cargo, equipment, supplies and other loads under the environmental conditions specified by the designer while the vessel or unit is at open sea and/or when there may be motion relative to the other vessel or unit during crane operations. Refer to 2-2/9. See also 2-1/9 FIGURE 1, for sketches of typical offshore cranes.

7.55 Onboard Lift (1 September 2012)

A lift by a crane from, or to, a deck of the vessel/unit upon which the crane is mounted.

7.57 Passive Heave Compensation System (1 July 2016)

A system that uses stored energy in order to maintain the vertical position of the live load within a preset range.

7.59 Passive Rope Tensioning System (1 July 2016)

A system that uses stored energy in order to maintain the tension on the load hoisting rope within a preset range.

7.61 Pedestal (1 September 2012)

The supporting structure above which the swing circle mechanism and the revolving upper structure are mounted.

7.63 Pitch Diameter (1 September 2012)

The diameter of a sheave or rope drum measured center to center of the rope (i.e., root diameter of sheave/drum plus diameter of the rope).

7.65 Primary Member or Critical Component (1 July 2016)

A member or component whose failure would impair the structural integrity of the crane and/or result in loss of control of the load. See 2-1/7.95 TABLE 1 and 2-1/7.95 TABLE 2 for examples.

7.67 Provision Crane (1 July 2016)

A crane that is used for loading and unloading provisions (groceries, housekeeping supplies, etc.) on a vessel/unit.

7.69 Radius (Outreach) (1 September 2012)

The horizontal distance from the axis of rotation to the center of the hoist line(s).

7.71 Reeving Diagram (1 September 2012)

A wire rope system where the rope travels around sheaves and drums (main and auxiliary).

7.73 Safe Working Load (SWL) (1 August 2014)

The *Safe Working Load* is the load that each complete crane assembly is approved to lift on the cargo hook, excluding the weight of the gear (hook, block, wire, etc.).

7.75 Shipboard Cranes (1 July 2016)

In general, *Shipboard Cranes* are lifting appliances mounted on surface-type vessels, used for lifting and moving loads of less than 1570 kN (160 tf, 352800 lbf) such as cargo, containers, equipment and other loads; or for handling hoses, while the vessel is within a harbor or sheltered area under mild environmental

conditions; or under other environmental conditions specified by the designer. Refer to 2-2/7. See also 2-1/9 FIGURE 1 and 2-1/9 FIGURE 2, for sketches of typical shipboard cranes.

7.77 Special Components (1 July 2016)

Components of special nature, such as hook blocks and sheaves, together with their connecting components, special lifting devices and components built into or for cranes, heavy lift gear, crane hooks or hoisting machinery which are specially designed for use with a particular lifting unit, the designs of which are submitted for approval as steel structural parts.

7.79 Standing Rope (Pendant) (1 September 2012)

A supporting rope that maintains a constant distance between the two components connected by the rope.

7.81 Subsea Lifting (1 July 2016)

Subsea lifting refers to the operation of a crane in which a load is lowered through the splash zone into the water column and is either held at an intermediate level, lowered to or released on the seabed, or is retrieved back to the vessel.

7.83 Swing (1 September 2012)

Rotation of the revolving upper structure for movement of loads in a horizontal direction about the axis of rotation.

7.85 Swing Circle (Slewing Ring) Assembly (Pedestal Mounted Cranes) (1 July 2016)

Swing Circle (Slewing Ring) Assembly is the connection component between the crane revolving upper structure and the pedestal. This component allows crane rotation and sustains the moment, radial and axial loads imposed by the crane operations.

7.87 Swing (Slewing) Mechanism (1 July 2016)

The machinery involved in providing rotation of the cranes' revolving upper structure.

7.89 Swinging Loads (1 July 2016)

Swinging Loads refers to the use of a single boom to lift a load, with arrangements for changing the position of the boom while supporting the load.

7.91 Union Purchase (1 July 2016)

Union Purchase means an arrangement in which a pair of booms is used in combination, the booms being fixed and the cargo runners coupled. Such an arrangement is also known as "coupled derricks", "married falls", or "burtoning".

7.93 Vertical Amplification Factor (VAF) (1 July 2016)

Vertical Amplification Factor is a factor calculated in accordance with 2-2/7, 2-2/9 or 2-2/11 in order to address the dynamic and impact effects on the lifted load.

7.95 Whipline (Auxiliary Line) (1 September 2012)

A secondary hoist rope system usually of a lighter load capacity than provided by the main hoist.

TABLE 1
Examples of Primary Structural Members (1 July 2016)

<i>No.</i>	<i>Member</i>
1	Boom or jib, including upper, lower and insert sections, chord members and lacings ⁽¹⁾
2	Center post, gantry, mast or “A”-frame, including chord members and other primary load carrying members
3	Crane base (revolving frame and tub-structure), slew column
4	Load carrying beams
5	Eye plates, lugs and brackets
6	Swing circle assembly and hold down bolts
7	Pins and shafts
8	Crane foundation, pedestal, and kingpost
9	Fasteners loaded in tension in the load path of all primary structural members
10	Hook blocks ⁽²⁾

Notes:

- 1 Lacings are considered as primary structural members, unless demonstrated by the designer that failure of one lacing would not impair the structural integrity of the crane boom.
- 2 Applicable only when treated as special component. See 2-5/1.5 and 2-5/5.

TABLE 2
Examples of Critical Machinery Components (1 July 2016)

<i>No.</i>	<i>Component</i>
1	Torque transmitting components of hoisting, luffing, and slewing mechanisms, such as drums, shafts, gears, couplings, and brakes
2	Winch supports and foundations
3	Luffing, folding, and telescoping hydraulic cylinders

9 Certification of Components (1 July 2016)

Crane components are to be certified in accordance with 2-1/9 TABLE 3. For the applicable requirements for each component, refer to the respective sections of this Guide.

TABLE 3
Crane Components Certification (1 July 2016)

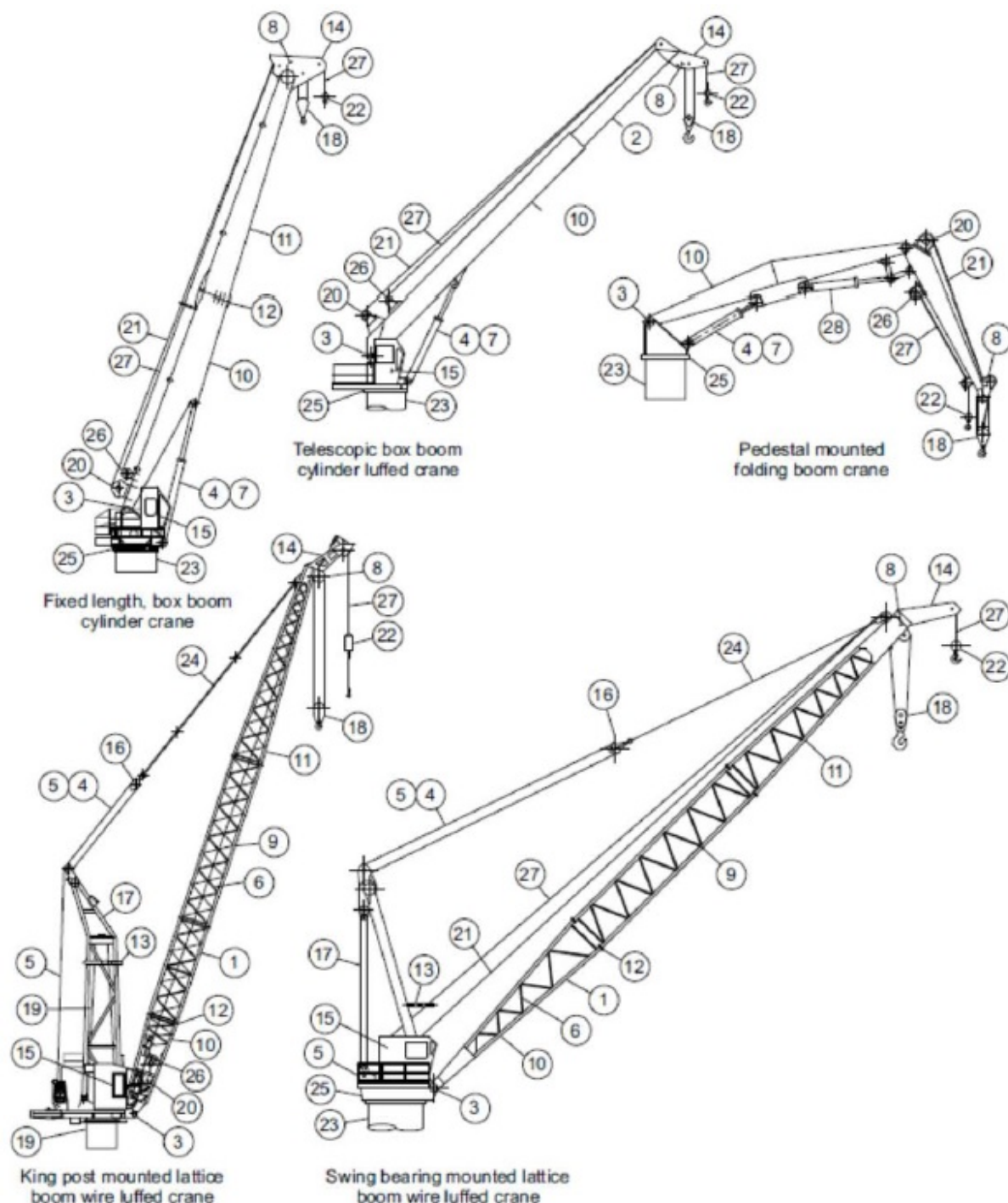
<i>Component ⁽²⁾</i>		<i>ABS Design Review</i>	<i>ABS Unit Certification</i>	<i>Additional Notes</i>
1	Certified Safe Electrical Equipment			Type-tested and certified by a competent, independent testing laboratory for compliance with IEC Publication 60079 or equivalent or ABS Type Approved.
2	Electric Cables			Testing by the manufacturers in accordance with the standards of compliance and records of test to be maintained and submitted upon request by ABS. Construction to be in accordance with the standards specified in 4-8-3/9 of the <i>Marine Vessel Rules</i> or ABS Type Approved.
3	Electric Motors ≥ 100 kW ⁽³⁾	X	X	
4	Electric Motors < 100 kW ⁽³⁾	X		Test certificate furnished by the manufacturer. Testing witnessed by the Surveyor after installation of the crane.
5	Flexible Hoses and Hose End Fittings	X		Design approved by ABS or, alternatively ABS Design Assessment Certificate (PDA)
6	Hoisting, Slewing, Luffing Winches/Gears ≥ 100 kW	X	X	
7	Hoisting, Slewing, Luffing Winches/Gears < 100 kW	X		Integrated gear boxes are to be design verified if located between the braking safety device and the load.
8	Hook Blocks ⁽⁵⁾	X	X	For mass produced hook blocks, acceptance may be based on satisfactory ABS design review and manufacturer's loose gear test certificate
9	Critical Hydraulic Cylinders (including Piston Rods) ⁽³⁾	X	X	
10	All other Hydraulic Cylinders (including Piston Rods)	X		Design review in accordance with 4-6-7/3.5.5 of the <i>Marine Vessel Rules</i>
11	Internal Combustion Engines			Manufacturer's affidavit for compliance with good commercial and marine practice and the requirements of 2-6/11, as applicable.
12	Loose Gear			Testing as per Section 2-5 and certificate furnished by the manufacturer, as per 2-5/1.3. For special components, as per 2-5/1.5 is requested, ABS design review and unit certification is required.

Component ⁽²⁾		ABS Design Review	ABS Unit Certification	Additional Notes
13	Pressure Vessels and Heat Exchangers of 150 mm (6 in.) in diameter and over and Accumulators, regardless of their diameter ⁽⁴⁾	X	X	Certification in accordance with Section 4-4-1 of the <i>Marine Vessel Rules</i>
14	Pressure Vessels and Heat Exchangers under 150 mm (6 in.) in diameter			Acceptance based on manufacturer's guarantee of physical properties and suitability for the intended service, provided the installation is carried out to the satisfaction of the Surveyor.
15	Sheaves	X		Materials to be as per Section 2-3. If not built into the structure they are to be treated as loose gear.
16	Swing Circle (Slewing Ring)	X	X	
17	Wire Ropes			Certificate of test furnished by the manufacturer, as per 2-4/5.

Notes:

- 1 For materials' certification, refer to Section 2-3.
- 2 For components not covered by this table, refer to the appropriate sections of this Guide.
- 3 (1 July 2016) Applicable only for critical components. Refer to 2-1/7.65.
- 4 (1 July 2016) Applicable only for pressure vessels and heat exchangers having design pressure, temperature and volume as defined in 4-4-1/1.1 TABLE 1 of the *Marine Vessel Rules*.
- 5 (1 July 2016) Applicable only when treated as special component. Refer to 2-5/1.5 and 2-5/5.

FIGURE 1
Pedestal Mounted Rotating Cranes (1 July 2016)



Key

- | | | | |
|---|--------------------------------------|--------------------------------|---------------------------------------|
| 1 boom chord | 9 boom section, insert | 15 cab | 23 pedestal or base |
| 2 boom extension | 10 boom section, lower, base or butt | 16 bridle | 24 pendant line |
| 3 boom heel pin | 11 boom section, upper, point or tip | 17 gantry, mast, or A-frame | 25 swing-circle assembly |
| 4 boom hoist mechanism | 12 boom splice | 18 hook block | 26 whip line or auxiliary hoist drum |
| 5 boom hoist wire rope or boomline | 13 boom stop | 19 kingpost or center post | 27 whip line or auxiliary hoist rope |
| 6 boom lacing | 14 boom tip extension or jib | 20 main hoist drum | 28 folding boom articulating cylinder |
| 7 boom luffing cylinder | | 21 main hoist rope or loadline | |
| 8 boom point sheave assembly or boom head | | 22 overhaul ball | |

2-1/Figure 1 is taken from API Specification 2C, *Offshore Pedestal-mounted Cranes*, Seventh Edition, March 2012. Reproduced courtesy of the American Petroleum Institute.

FIGURE 2
Gantry Cranes

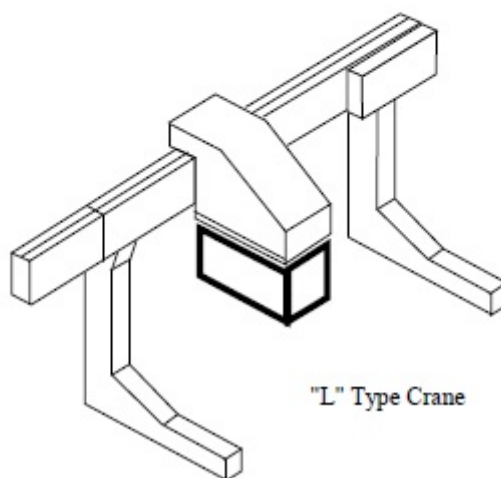
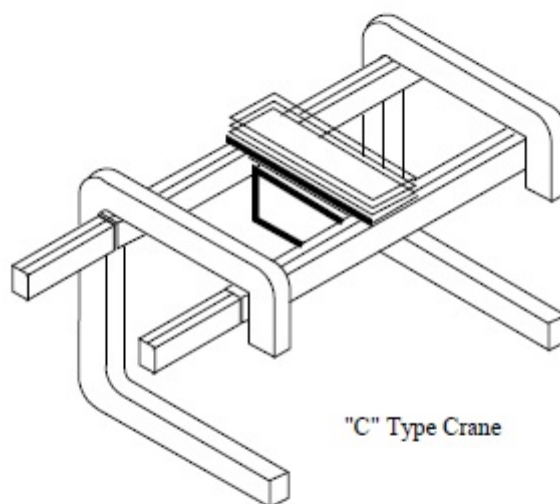
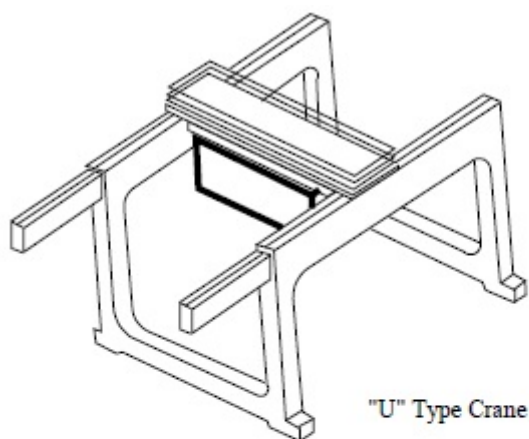


FIGURE 3
Tub Mounted Rotating Crane

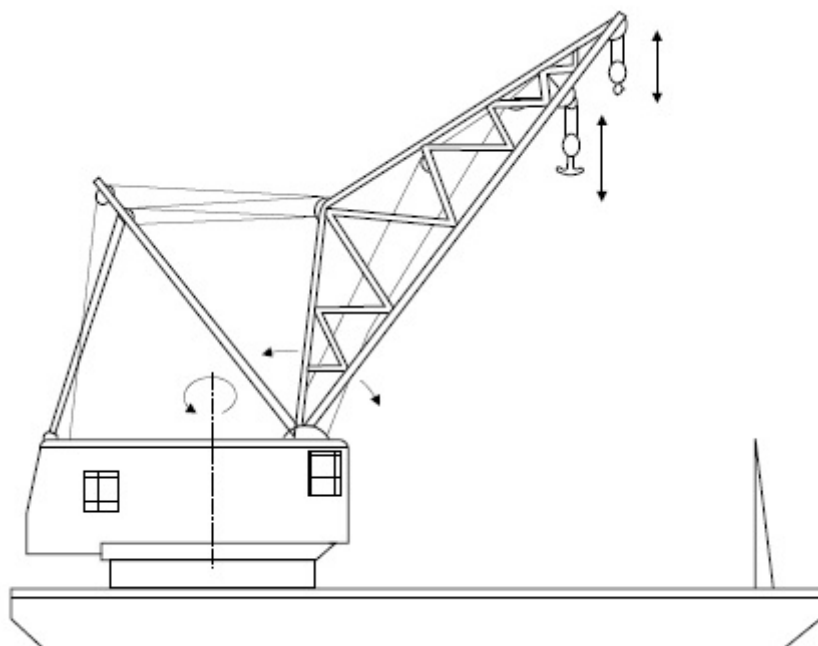


FIGURE 4
Shear Leg Crane

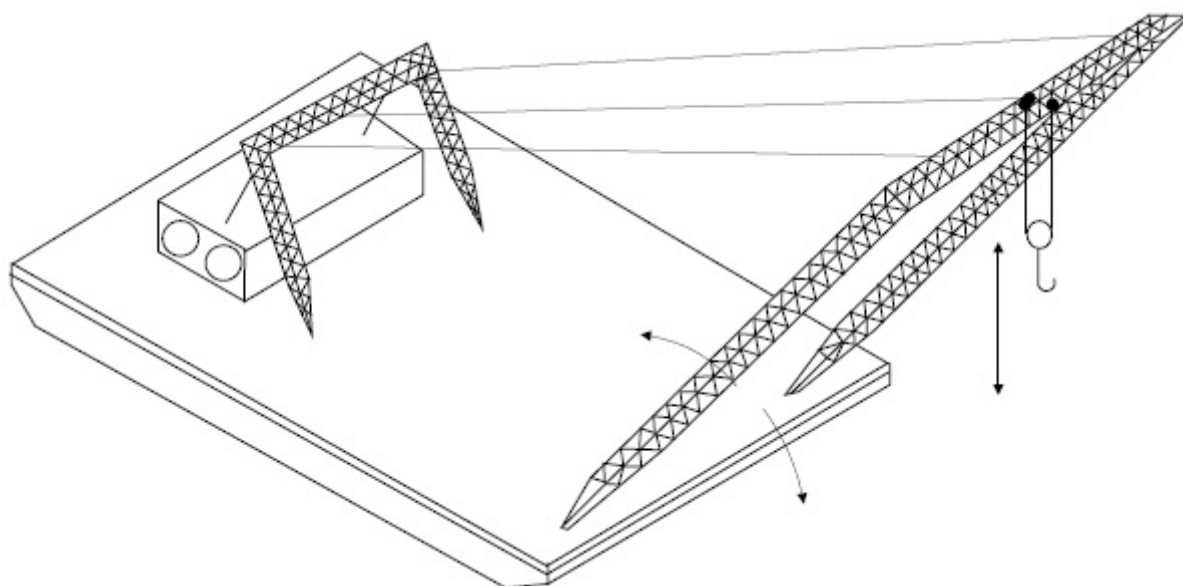


FIGURE 5
Stiffleg Derrick Crane

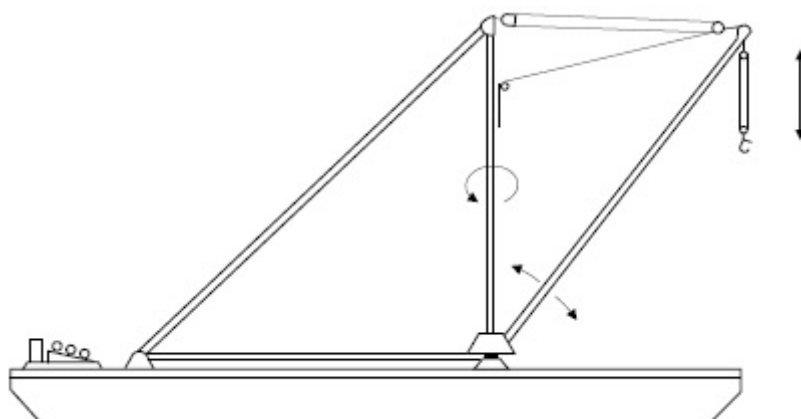
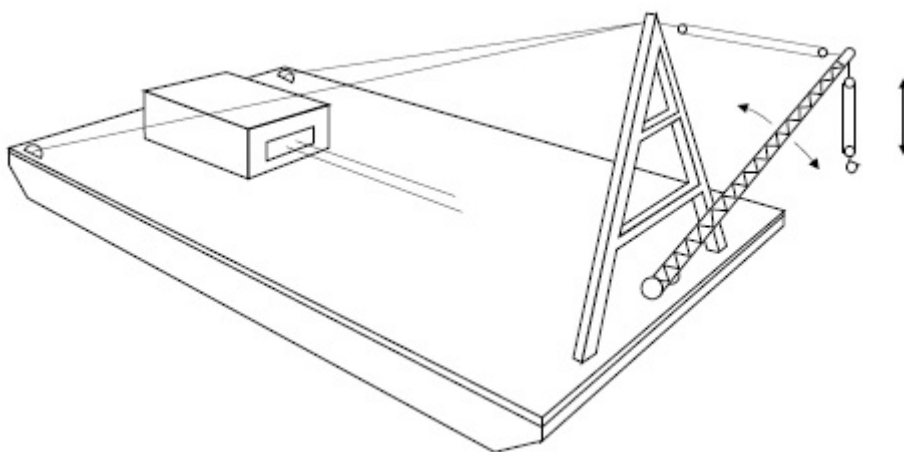


FIGURE 6
“A”-Frame Derrick Crane



CHAPTER 2 Guide for Certification of Cranes

SECTION 2 Structural Requirements (1 July 2016)

1 General (1 July 2016)

1.1 Cranes

These requirements are applicable to pedestal and tub mounted rotating, gantry, shear leg, stiffleg, “A”-frame type and overhead (bridge) cranes, as defined in 2-1/7.31, 2-1/7.53 and 2-1/7.75. Other types of cranes will be considered on an individual basis. Except where indicated otherwise, 2-2/3 and 2-2/5 are general requirements which apply to the cranes specified in 2-2/7, 2-2/9 and 2-2/11.

The design service temperature (DST) is to be indicated at an appropriate place for the crane operator’s information. For lifting appliances approved for varying capacities, it is to be indicated on the crane capacity rating chart (see 2-2/1.5).

1.3 Conditions for Strength Assessment

Crane primary structural members are to be designed for full compliance with the requirements in this Section. The following three conditions are to be considered in application of these strength criteria:

- i) Crane in-service; crane suspends a load from the cargo hook,
- ii) Crane out-of-service; the boom not stowed on boom rest or on other stowage arrangement,
- iii) Crane out-of-service, the boom stowed on boom rest or other stowage arrangement

1.5 Crane Capacity Rating Charts (Load Charts)

For cranes approved for varying capacities and/or environmental conditions, crane capacity rating charts (load charts) are to be provided, which are to include the following information:

- i) Safe Working Load ratings for operating radii increments not exceeding 1.5 m (5 ft), or corresponding boom angles for the specified boom and jib length
- ii) Corresponding environmental conditions, such as significant wave height and wind speed, and vessel inclinations (list and trim)
- iii) Corresponding rating conditions, such as onboard or offboard lifting, as applicable
- iv) Design Service Temperature (DST) of the crane
- v) Corresponding number of wire rope line parts (falls) and/or reference to corresponding wire rope reeving diagrams, as applicable
- vi) Weight of the hook, hook block, etc.
- vii) The name of the vessel or unit the chart is applicable to, the crane’s serial number and manufacturer

An approved copy of the crane capacity rating chart will be included in the Register of Lifting Appliances and is to be furnished to the Owner for use by crane personnel. See 2-7/5.11.

For capacity rating chart requirements of cranes used for personnel lifting, see Section 2-9.

3 Materials

3.1 Material Selection Requirements

Material for structural members and components is to be as required in Section 2-3.

3.3 Minimum Thickness of Structural Members

Crane boom chords and other members considered to be critically stressed are to have the following minimum thickness:

Solid Sections: 6 mm (0.24 inch) thick

Hollow Sections (e.g., truss boom lacings): 4 mm (0.16 inch) thick

For less stressed members, a minimum thickness of 4 mm (0.16 in.) is to be provided.

Interior of hollow sections is to be either coated or is shown to be tight to the attending Surveyor.

3.5 Effective Corrosion Control (1 July 2016)

Special protective coatings are to be applied to those structural members of the crane where the thickness is less than 6 mm (0.24 in.) to the satisfaction of the attending Surveyor.

5 Loads and Stresses (1 July 2016)

5.1 Loading Conditions (1 July 2016)

5.1.1 In-service Loads

Typical loads to be submitted and considered in the analysis of the cranes, as applicable, are:

- i) Dead loads
- ii) Live loads and dynamic loads, including the applicable vertical amplification factors, as per 2-2/7, 2-2/9, or 2-2/11
- iii) Loads due to vessel's or unit's motions, as per 2-2/5.17
- iv) Loads due to wind, as per 2-2/5.19
- v) Loads due to list and/or trim, as per 2-2/5.21
- vi) Load swing caused by non-vertical lift
- vii) Snow and ice

The analysis of the cranes is to be based on the worst combination of the above loads, as applicable.

For additional requirements for Shipboard, Offshore and Heavy Lift Cranes, refer to 2-2/7, 2-2/9, and 2-2/11 respectively.

If the crane is subject to unusual loads and/or unusual operating conditions, these are also to be submitted and are specially considered for each case.

5.1.2 Out-of-service Loads

In addition to the in-service loads, the out-of-service loads are to be submitted and considered in the structural analysis of the crane. The out-of-service loads are to include the loads resulting from the weight of the crane and the following environmental and motion loads:

- i) Environmental forces (wind, snow and ice, etc.)

- ii) Loads due to vessel's or unit's motions
- iii) Loads due to list and trim

In the out-of-service condition no load is to be suspended from the crane's hook.

The designer is to demonstrate, through analysis, that the stresses during out-of-service conditions, with boom stowed and not stowed, do not exceed the allowable stresses given in 2-2/5.5. For extreme conditions of seismic loads or extreme winds, an increase of up to 33% in the allowable stresses may be used.

5.3 Allowable Stress Coefficients

The allowable stress coefficients, S_c , referred to herein are specified in 2-2/5.3 Table 1.

TABLE 1
Allowable Stress Coefficient, S_c (1 July 2016)

Type of Stress	Allowable Stress Coefficient, S_c
<i>Tension:</i>	
Non-Pin Connected members (gross area)	0.60
Pin Connected members (net area)	0.45
<i>Shear:</i>	
On the Cross Sectional Area Effective in Resisting Shear	0.40
<i>Bending: (Tension and Compression on Extreme Fibers)</i>	
Solid Round and Square Bars	0.75
Members with Compact Sections ⁽³⁾	0.66
Members with Non-Compact Sections ⁽³⁾	0.60
<i>Bearing Stress:</i>	
On contact area of surfaces and projected area of pins in holes	0.90
<i>Combined Stress:</i>	
Von Mises Stress	0.75
Von Mises Stress using FEM Fine Mesh Analysis with All Loads	0.85

Notes:

- 1 Members subjected to combined stresses are to be proportioned to satisfy requirements of 2-2/5.7.
- 2 For additional guidance, see AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings, June 1, 1989.
- 3 (1 July 2016) For classification of sections as compact or non-compact, refer to 2/1.7 of ABS *Guide for Buckling and Ultimate Strength Assessment for Offshore Structures*.

5.5 Allowable Stresses (1 July 2016)

Computed tensile, bending and shear stress components and, as applicable, combinations of such stresses, for primary structural members are not to exceed the allowable stress, F , as obtained from the following equation:

$$F = F_y \times S_c$$

For steel booms:

$$F_y = \text{specified minimum yield point of the material}$$

For all other steel structural parts:

$$F_y = \text{minimum yield point. For design purposes, for steels with yield strength not exceeding } 355 \text{ N/mm}^2 \text{ (36 kgf/mm}^2, 51 \text{ ksi)} F_y \text{ is to be considered taken as not greater than 72\% of the minimum ultimate strength of the steel.}$$

$$S_c = \text{specified in 2-2/5.3}$$

5.7 Buckling and Combined Stresses (1 July 2016)

Members subjected to axial compression or combined loads, such as axial compression and bending moment, are to be assessed in accordance with the requirements of *ABS Guide for Buckling and Ultimate Strength Assessment for Offshore Structures*. Assessment performed in accordance with other applicable standards will be subject to special consideration.

For members with non-compact cross sections, as classified in accordance with 2/1.7 of *ABS Guide for Buckling and Ultimate Strength Assessment for Offshore Structures*, the local buckling is to be taken into account and is to be evaluated in accordance with the provisions of *ABS Guide for Buckling and Ultimate Strength Assessment for Offshore Structures*.

Design section properties of tapered members are to be determined in accordance with 2-2/5.9.2.

The effective length of crane booms may be determined in accordance with Appendix C of BS 2573-1:1983 or other recognized standards.

5.9 Design Properties for Structural Members

5.9.1 General (1 July 2016)

The design section properties for a box type boom of lattice construction with tapered ends are specified in 2-2/5.9.2. Other types of members will also be considered.

Built up sections with multiple layered plates of primary structural members will be subject to special consideration.

5.9.2 Tapered Members

The moment of inertia, section modulus and radius of gyration to be used in the design of box-type booms of lattice construction, having tapered ends of similar proportions and constant-size corner members, are to be those of a prismatic member of equivalent stiffness, having ends that are similar, equal and parallel. See 2-2/5.9.2 FIGURE 1.

The moment of inertia I_z at any cross-section within the tapered portion may be computed as:

$$I_z = I_1(Z/a)^2$$

where I_1 is the moment of inertia at the small end of tapered portion and the distances Z and a are shown in 2-2/5.9.2 FIGURE 1.

If the moment of inertia I_1 , at the top end of the boom, differs from the bottom end, the smaller of the two values is to be used to find the ratio I_1/I_o

The moment of inertia I_o at the large end of the tapered portion may be computed as:

$$I_o = I_1(d_o/d_1)^2$$

where d_o and d are, respectively, the out-to-out distance of chord angles at the large and small end of the tapered portion.

The equivalent radius of gyration, r , for use in determining the slenderness ratio of the boom acting as a column, is:

$$r = \sqrt{CI_o/A}$$

where

I_o = moment of inertia at any section through length h (prismatic central portion) of the member

C = applicable coefficient from 2-2/5.9.2 TABLE 2.

A = area of cross-section at any section through length h (prismatic central portion)

CI_o = average moment of inertia

FIGURE 1
Box Type Boom

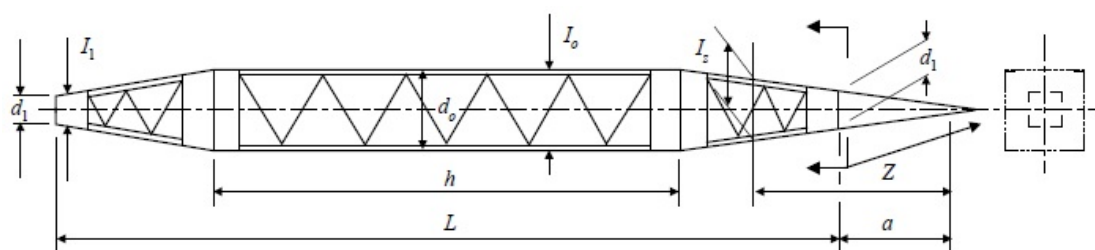


TABLE 2
Coefficients C

I_1/I_0	h/L					
	0	0.2	0.4	0.6	0.8	1.0
0.0	0.101	0.158	0.282	0.633	0.970	1.000
0.01	0.350	0.479	0.667	0.873	0.984	1.000
0.1	0.548	0.675	0.818	0.937	0.993	1.000
0.2	0.645	0.760	0.873	0.957	0.995	1.000
0.4	0.772	0.852	0.929	0.976	0.998	1.000
0.6	0.863	0.916	0.962	0.987	0.999	1.000
0.8	0.937	0.963	0.982	0.995	1.000	1.000
1.0	1.000	1.000	1.000	1.000	1.000	1.000

5.11 Crane Boom and Structural Component Fasteners

Allowable tension and shear stresses for boom and structural component rivets, bolts and thread parts are to be as per AISC Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings, or other recognized standards. For hold-down bolts see 2-2/5.13.

5.13 Swing Circle (Slewing Ring) (1 July 2016)

The following requirements apply to swing circle assemblies (as defined in 2-1/7.85) for Shipboard, Offshore, and Heavy Lift Pedestal Mounted Cranes.

5.13.1 Loads and Moments

Based on the type of the crane (i.e., Shipboard, Offshore or Heavy Lift), the respective loads and moments from 2-2/5.1 and 2-2/7, 2-2/9, or 2-2/11 are to be considered for the analysis of the swing circle assembly.

5.13.2 Supporting Flanges

The design of flanges and their attachment to the pedestal or other supporting structures is to consider the slew bearing manufacturer's recommendations for maximum permissible flange deflection as well as the degree of flatness of the surface of the flanges that are in contact with the slew bearing.

Where principal loads from either service or weld residual stresses are imposed to the flange through thickness direction, the flanges are to be made of material with improved through thickness properties, as per 2-3/11.

5.13.3 Hold-down Bolts

The bolt load, P_b , on the most heavily loaded slewing ring bolt is to be calculated for the most severe in-service loading conditions by the following equation:

$$P_b = \frac{4M}{ND} - \frac{V}{N}$$

where

- M = design overturning moment, as calculated based on the loads of 2-2/5.1, using 3.75 times the vertical design load (see 2-2/7, 2-2/9, or 2-2/11, as applicable)
- V = vertical load, as calculated based on the loads of 2-2/5.1, using 3.75 times the vertical design load (see 2-2/7, 2-2/9, or 2-2/11, as applicable)
- D = pitch circle diameter of bolts
- N = number of slewing ring bolts in a 360° uniform bolting pattern

The design overturning moment is to be based on a combination of in-plane and side plane loading.

As an alternative to the above, consideration will be given to calculation of the bolt load (P_b) using an independent analysis, which is to be submitted for review.

The maximum calculated bolt tensile stress is not to exceed the minimum specified ultimate tensile strength of the bolt material.

During installation, the bolts are to be pretensioned by controlled means to the satisfaction of the attending Surveyor. Pretensioning, by bolt torque or by hydraulic tensioning device, is to be in accordance with the bearing manufacturer's instructions and is not to exceed 0.7 times the bolt yield strength for bolts pretensioned by torque or 0.9 times the bolt yield strength for bolts pretensioned by axial tension.

Elongation of the bolts is to be measured to verify pretensioning. At least 10 percent of the bolts, randomly selected, are to be measured to the satisfaction of the attending Surveyor.

The material used in hold-down bolts is to be in accordance with 2-3/5.9.

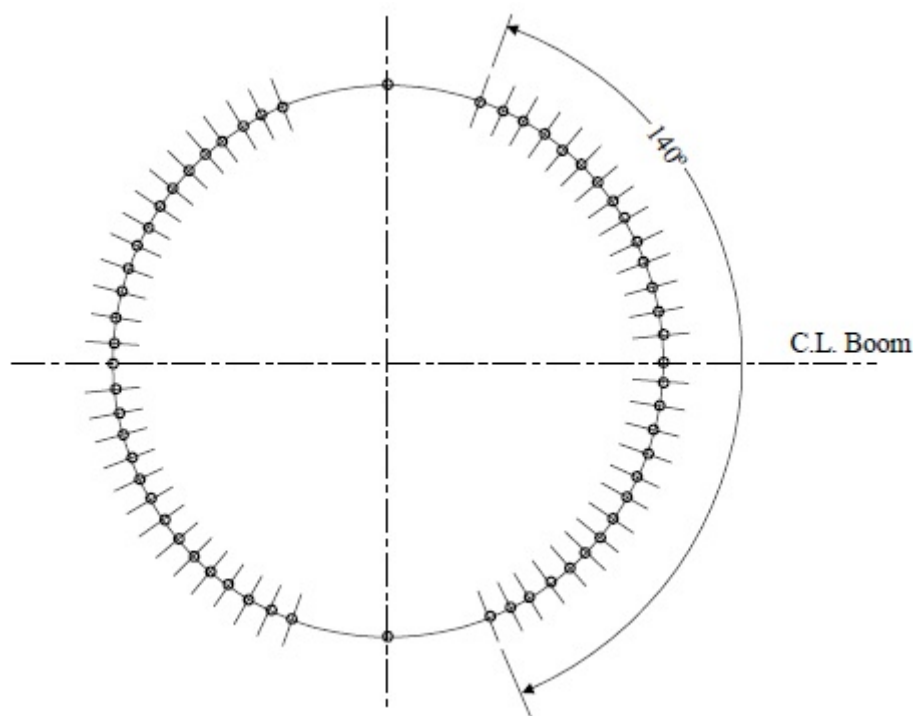
5.13.4 Bolting Arrangement

Where the swing circle assembly utilizes a roller or ball bearing slewing ring, the inner and outer bearing rings are to have a 360-degree uniform bolting pattern.

Consideration will be given to the use of sector bolting arrangement, provided a detailed structural analysis which includes side loading of the race, rings and bolted connection is submitted for review.

Where sector bolting is used, it is not to be less than 140-degree sectors and at least one additional bolt is to be fitted at the mid-point between each 140-degree sector where sectors extend to include a full circle. The center of each 140-degree sector is to be in line with the centerline of the boom. See 2-2/5.13.4 FIGURE 2.

FIGURE 2
Sector Bolting



5.13.5 Slewing Ring

5.13.5(a) Static Capacity of Bearing Raceways. The most severe loading at the slewing ring, based on the loads and moments of 2-2/5.1 and 2-2/7, 2-2/9, or 2-2/11, as applicable, is not to exceed the static capacity of the raceways, as specified by the bearing manufacturer. The design of bearing raceways is to take into consideration the maximum permissible bearing wear over the life of the bearing, as specified by the bearing manufacturer.

5.13.5(b) Lubrication. The slew bearing is to be sealed so as to prevent the ingress of foreign matter and contamination. A greasing nipple is to be provided for lubrication.

Lubrication holes are not to terminate on bearing raceways, except for ball bearings, where they are to be located outside the contact path of the ball bearings. The edges of lubrication holes are to be sloped gently so as to avoid sharp edges.

5.13.5(c) Retaining Components. Retaining components of slewing rings are to be designed for the overturning moments and vertical loads, as calculated based on the loads of 2-2/5.1, using 3.75 times the vertical design load (see 2-2/7, 2-2/9, or 2-2/11, as applicable), of the most severe in-service loading conditions. The overturning moment is to be based on a combination of in-plane and side plane loading.

The calculated stresses are not to exceed the ultimate tensile strength of the respective materials of the retaining components.

5.13.6 Swing Circle Assembly Retainer

An auxiliary device to restrain the upper frame against separation from the pedestal may be supplied at the option of the buyer. When the auxiliary device is supplied, the properties of materials used in its design and manufacture should be selected to resist fracture under impact loading. The maximum calculated stress, based on the loads of 2-2/5.13.5(c), is not to exceed the minimum specified ultimate tensile strength of the material.

5.13.7 Materials

Materials used in the swing circle assembly are to be in accordance with Section 2-3.

5.15 Pedestals, Kingposts, Foundations, and Supporting Structure (2018)

Crane pedestals, kingposts, foundations, and supporting structure are to be designed for the maximum reaction forces and moments due to most severe in-service and out-of-service loading conditions, in accordance with 2-2/5.1, where the horizontal and vertical loads due to the live load, including the applicable vertical amplification factors, in accordance with 2-2/7, 2-2/9, or 2-2/11, are to be multiplied by the pedestal factor as obtained from the following equation:

$$PF = 1.56 - \frac{LL}{C}$$

is not to be taken greater than 1.5 for all crane types, and

is not to be taken less than 1.2 for Offshore Cranes or less than 1.0 for Heavy Lift Cranes.

where

PF = pedestal factor

LL = live load, in kN (tf, lbf); See 2-1/7.41

C = 4000 (408, 900000)

No doubler plate is allowed between the pedestal and deck plate where any tension load is anticipated.

Detail drawings of the foundation and supporting structure on which the crane is to be installed are to be submitted and approved prior to certification.

These components are to meet the applicable allowable stresses without the 33% increase for extreme conditions of seismic loads or extreme winds as indicated in 2-2/5.1.2.

5.17 Loads due to Vessel's or Unit's Motions (1 July 2016)

Vertical and horizontal accelerations due to vessel's or unit's motions are to be specified by the manufacturer, are to be determined based on vessel motion analysis and are to be submitted and considered

in the analysis of Offshore Cranes, as per 2-2/9, and as applicable of Shipboard and Heavy Lift Cranes, as per 2-2/7 and 2-2/11.

In the absence of specific details, the minimum vertical and horizontal accelerations for vessels and units that are to be taken into consideration in the calculation of loads due to vessel's or unit's motions are to be in accordance with 2-2/5.17 TABLE 3.

The vertical load due to each crane component is to be calculated by the following equation:

$$VL_{DL} = DL(1 + a_v)$$

where

VL_{DL} = vertical load due to dead load, in kN (tf, lbf)

DL = component's dead load, in kN (tf, lbf)

a_v = vertical acceleration, in g

The horizontal load due to each crane component is to be calculated by the following equation:

$$HL_{DL} = DL a_h$$

where

HL_{DL} = horizontal load due to dead load, in kN (tf, lbf)

DL = component's dead load, in kN (tf, lbf)

a_h = horizontal acceleration, in g

The calculated vertical loads (VL_{DL}) and horizontal loads (HL_{DL}) are to be applied at the center of gravity of each crane component.

The horizontal load due to the lifted load is to be calculated by the following equation:

$$HL_{LL} = VDL a_h$$

where

HL_{LL} = horizontal load due to live load, in kN (tf, lbf)

VDL = vertical design load, in kN (tf, lbf); see 2-2/7, 2-2/9, and 2-2/11

a_h = horizontal acceleration, in g

The calculated horizontal load (HL_{LL}) is to be applied at the boom tip.

The angle of application of the horizontal loads is to be taken as such so as to induce the maximum loading on the crane.

TABLE 3
Minimum Accelerations due to Vessel's or Unit's Motions (1 July 2016)

<i>Vessel or Unit Type</i>	<i>Vertical Acceleration (g) a_v</i>	<i>Horizontal Acceleration (g) a_h</i>
Ship/barge in calm water and bottom supported structure	0	0
Tension Leg Platform/Spar	$H_{sig}/101.6$ (H_{sig} in m) $H_{sig}/333$ (H_{sig} in ft) but not less than 0.07	$H_{sig}/43.6$ (H_{sig} in m) $H_{sig}/143$ (H_{sig} in ft) but not less than 0.03
Semi-submersible	$H_{sig}^2/133$ (H_{sig} in m) $H_{sig}^2/1429$ (H_{sig} in ft) but not less than 0.07	
Drillship/FPSO	$H_{sig}^2/77.5$ (H_{sig} in m) $H_{sig}^2/833$ (H_{sig} in ft) but not less than 0.07	$H_{sig}^{1.1}/27$ (H_{sig} in m) $H_{sig}^{1.1}/100$ (H_{sig} in ft) but not less than 0.03

Notes:

- 1 H_{sig} = Significant Wave Height
- 2 For additional guidance, refer to Annex B of API Specification 2C – 7th edition.

5.19 Loads due to Wind (1 July 2016)

5.19.1 General

The wind velocities during in-service and out-of-service conditions are to be specified by the manufacturer, are to include the effects of gusts and vertical distance from the water surface to the crane location and are to be submitted and considered in the analysis of the cranes in accordance with sections 2-2/5.19.2 and 2-2/5.19.3.

In the absence of specific details, the following wind velocities are to be used:

- i) For crane in-service, 10.3 m/s (20 kn)
- ii) For crane out-of-service, boom not stowed, 36 m/s (70 kn)
- iii) For crane out-of-service, boom stowed, 51.5 m/s (100 kn)

5.19.2 Wind Pressure

In the calculation of wind pressure, P , the following equation is to be used.

$$P = \frac{V_k^2 \cdot C_s}{f} \text{ kN/m}^2 \text{ (tf/m}^2, \text{ lbf/ft}^2\text{)}$$

where

- $$f = 1637 \text{ (16051, 296)}$$
- $$V_k = \text{wind velocity in m/s (m/s, kn)}$$
- $$C_s = \text{shape coefficient from 2-2/5.19.2 TABLE 4}$$

TABLE 4
Values of C_s (1 July 2016)

<i>Component</i>	C_s
Spherical	0.4
Cylindrical shapes (all sizes)	0.5
Flat surfaces	1.0
Isolated structural shapes (angles, channels, beams, etc.)	1.5
Wires	1.2
Small parts	1.4
Lattice booms and derricks (each face)	1.25

Note: Shapes or combinations of shapes which do not readily fall into the specified categories will be subject to special consideration.

5.19.3 Wind Force

The wind force is to be calculated in accordance with the following equation for the live load and each crane component and the resultant force and point of application is to be determined.

$$HL_{wind} = PA$$

where

HL_{wind} = horizontal wind force, in kN (tf, lbf)

P = wind pressure, in kN/m² (tf/m², lbf/ft²)

A = projected area, in m² (m², ft²), of all exposed surfaces

In calculating the wind forces, the following procedures are recommended:

- i) The projected area of the live load is to be specified by the manufacturer or calculated in accordance with the following equation:

$$A_{LL} = CLL^{2/3}$$

where

A_{LL} = projected area of the lifted load, in m² (m², ft²)

C = 0.1215 (0.5565, 0.03536)

LL = live load, in kN (tf, lbf)

- ii) Open truss work commonly used for booms, certain types of masts, etc., may be approximated by taking 30% of the projected block areas of both the front and back sides (i.e., 60% of the projected block area of one side for double sided truss work). The shape coefficient is to be taken in accordance with 2-2/5.19.2 TABLE 4.
- iii) Wind forces are to be added in the horizontal loads of the live load and each crane component.

5.21 Loads due to List and Trim (1 July 2016)

Loads for each crane component and the lifted load due to the static inclination angles (list and trim) of the vessel or unit are to be applied as horizontal side loads at the center of gravity of each crane component and at the boom tip for the lifted load. The respective horizontal side loads are to be calculated by the following equation:

$$HL_{SLA} = L \times \sin \sqrt{\text{list}^2 + \text{trim}^2}$$

where

- HL_{SLA} = horizontal side load due to the static inclination angles (list and trim)
- L = dead load including the effect of vertical accelerations, as per 2-2/5.17, as applicable, or live load including the applicable vertical amplification factor, as per 2-2/7, 2-2/9, and 2-2/11

The static inclination angles for vessels and units that are to be taken into consideration in the calculation of loads due to list and trim are to be as follows:

- For in service conditions: as specified by the manufacturer, or in the absence of specific details in accordance with 2-2/5.21 TABLE 5.
- For out-of-service, with boom stowed, conditions: in accordance with 4-1-1/9 TABLE 7 of the *Marine Vessel Rules* or 4-1-1/7.1 TABLE 1 of the *MOU Rules*, as applicable.
- For out-of-service, with boom not stowed, conditions: as specified by the manufacturer.

TABLE 5
Minimum Static Inclination Angles for Vessels and Units (1 July 2016)

<i>Vessel or Unit Type</i>	<i>List (degrees)</i>	<i>Trim (degrees)</i>
Ship/barge in calm water	5	2
Bottom supported structure/Tension Leg Platform/Spar	0.5	0.5
Semi-submersible	1.5	1.5
Drillship/FPSO	2.5	1

5.23 Fatigue (2018)

For offshore cranes, fatigue analysis for the life expectancy of the crane, performed in accordance with a recognized method, such as API Spec 2C – 7th edition or F.E.M. 1.001 (3rd edition revised 1998.10.01), is to be submitted for review.

7 Shipboard Cranes (1 July 2016)

7.1 General

These requirements apply to shipboard cranes having Safe Working Loads (SWLs) of less than 1570 kN (160 tf, 352800 lbf). See 2-1/7.75. For additional requirements see 2-2/1, 2-2/3 and 2-2/5.

Cranes approved for varying capacities are to be in compliance with the requirements for shipboard cranes, as per 2-2/7, when SWLs are less than 1570 kN (160 tf, 352800 lbf), and in compliance with the requirements for heavy lift cranes, as per 2-2/11, when SWLs are 1570 kN (160 tf, 352800 lbf) or greater, as applicable.

Cranes intended to be operated while the vessel is at open sea, or where there may be motion relative to the other vessel during crane operations, are to meet the requirements for offshore cranes as per 2-2/9.

7.3 Design Considerations

Shipboard cranes are to be designed for the most severe in-service and out-of-service loading conditions as per 2-2/5.1, where the vertical design load due to the lifted load is to be calculated by the following equation:

$$VDL = LLVAF$$

where

VDL = vertical design load, in kN (tf, lbf)

LL = live load, in kN (tf, lbf); see 2-1/7.41

VAF = vertical amplification factor

= 1.3 for $SWL < 392$ kN (40 tf, 88200 lbf)

= $1.366 - \frac{SWL}{C}$ for 392 kN (40 tf, 88200 lbf) $\leq SWL < 1570$ kN (160 tf, 352800 lbf)

SWL = safe working load, in kN (tf, lbf); see 2-1/7.73

C = 5884 (600, 1322774)

The above vertical amplification factors are based on crane operations in mild environmental conditions, where there are no significant accelerations due to vessel's motions. For other environmental conditions, the above vertical amplification factors are to be increased by adding the respective accelerations as specified by the manufacturer and in accordance with 2-2/5.17; but when these accelerations exceed 0.07g, cranes are to meet the requirements for offshore cranes as per 2-2/9.

The total horizontal side load at the boom tip is to be calculated taking into account all applicable side loads in accordance with 2-2/5.1, including the effects of vessel motions, wind and vessel inclinations, as per 2-2/5.17, 2-2/5.19 and 2-2/5.21, but is not to be taken less than $0.02 \times VDL$.

The SWL for grab cranes is not to exceed 80% of the load that each complete crane assembly is approved to lift on the cargo hook. The weight of cargoes lifted by the grab including the weight of the grab and its accessories is not to be greater than the SWL for the grab crane.

9 Offshore Cranes (1 July 2016)

9.1 General

These requirements apply to offshore cranes. Operations may consist of lifting and setting loads on the vessel or structure on which the crane is installed (onboard lifts), or on other structures or vessels (offboard lifts). See 2-1/7.53. For additional requirements see 2-2/1, 2-2/3 and 2-2/5.

9.3 Design Considerations

9.3.1 Onboard Lifts

For onboard lifts, the vertical design load due to the lifted load is to be calculated by the following equation:

$$VDL = LLVAF_{onb}$$

where

VDL = vertical design load, in kN (tf, lbf)

LL = live load, in kN (tf, lbf); see 2-1/7.41

VAF_{onb} = onboard vertical amplification factor

$$= 1.373 - \frac{LL}{C} + a_v, \text{ but is not to be less than } 1.1 + a_v \text{ or greater than } 1.33 + a_v$$

C = 5220 (532.5, 1173913)

a_v = vertical acceleration, in g; see 2-2/5.17

The total horizontal side load at the boom tip, taking into account all applicable side loads in accordance with 2-2/5.1, including the effects of vessel motions, wind and vessel inclinations, as per 2-2/5.17, 2-2/5.19, and 2-2/5.21, is not to be less than $0.02 \times VDL$.

9.3.2 Offboard Lifts

For offboard lifts, where there may be motion relative to the other vessel during crane operations, the vertical design load due to the lifted load is to be calculated by the following equation:

$$VDL = LLVAF_{offb}$$

where

VDL = vertical design load, in kN (tf, lbf)

LL = live load, in kN (tf, lbf); see 2-1/7.41

VAF_{offb} = offboard vertical amplification factor; but is not to be less than the onboard vertical amplification factor, VAF_{onb} , as obtained in 2-2/9.3.1

$$= 1 + v_r \times \sqrt{\frac{K}{g \times LL}}$$

g = acceleration due to gravity

$$= 9.81 \text{ m/s}^2 (32.2 \text{ ft/s}^2)$$

K = crane stiffness, in kN/m (tf/m, lbf/ft); as specified by the crane manufacturer, where it is to be calculated taking into account all elements from the hook through the pedestal structure.

v_r = relative velocity, in m/s (m/s, ft/s)

$$= v_h + \sqrt{v_d^2 + v_c^2}$$

v_h = maximum steady hoisting velocity for the live load, in m/s (m/s, ft/s); not to be less than v_{hmin}

v_{hmin} = minimum steady hoisting velocity to avoid re-contact of the lifted load with the supply boat
m/s (m/s, ft/s)

$$= 0.01 + 0.098 \times H_{sig} \quad \text{in m/s; for } H_{sig} \leq 1.8 \text{ m}$$

$$= 0.033 + 0.098 \times H_{sig} \quad \text{in ft/s; for } H_{sig} \leq 6 \text{ ft}$$

$$= 0.067 \times (H_{sig} + 1) \quad \text{in m/s; for } H_{sig} > 1.8 \text{ m}$$

$$= 0.067 \times (H_{sig} + 3.3) \quad \text{in ft/s; for } H_{sig} > 6 \text{ ft}$$

- H_{sig} = significant wave height, in m (m, ft)
- v_d = vertical velocity of the deck of the vessel or unit supporting the load, in m/s (m/s, ft/s); as specified by the manufacturer; or in the absence of specific details in accordance with 2-2/9.3.2 TABLE 6
- v_c = vertical velocity of the crane boom tip due to the motions of the vessel or unit the crane is mounted on, in m/s (m/s, ft/s); as specified by the manufacturer based on motion analysis of the crane and vessel or unit; or in the absence of specific details in accordance 2-2/9.3.2 TABLE 7

TABLE 6
Vertical Velocity of the Deck Supporting the Load, v_d (1 July 2016)

Lifting from or to:	v_d (m/s)	v_d (ft/s)
Bottom supported structure	0	0
Moving vessel (supply boat), for $H_{sig} < 3$ m (9.8 ft)	$0.6 \times H_{sig}$ (in m)	$0.6 \times H_{sig}$ (in ft)
Moving vessel (supply boat), for $H_{sig} \geq 3$ m (9.8 ft)	$0.9 + 0.3 \times H_{sig}$ (in m)	$5.9 + 0.3 \times (H_{sig} - 9.8)$ (in ft)

Notes:

- 1 H_{sig} = Significant Wave Height
- 2 For additional guidance, refer to Annex B of API Specification 2C – 7th edition.

TABLE 7
Vertical Velocity of the Crane Boom Tip, v_c (1 July 2016)

Lifting from or to:	v_c (m/s)	v_c (ft/s)
Ship/barge in calm water and bottom supported structure	0	0
Tension Leg Platform/Spar	$0.05 \times H_{sig}$ (in m)	$0.05 \times H_{sig}$ (in ft)
Semi-submersible	$0.082 \times H_{sig}^2$ (in m)	$0.025 \times H_{sig}^2$ (in ft)
Drillship/FPSO	$0.164 \times H_{sig}^2$ (in m)	$0.05 \times H_{sig}^2$ (in ft)

Notes:

- 1 H_{sig} = Significant Wave Height
- 2 For additional guidance, refer to Annex B of API Specification 2C – 7th edition.

The horizontal loads due to the motions of the deck of the vessel or unit that is supporting the load are to be taken into account in all offboard lifts.

When specific offlead and sidelead angles are specified by the manufacturer for the horizontal loads at the boom tip due to the motions of the deck of the vessel or unit that is supporting the lifted load, the horizontal radial in-plane (offlead) load and the horizontal side load are to be calculated as follows:

$$HL_{SV.offlead} = VDL \tan(\text{offlead angle})$$

$$HL_{SV.side} = VDL \tan(\text{sidelead angle})$$

where

$HL_{SV.offlead}$ = horizontal radial in-plane (offlead) load due to the motions of the deck of the vessel or unit that is supporting the lifted load, in kN (tf, lbf)

$HL_{SV.side}$ = horizontal side load due to the motions of the deck of the vessel or unit that is supporting the lifted load, in kN (tf, lbf)

In the absence of specific details, the horizontal radial in-plane (offlead) load and the horizontal side load are to be calculated as follows:

$$HL_{SV.offlead} = VDLf_{SV} \quad \text{in kN (tf, lbf)}$$

$$HL_{SV.side} = 0.5HL_{SV.offlead} \quad \text{in kN (tf, lbf)}$$

where

f_{SV} = offlead factor; but not greater than 0.30

$$= \frac{2.5 + 1.5 \times H_{sig}}{H_{tip}} \quad \text{for } H_{sig} \text{ and } H_{tip} \text{ in m}$$

$$= \frac{2.5 + 0.457 \times H_{sig}}{0.305 \times H_{tip}} \quad \text{for } H_{sig} \text{ and } H_{tip} \text{ in ft}$$

H_{sig} = significant wave height, in m (ft)

H_{tip} = vertical distance from boom tip to deck of the vessel or unit supporting the lifted load, in m (ft)

The horizontal loads due to effects on the live load of the vessel's or unit's motions on which the crane is mounted on (refer to 2-2/5.17) and the motions of the deck of the vessel or unit that is supporting the load are to be combined as follows:

$$HL_{comb} = \sqrt{HL_{SV}^2 + HL_{LL}^2}$$

where

HL_{comb} = combined horizontal load; radial in-plane (offlead) load or side load

HL_{SV} = horizontal load due to the motions of the deck of the vessel or unit that is supporting the lifted load; radial in-plane load or side load, respectively

HL_{LL} = horizontal load due to the motions of the vessel or unit the crane is mounted on; radial in-plane load or side load, respectively; see 2-2/5.17

The total horizontal side load at the boom tip, taking into account the above combined horizontal side load and all other applicable side loads in accordance with 2-2/5.1, including the effects of wind and vessel inclinations, as per 2-2/5.19 and 2-2/5.21, is not to be less than $0.02 \times VDL$.

11 Heavy Lift Cranes (1 July 2016)

11.1 General (1 July 2016)

These requirements apply to heavy lift cranes having Safe Working Loads (SWLs) of not less than 1570 kN (160 tf, 352800 lbf). See 2-1/7.31. For additional requirements, see 2-2/1, 2-2/3 and 2-2/5.

Cranes approved for varying capacities are to be in compliance with the requirements for shipboard cranes, as per 2-2/7, when SWLs are less than 1570 kN (160 tf, 352800 lbf), and in compliance with the requirements for heavy lift cranes, as per 2-2/11, when SWLs are 1570 kN (160 tf, 352800 lbf) or greater, as applicable.

Cranes intended to be operated while the vessel is at open sea in environmental conditions other than mild, or where there may be motion relative to the other vessel during crane operations, are to meet the requirements for offshore cranes as per 2-2/9.

11.3 Design Considerations (1 July 2016)

Heavy lift cranes are to be designed for the most severe in-service and out-of-service loading conditions as per 2-2/5.1, where the vertical design load due to the lifted load is to be calculated by the following equation:

$$VDL = LLVAF$$

where

VDL	=	vertical design load, in kN (tf, lbf)
LL	=	live load, in kN (tf, lbf); see 2-1/7.41
VAF	=	vertical amplification factor
	=	1.1

The above vertical amplification factor is based on crane operations in mild environmental conditions, where there are no significant accelerations due to vessel's motions. For other environmental conditions, the above vertical amplification factor is to be increased by adding the respective accelerations as specified by the manufacturer and in accordance with 2-2/5.17; but when these accelerations exceed 0.07g, cranes are to meet the requirements for offshore cranes as per 2-2/9.

The horizontal side load due to the lifted load is to be calculated taking into consideration all applicable side loads in accordance with 2-2/5.1, including the effects of vessel motions, wind and vessel inclinations, as per 2-2/5.17, 2-2/5.19, and 2-2/5.21, but is not to be less than $0.02 \times VDL$.

11.5 Tub Mounted Crane Hook Roller Restraining Components

Hook roller restraining components are to be designed for 1.2 times the live load plus dead load without exceeding the allowable stresses specified in 2-2/5.3 Table 1.

13 Special Purpose Cranes (1 July 2016)

13.1 Davits

Davits for non-life saving applications are to meet the applicable requirements for shipboard cranes as per 2-2/7 of this Guide. When the davit is subjected to dynamic loads due to motion of the vessel/unit or when there may be motion relative to the other vessel/unit during davit operations, then the davit is to meet the applicable requirements for offshore cranes as per 2-2/9 of this Guide.

13.3 Monorail Hoists/Engine Room Overhead Cranes

Monorail hoists/engine room cranes are to meet the applicable requirements for shipboard cranes as per 2-2/7 of this Guide. When monorail hoists/engine room cranes are subjected to dynamic loads due to motion of the vessel/unit, then they are to meet the applicable requirements for offshore cranes as per 2-2/9 of this Guide.

13.5 Provision Cranes

Provision cranes are to meet the applicable requirements for shipboard cranes as per 2-2/7 of this Guide. When provision cranes are subjected to dynamic loads due to motion of the vessel/unit or when there may be motion relative to the other vessel/unit during crane operations, then they are to meet the applicable requirements for offshore cranes as per 2-2/9 of this Guide.

13.7 Union Purchase

Lifting gear for union purchase is to meet the applicable requirements for shipboard cranes as per 2-2/7 of this Guide. When union purchase is subjected to dynamic loads due to motion of the vessel/unit or when there may be motion relative to the other vessel/unit during union purchase operations, then the lifting gear is to meet the applicable requirements for offshore cranes as per 2-2/9 of this Guide.

The safe working load for union purchase should be determined with due regard for the swinging safe working loads for which the individual booms are certified. In no case is the safe working load for union purchase to exceed the safe working load of either of the individual booms and their associated gear for swinging loads.

The boom head locations for the certification of union purchase conditions should reflect realistic operating conditions for the particular gear and hatch configuration.

The path of the load hook between booms for analysis and testing is to be a straight line parallel to the deck. The height of the path above the deck is to be the lowest height at which the angle between the cargo runners equals 120 degrees. Where sufficient hook clearance above coamings and bulwarks can be obtained using a lesser height, such a height may be approved.

The angle between the cargo runners is not to exceed 120 degrees.

CHAPTER 2 Guide for Certification of Cranes

SECTION 3 Materials and Welding (1 July 2016)

1 Scope

This Section applies to materials for primary structural members, critical machinery components and other components as listed in this section, of lifting appliances covered by this Chapter, as well as lifting appliances of other Chapters of this Guide, as referenced therein.

3 General Requirements

3.1 General

Materials are to be suitable for the intended service conditions. They are to be of good quality, free of injurious defects and are to exhibit satisfactory formability and weldability characteristics.

3.3 Certification

Unless specified otherwise, materials used in the construction of lifting appliances are not required to be manufactured at steel works approved by ABS and tests are not required to be conducted in the presence of an ABS Surveyor. Where ABS material certification is required, the materials are to be certified in accordance with the applicable sections of ABS *Rules for Materials and Welding (Part 2)*.

Materials are to be furnished with certificates issued by the mill or the material manufacturer, indicating, as a minimum and as applicable, the material specification, grade, process of manufacture, heat treatment details, mechanical and chemical properties, identification numbers and test results. For those rolled steel products used for crane pedestals and kingposts, the appropriate grade to be used for respective material class and thickness is shown in 2-3/7.3 TABLE 1.

3.5 Identification of Materials

The manufacturer is to adopt a system for the identification of ingots, slabs, finished plates, shapes, castings and forgings which will enable the material to be traced to its original heat; and the Surveyor is to be given sufficient documentation and means for verifying the traceability of the material.

3.7 Other Standards

Materials, test specimens and mechanical testing procedures having characteristics differing from those prescribed herein may be approved upon application, with due regard being given to the design criteria, the established practices in the country in which the material is produced and the purpose for which the material is intended.

3.9 Materials other than Steel

Materials other than steel will be specially considered.

3.11 Materials Containing Asbestos

Installation of materials which contain asbestos is prohibited.

5 Material Selection

5.1 Primary Structural Members

5.1.1 General

Primary structural members are to be constructed from steels conforming to the requirements of this Section.

For lifting appliances with design service temperature -10°C (14°F) and above, materials for primary structural members are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in 2-3/7, except for materials with thicknesses up to 25 mm (1 inch), which may be tested at the design service temperature.

For lifting appliances with design service temperature below -10°C (14°F), materials for primary structural members are to conform to the toughness requirements of 2-3/7.

Materials for slewing rings are to comply with the impact test requirements of 2-3/7.7.

5.1.2 Pedestals and Kingposts

When pedestals or kingposts are welded to the hull structure, the section of the pedestal or kingpost from the hull structure up to the first bolted connection or crane interface, whichever is closer to the deck, is to be constructed of appropriate ABS grade steel selected in accordance with 2-3/7.3. The toughness of the material of the pedestal or kingpost in way of the transition to the hull structure should at least match the hull material to which it is welded.

Non-ABS grade steels that comply with other recognized standards may be used subject to the following:

- i) Full equivalence of the physical properties and weldability to the appropriate ABS grade in accordance with 2-3/7.3 is to be maintained.
- ii) Steels are to be manufactured at steel works approved by ABS for the equivalent ABS grade steel.
- iii) Steels are to comply with the additional impact test requirements of 2-3/7.5 and tests are to be witnessed by an ABS Surveyor.

5.1.3 Slewing Rings

Material specifications for slewing rings are to include as applicable, chemical composition limits, mechanical properties, core hardness requirements, surface hardened layer requirements (hardness range values and hardness depth), inclusion control and limits.

Materials for slewing rings are to conform to the toughness requirements of 2-3/7.7. CVN tests are to be taken from material representing the core properties. Test certificates issued by the mill or material manufacturer are to be submitted to the Surveyor for verification.

5.3 Critical Machinery Components

Machinery components are to be constructed from materials which are ductile at the design service temperature, such as steel, nodular iron or spheroidal iron, and which conform to the requirements of this Section.

Materials used in non-redundant gearbox components are to comply with the elongation requirements of 2-3/9.3.

For lifting appliances with design service temperature -20°C (-4°F) and above, materials for critical machinery components are to have fracture toughness suitable for the intended application as evidenced by

previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in 2-3/7, except they may be tested at the design service temperature.

For lifting appliances with design service temperature below -20°C (-4°F), materials for critical machinery components are to conform to the toughness requirements of 2-3/7.

For parts of machinery components not exposed directly to the atmosphere, if the start-up and operating temperature of the equipment is demonstrated to be higher than the design service temperature of the crane itself, then the start-up temperature can be applied as the design service temperature of such parts.

The materials of pressure retaining components of hydraulic cylinders are also to comply with the requirements of the standard or code to which the cylinder is designed and constructed. Ordinary cast iron having an elongation of less than 12% is not to be used for hydraulic cylinders.

5.5 Piping Systems

Piping systems are to be constructed of materials conforming to the requirements of Part 4, Chapter 6 of the *Marine Vessel Rules* and Part 2, Chapter 3 of the *ABS Rules for Materials and Welding (Part 2)*.

5.7 Pressure Vessels

Pressure vessels are to be constructed of materials conforming to the requirements of Part 4, Chapter 4 of the *Marine Vessel Rules*.

5.9 Bolting

5.9.1 General

Bolts are to be in accordance with a recognized bolting standard and are to be selected to meet strength and corrosion resistance requirements for the intended service.

Bolts subjected to tensile loading, other than pre-tensioning (e.g., foundation bolts), employed in joining of primary structural members of lifting appliances are to comply with any of the following toughness requirements:

- i) The toughness requirements for bolts of 2-3/7.9 and 2-3/7.11 TABLE 2.
- ii) The toughness requirements of Table 26 of API Specification 2C – 7th edition.
- iii) Fabricated to a standard that specifically covers low temperatures, such as ASTM 320, provided the selected grade is suitable for the intended service temperature.

Bolts are to be furnished with a traceable test certificate issued by the bolt manufacturer.

Round bottom and rolled thread profiles are to be used for bolts in critical bolt connections.

Additional tests, such as hardness tests and magnetic particle inspection 48 hours after final quench and tempering, as deemed necessary by the attending Surveyor, may be required to ensure the quality of the bolt material.

Bolts are to be permanently marked with fastener manufacturer's identification mark and industry grade, such as SAE, ASTM or ISO.

5.9.2 Hold-down Bolts

Hold-down bolts are to comply with ISO 898-1, or equivalent, and in general are not to be made of material with ultimate tensile strength exceeding 1040 N/mm^2 (106 kgf/mm^2 , 150800 psi) (10.9 Grade).

5.11 Sheaves

Sheaves are to be constructed from materials which are ductile at the design service temperature, such as, steel, nodular iron or spheroidal iron.

For sheaves built into the structure of the crane and sheaves which are to be treated as special components in accordance with 2-5/3.viii and 2-5/1.5, materials are to comply with the impact test requirements of 2-3/7.11.

7 Toughness Requirements

7.1 General

Charpy V-Notch (CVN) testing procedures are to be in accordance with the requirements of 2-1-2/11 of the *ABS Rules for Materials and Welding (Part 2)*.

2-3/7.11 TABLE 2 summarizes the Charpy V-Notch (CVN) impact testing criteria for non-ABS Grade materials.

Charpy V-Notch (CVN) impact testing is not required for plates, structural tubes, castings and forgings, with thickness less than 6 mm (0.24 in.).

For materials other than steel, the tested Charpy V-Notch values are to be assessed against the ductile to brittle characteristics of the material, in each case.

Charpy V-Notch (CVN) impact testing is not required for austenitic stainless steels.

7.3 Criteria for ABS Grade Materials

Material grades are to be selected based on design service temperature and thickness in accordance with 2-3/7.3 TABLE 1.

Note:

ABS grade materials are only produced by manufacturers approved by ABS and mechanical tests are witnessed by the ABS Surveyor at the mill.

TABLE 1
Material Grades (1 July 2016)

<i>Design Service Temperature</i>					
<i>Thickness in mm (in.)</i>	<i>DST ≥ 0°C (DST ≥ 32°F)</i>	<i>0°C > DST ≥ -10°C (32°F > DST ≥ 14°F)</i>	<i>-10°C DST ≥ -20°C (14°F > DST ≥ -4°F)</i>	<i>-20°F > DST ≥ -30°C (-4°F > DST ≥ -22°F)</i>	<i>-30°F > DST ≥ -40°C (-22°F > DST ≥ -40°F)</i>
<i>t < 12.5 (t < 0.50)</i>	A,AH	A,AH	A,AH	A,AH	B ⁽²⁾ ,AH
<i>12.5 < t ≤ 20 (0.50 < t ≤ 0.79)</i>	A,AH	A,AH	A,AH	B,AH	D,DH
<i>20 < t ≤ 25 (0.79 < t ≤ 0.98)</i>	A,AH	A,AH	B,AH	D,DH	D ⁽¹⁾ ,DH ⁽¹⁾
<i>25 < t ≤ 30 (0.98 < t ≤ 1.18)</i>	A,AH	A,AH	D,DH	D,DH	E,EH
<i>30 < t ≤ 35 (1.18 < t ≤ 1.38)</i>	A,AH	B,AH	D,DH	D,DH	E,EH

Design Service Temperature					
Thickness in mm (in.)	$DST \geq 0^{\circ}C$ ($DST \geq 32^{\circ}F$)	$0^{\circ}C > DST \geq -10^{\circ}C$ ($32^{\circ}F > DST \geq 14^{\circ}F$)	$-10^{\circ}C DST \geq -20^{\circ}C$ ($14^{\circ}F > DST \geq -4^{\circ}F$)	$-20^{\circ}F > DST \geq -30^{\circ}C$ ($-4^{\circ}F > DST \geq -22^{\circ}F$)	$-30^{\circ}F > DST \geq -40^{\circ}C$ ($-22^{\circ}F > DST \geq -40^{\circ}F$)
$35 < t \leq 40$ ($1.38 < t \leq 1.57$)	A,AH	D,DH	D,DH	D,DH	E,EH
$40 < t$ ($1.57 < t$)	B,AH	D,DH	D,DH	D,DH	E,EH

Notes:

- 1 To be normalized.
- 2 May be “A” if fully killed.

7.5 Criteria for non-ABS Grade Materials

7.5.1 Steels up to and Including 420 N/mm² (43 kgf/mm², 61 ksi) Yield Strength

Charpy V-Notch (CVN) impact tests are required to demonstrate that steels would meet the following longitudinal CVN impact requirements. In the absence of satisfactory CVN test data, consideration will be given to steel that has appropriate supporting information, ductile to brittle transition, or statistical test data that clearly indicates the toughness of the steels will be adequate for their intended application in the crane at the minimum design service temperature.

Yield Strength			CVN (Longitudinal)			Test Temperature
N/mm ²	kgf/mm ²	ksi	J	kgf-m	ft-lbf	
235-305	24-31	34-44	27	2.8	20	10°C (18°F) below DST
305-420	31-43	44-61	34	3.5	25	

7.5.2 Extra High Strength Steels in the 420-690 N/mm² (43-70 kgf/mm², 61-100 ksi) Yield Strength Range

Steels in the 420-690 N/mm² (43-70 kgf/mm², 61-100 ksi) yield strength range, are to be tested at 20°C (36°F) below the design service temperature with a minimum average longitudinal CVN value of 34 J (3.5 kgf-m, 25 ft-lbf); except for steels with thicknesses up to 25 mm (1 inch), which may be tested at 10°C (18°F) below the design service temperature with a minimum average longitudinal CVN value of 42 J (4.3 kgf-m, 31 ft-lbf).

7.5.3 Extra High Strength Steels above 690 N/mm² (70 kgf/mm², 100 ksi) Yield Strength

Application of steels with specified minimum yield strength above 690 N/mm² (70 kgf/mm², 100 ksi) is to be specially agreed with ABS.

Steels in the 690-960 N/mm² (70-98 kgf/mm², 100-139 ksi) yield strength range, are to be tested at 20°C (36°F) below the design service temperature with a minimum average longitudinal CVN value of 34 J (3.5 kgf-m, 25 ft-lbf), with the following additional requirements:

- i) The lateral expansion measurement is at least 0.38 mm (0.015 inches).
- ii) Longitudinal elongation is to be a minimum of 12%.
- iii) Welding procedures are to be appropriately qualified to meet base metal requirements.

When the manufacturer has no evidence of satisfactory service experience with steel with specified minimum yield strength above 690 N/mm² (70 kgf/mm², 100 ksi), supporting fracture mechanics testing and analysis of base metal and weldments may be required.

7.5.4 Cast Steels

Cast steel components are to comply with the following impact test requirements:

Yield Strength			CVN (Longitudinal)			Test Temperature
N/mm ²	kgf/mm ²	ksi	J	kgf-m	ft-lbf	
235-305	24-31	34-44	24	2.4	18	10°C (18°F) below DST
305-420	31-43	44-61	27	2.8	20	
420-690	43-70	61-100	34	3.5	25	
>690	>70	>100	To be agreed with ABS			

7.5.5 Forged Steels

Forged steel components are to comply with the following impact test requirements:

Yield Strength			CVN (Longitudinal)			Test Temperature
N/mm ²	kgf/mm ²	ksi	J	kgf-m	ft-lbf	
235-305	24-31	34-44	27	2.8	20	10°C (18°F) below DST
305-420	31-43	44-61	34	3.5	25	
420-690	43-70	61-100	42	4.3	31	
>690	>70	>100	To be agreed with ABS			

7.5.6 Alternative Requirements

As an alternative to the requirements in 2-3/7.5.1 or 2-3/7.5.2, one of the following may be complied with.

- For transverse specimens, $\frac{2}{3}$ of the energy shown for longitudinal specimens.
- For longitudinal specimens, lateral expansion is not to be less than 0.5 mm (0.02 in.). For transverse specimens, lateral expansion is not to be less than 0.38 mm (0.015 in.).
- Nil-ductility temperature as determined by drop weight tests is to be 5°C (9°F) below the test temperature specified in 2-3/7.5.1 or 2-3/7.5.2 as appropriate.
- Other means of fracture toughness testing, such as Crack Opening Displacement (COD) testing, will be specially considered.

7.7 Material Toughness Requirements for Slewing Rings

Charpy V-Notch impact tests for materials for slewing rings are to be taken from material representing the core properties and are to comply with the following values, when tested at -20°C (-4°F) or at 10°C (18°F) below the design service temperature, whichever is lower:

- Minimum Average Energy for 3 (three) Charpy Test bars: 42 J (4.3 kgf-m, 31 ft-lb)
- Minimum Single Energy for each test: 27 J (2.8 kgf-m, 20 ft-lb)

7.9 Toughness Requirements for Bolts Subjected to Tensile Loading

Bolts subjected to tensile loading, other than pre-tensioning (e.g., foundation bolts), employed in joining of primary structural members of lifting appliances are to comply with the following Charpy V-Notch impact values when tested at 10°C (18°F) below the design service temperature:

- Minimum Average Energy for 3 (three) Charpy Test bars: 42 J (4.3 kgf-m, 31 ft-lb)
- Minimum Single Energy for each test: 27 J (2.8 kgf-m, 20 ft-lb)

7.11 Material Toughness Requirements for Sheaves

For steel sheaves of welded and un-welded construction for lifting appliances with design service temperatures of -20°C (-4°F) and above, CVN impact testing is not required.

For steel sheaves of welded and un-welded construction for lifting appliances with design service temperatures below -20°C (-4°F), materials are to meet the requirements of 2-3/7.3 or 2-3/7.5, as applicable, except they may be tested at the design service temperature. In addition, the weld procedures used in the fabrication of the sheaves are to be qualified with the appropriate CVN tests.

For metallic materials other than steel, the tested Charpy V-Notch values are to be assessed against the ductile to brittle characteristics of the material, in each case.

For non-metallic sheaves, the low temperature characteristics of the materials should be documented and be suitable for the design service temperature.

TABLE 2
Summary of CVN Impact Testing Criteria for non-ABS Grade
Materials (1 July 2016)

SI Units

Item	Material Category		Design Service Temperature (DST) (°C)	Yield Strength (N/mm ²)	CVN Value (J)	CVN Test Temperature
1	Primary structural members	a) Steel	Below −10 ⁽¹⁾	235 – 305	27	10°C below DST
				305 – 420	34	
				420 – 690	34	20°C below DST ⁽²⁾
				690 – 960 ⁽³⁾	34	20°C below DST
				> 960 ⁽³⁾	See Note 4	20°C below DST
		b) Cast steel unwelded	Below −10 ⁽¹⁾	235 – 305	24	10°C below DST
				305 – 420	27	
				420 – 690	34	
				> 690 ⁽³⁾	See Note 4	
		c) Forged steel unwelded	Below −10 ⁽¹⁾	235 – 305	27	10°C below DST
				305 – 420	34	
				420 – 690	42	
				> 690 ⁽³⁾	See Note 4	
2	Slewing rings		All temperatures	All strength grades	42 ⁽⁵⁾	Minimum of – 20°C or 10°C below DST
3	Critical bolting in tensile loading		All temperatures	All strength grades	42 ⁽⁵⁾	10°C below DST
4	Sheaves		Below –20	Refer to items 1a, 1b and 1c for specific product forms. Includes WPS qualification.		At DST

<i>Item</i>	<i>Material Category</i>	<i>Design Service Temperature (DST) (°C)</i>	<i>Yield Strength (N/mm²)</i>	<i>CVN Value (J)</i>	<i>CVN Test Temperature</i>
5	Machinery components	Below −20 ⁽⁷⁾	Refer to items 1a, 1b and 1c for specific product forms ⁽⁶⁾		
6	Materials other than steel ⁽⁸⁾	CVN values assessed against the material ductile to brittle characteristics in each case.			

Notes:

- When DST is –10°C and above, materials are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience; or are to conform to toughness requirements similar to those indicated in this table, except for steels with thicknesses up to 25 mm, which may be tested at the DST.
- Steels with thicknesses up to 25 mm may be tested at 10°C below the DST with a minimum average longitudinal CVN value of 42 J.
- Application of steels with specified minimum yield strength above 690 N/mm² is to be specially agreed with ABS. Refer to 2-3/7.5.3 for additional requirements.
- CVN values to be agreed with ABS.
- The minimum single energy for each test is not to be less than 27 J.
- For parts of machinery components not exposed directly to the atmosphere, if the start-up and operating temperature of the equipment is demonstrated to be higher than the DST of the crane itself, then the start-up temperature can be applied as the DST of such parts.
- When DST is –20°C and above, materials are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in this table, except they may be tested at the DST.
- Materials other than steel will be subject to special consideration.

MKS Units

Item	Material Category		Design Service Temperature (DST) (°C)	Yield Strength (kgf/mm ²)	CVN Value (kgf-m)	CVN Test Temperature
1	Primary structural members	a) Steel	Below –10 ⁽¹⁾	24 – 31	2.8	10°C below DST
				31 – 43	3.5	
				43 – 70	3.5	20°C below DST ⁽²⁾
				70 – 98 ⁽³⁾	3.5	
				> 98 ⁽³⁾	See Note 4	
		b) Cast steel unwelded	Below –10 ⁽¹⁾	24 – 31	24	10°C below DST
				31 – 43	2.8	
				43 – 70	3.5	
				> 70 ⁽³⁾	See Note 4	
		c) Forged steel unwelded	Below –10 ⁽¹⁾	24 – 31	2.8	10°C below DST
				31 – 43	3.5	
				43 – 70	4.3	
				> 70 ⁽³⁾	See Note 4	

Item	Material Category	Design Service Temperature (DST) (°C)	Yield Strength (kgf/mm ²)	CVN Value (kgf-m)	CVN Test Temperature
2	Slewing rings	All temperatures	All strength grades	4.3 ⁽⁵⁾	Minimum of –20°C or 10°C below DST
3	Critical bolting in tensile loading	All temperatures	All strength grades	4.3 ⁽⁵⁾	10°C below DST
4	Sheaves	Below –20	Refer to items 1a, 1b and 1c for specific product forms. Includes WPS qualification.		At DST
5	Machinery components	Below –20 ⁽⁷⁾	Refer to items 1a, 1b and 1c for specific product forms ⁽⁶⁾		
6	Materials other than steel ⁽⁸⁾	CVN values assessed against the material ductile to brittle characteristics in each case.			

Notes:

- When DST is –10°C and above, materials are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in this table, except for steels with thicknesses up to 25 mm, which may be tested at the DST.
- Steels with thicknesses up to 25 mm may be tested at 10°C below the DST with a minimum average longitudinal CVN value of 4.3 kgf-m.
- Application of steels with specified minimum yield strength above 70 kgf/mm² is to be specially agreed with ABS. Refer to 2-3/7.5.3 for additional requirements.
- CVN values to be agreed with ABS.
- The minimum single energy for each test is not to be less than 2.8 kgf-m.
- For parts of machinery components not exposed directly to the atmosphere, if the start-up and operating temperature of the equipment is demonstrated to be higher than the DST of the crane itself, then the start-up temperature can be applied as the DST of such parts.
- When DST is –20°C and above, materials are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in this table, except they may be tested at the DST.
- Materials other than steel will be subject to special consideration.

US units

Item	Material Category		Design Service Temperature (DST) (°F)	Yield Strength (ksi)	CVN Value (ft-lbf)	CVN Test Temperature
1	Primary structural members	a) Steel	Below 14 ⁽¹⁾	34 – 44	20	18°F below DST
				44 – 61	25	
				61 – 100	25	36°F below DST (2)
				100 – 139 ⁽³⁾	25	36°F below DST
				> 139 ⁽³⁾	See Note 4	36°F below DST
		b) Cast steel unwelded	Below 14 ⁽¹⁾	34 – 44	18	18°F below DST
				44 – 61	20	
				61 – 100	25	
				> 100 ⁽³⁾	See Note 4	
		c) Forged steel unwelded	Below 14 ⁽¹⁾	34 – 44	20	18°F below DST
				44 – 61	25	
				61 – 100	31	
				> 100 ⁽³⁾	See Note 4	
2	Slewing rings		All temperatures	All strength grades	31 ⁽⁵⁾	Minimum of – 4°F or 18°F below DST
3	Critical bolting in tensile loading		All temperatures	All strength grades	31 ⁽⁵⁾	18°F below DST
4	Sheaves		Below -4	Refer to items 1a, 1b and 1c for specific product forms. Includes WPS qualification.		At DST
5	Machinery components		Below -4 ⁽⁷⁾	Refer to items 1a, 1b and 1c for specific product forms ⁽⁶⁾		
6	Materials other than steel ⁽⁸⁾		CVN values assessed against the material ductile to brittle characteristics in each case.			

Notes:

- 1 When DST is 14°F and above, materials are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in this table, except for steels with thicknesses up to 1 inch, which may be tested at the DST.
- 2 Steels with thicknesses up to 1 inch may be tested at 18°F below the DST with a minimum average longitudinal CVN value of 31 ft-lbf.
- 3 Application of steels with specified minimum yield strength above 100 ksi is to be specially agreed with ABS. Refer to 2-3/7.5.3 for additional requirements.
- 4 CVN values to be agreed with ABS.
- 5 The minimum single energy for each test is not to be less than 20 ft-lbf.
- 6 For parts of machinery components not exposed directly to the atmosphere, if the start-up and operating temperature of the equipment is demonstrated to be higher than the DST of the crane itself, then the start-up temperature can be applied as the DST of such parts.
- 7 When DST is -4°F and above, materials are to have fracture toughness suitable for the intended application as evidenced by previous satisfactory marine service experience or are to conform to toughness requirements similar to those indicated in this table, except they may be tested at the DST.
- 8 Materials other than steel will be subject to special consideration.

9 Elongation Requirements

9.1 General

Elongation of steel and other acceptable ductile materials is to meet the minimum requirements of the applicable standard or specification, and the specified elongation is not to be less than 12%.

9.3 Elongation Requirements for Non-Redundant Gearbox Components

A minimum elongation value of 8% is considered acceptable for high strength case hardened gears or pins constructed in accordance with recognized standards.

Nodular or ductile cast iron may be used for flanges, planet carriers or gears in epicyclical type gearboxes, provided the material has a minimum specified elongation of 10%. Lower elongation values may be specially considered for components that are not subject to catastrophic rupture due to abrupt or shock loading generated during operation, as evidenced by previous satisfactory marine service experience for similar applications.

11 Steel Plates with Improved Through Thickness Properties (“Z” Quality) (2018)

The use of special material with improved through thickness properties, such as “Z” quality steel, is required to be employed in those structural details, where tee or cruciform connections employ fillet, partial or full penetration welds subject to significant tensile strains, from weld shrinkage or in-service loading, in the through thickness direction, such as pedestal and slewing column flanges, in order to minimize the possibility of lamellar tearing. ABS grade materials or non-ABS materials complying with the testing procedure in 21-1/17 of the *ABS Rules for Materials and Welding (Part 2)* to “Z25” quality steel are considered as meeting this requirement.

13 Welding

In general, welding may be in accordance with the latest edition of AWS D1.1 “Structural Welding Code – Steel”, ASME/ANSI or other recognized codes. Drawings are to indicate the applicable code. Welding procedures are to be to the satisfaction of the attending Surveyor.

15 Nondestructive Testing (NDT)

NDT is to be in accordance with the ABS *Guide for Nondestructive Inspection of Hull Welds* or other recognized codes.

The areas to be nondestructively inspected and methods of inspection are to be submitted together with the design plans. The minimum extent of NDT to be carried out is shown in 2-3/15 TABLE 3.

Volumetric NDT techniques include Radiographic Testing (RT) and Ultrasonic Testing (UT). Surface NDT techniques include Magnetic Particle Inspection (MPI), Penetrant Testing (PT), Eddy Current (EC) or Alternating Current Field Measurement (AFCM).

Method and extent of nondestructive testing for slewing rings is to be specified by the slewing ring manufacturer. After hardening and finishing, bearing ring raceways are to be inspected by surface NDT along their entire length. Bearing rings are to be 100% ultrasonically tested for internal defects and the manufacturer is to certify that the materials are free from detrimental defects which may impair the performance of the slewing ring.

The Surveyor is to be provided with records of NDT inspections. Additional inspections may be requested at the discretion of the Surveyor.

TABLE 3
Nondestructive Testing* (NDT) of Steel Structure Welds (1 July 2016)

<i>Weld Location</i>	<i>Extent and Type of NDT</i>
Critical circumferential welds in crane pedestals, kingposts and transition pieces between the pedestal and the slewing ring	100% Volumetric NDT plus 100% Surface NDT of all Complete Joint Penetration (CJP) welds, where welded plate thickness is ≥ 8.0 mm ($\frac{5}{16}$ inch); and 100% MPI of all fillet welds, where plate thickness is ≥ 8.0 mm ($\frac{5}{16}$ inch).
Welds of primary members	20% Volumetric NDT plus 100% Surface NDT of all CJP welds, where plate thickness is ≥ 8.0 mm ($\frac{5}{16}$ inch); and 10% Surface NDT of all fillet welds, where plate thickness is ≥ 8.0 mm ($\frac{5}{16}$ inch).
Other welded connections	Random Volumetric NDT of CJP welds and Surface NDT of fillet welds, only if considered suspect by the attending Surveyor during construction.

Note:

* NDT procedures and acceptance criteria are to at least satisfy the ABS *Guide for Nondestructive Inspection of Hull Welds*.

CHAPTER 2 Guide for Certification of Cranes

SECTION 4 Wire Rope

1 General (1 April 2019)

The construction of the wire rope is to comply with a recognized standard such as API Spec 9A, EN 12385 or ISO 2408. The hoisting and luffing steel wire ropes are to be in accordance with the following:

- i) Rotation resistant rope is to be given special care in installations, so as to prevent its possible damage.
- ii) Socketing is to be carried out as recommended by the manufacturer of the wire rope or fitting.
- iii) If a load is supported by more than one part of rope, the tension in the parts is to be equalized.
- iv) Tie-downs (kicker devices) are to have locknuts or other provision to prevent loosening.

Ropes of material other than steel may be considered for acceptance, subject to satisfactory review of rope properties, performance and evidence of satisfactory service experience for the intended service.

3 Factors of Safety

3.1 General

The minimum breaking strength of running and standing wire ropes is not to be less than the maximum tension in the rope multiplied by the factors of safety, for the appropriate crane type, obtained in accordance with 2-4/Tables 1 through 3.

The maximum tension in the rope is to be calculated by the formula in 2-4/3.3, where:

- For main and auxiliary load hoist ropes, the total load is to be based on the Live Load.
- For boom hoist ropes and pendants, the total load is to be based on the boom in-plane loading, which is to include, as applicable, the effects of the Live Load, dead load with accelerations of the vessel or unit, wind loading on the boom and lifted load.

TABLE 1
Wire Rope Factors of Safety for Shipboard Cranes (1 July 2016)

Wire Rope	Factors of Safety		
	SWL < 98 kN (10 tf, 22050 lbf)	98 kN (10 tf, 22050 lbf) ≤ SWL < 588 kN (60 tf, 132300 lbf)	588 kN (60 tf, 132300 lbf) ≤ SWL < 1570 kN (160 tf, 352800 lbf)
Load (Main & Aux.) Hoist & Boom Hoist Rigging Standing Rigging and Pendants	5.0	$5 - \frac{(SWL - 98)}{490}$ kN $5 - \frac{(SWL - 10)}{50}$ tf $5 - \frac{(SWL - 22050)}{110250}$ lbf	$4 - \frac{(SWL - 588)}{980}$ kN $4 - \frac{(SWL - 60)}{100}$ tf $4 - \frac{(SWL - 132300)}{220500}$ lbf

TABLE 2
Wire Rope Factors of Safety for Offshore Cranes (1 July 2016)

Wire Rope	Factors of Safety	
	greater of (but not to be less than 3.0)	
Load (Main & Aux.) & Boom Hoist Running Rigging	$\frac{10,000}{0.885 \cdot LL + 1910} \quad \text{kN}$ $\frac{10,000}{8.682 \cdot LL + 1910} \quad \text{tf}$ $\frac{10,000}{0.004 \cdot LL + 1910} \quad \text{lbf}$ but not greater than 5.0	2.25 × VAF
Standing Rigging and Pendants	$\frac{10,000}{0.562 \cdot LL + 2444} \quad \text{kN}$ $\frac{10,000}{5.512 \cdot LL + 2444} \quad \text{tf}$ $\frac{10,000}{0.0025 \cdot LL + 2444} \quad \text{lbf}$ but not greater than 4.0	2.0 × VAF

TABLE 3
Wire Rope Factors of Safety for Heavy Lift Cranes (1 July 2016)

Wire Rope	Factor of Safety*
Load and Boom Hoist Rigging	3.0
For Aux. Hoist Rigging Above 1570 kN (160 tf, 352800 lbf)	3.0
For Aux. Hoist Rigging Below 1570 kN (160 tf, 352800 lbf)	See 2-4/3.1 TABLE 1
Standing rigging and pendants	3.0

* If the crane needs to comply with the ILO Regulations at the request of the Authorities where the crane will be operating, selection of wire ropes for both running and standing rigging is to be in accordance with 2-4/3.1 TABLE 1.

3.3 Rope Tension or Line Pull Force

The tension or line pull force in the rope is to be calculated by the following formula:

$$T = \frac{L}{N \times E}$$

where

- T = tension or line pull force in the wire rope, in N (kgf, lbf)
- L = total load on the rope, in N (kgf, lbf)
- N = number of wire rope line parts (falls) supporting the total load
- E = efficiency of the wire rope reeving system, as determined from 2-4/3.560

3.5 Reeving System Efficiency

The reeving system efficiency of running ropes is to be determined from the following equation:

$$E = \frac{K^N - 1}{K^S \times N \times (K - 1)}$$

where

- E = efficiency of the wire rope reeving system
- N = number of wire rope line parts (falls) supporting the total load
- S = number of sheaves in the reeving system
- K = friction loss per sheave constant; not less than 1.045 for sheaves with bronze bearings and not less than 1.02 for sheaves with roller or ball bearings

Special consideration may be given to lower friction loss per sheave constants, provided that the values are demonstrated by way of testing.

For standing ropes, the reeving system efficiency may be taken as 1.

5 Wire Rope Test

All wire ropes are to have a certificate of test, furnished by the manufacturer or the certifying authority, showing the breaking test load of a sample. The certificate is to show also standard of construction (see 2-4/1), size of rope, number of strands, number of wires per strand, lay, core, quality of wires, date of test, and is to be submitted for inclusion in the Register of Lifting Appliances. See 2-8/1.

7 Splicing of Wire Rope

Single wire rope cargo falls, wire rope pendants, topping lifts and preventers shall consist of clear lengths without splices except splices are permitted at the ends. Such eye splices are to be made in accordance with recommendations of the rope, crane manufacturer or qualified person. Rope thimbles are to be used in the eye. A thimble or loop splice made in any wire rope is to have at least three (3) tucks with a whole strand of the rope and two (2) tucks with one-half of the wires cut out of each strand, provided that this requirement shall not preclude the use of another form of splice which can be shown to be as efficient as that required in this Subsection. Bolted cable clips for splicing wire rope are not acceptable.

9 Reeving Accessories

- i) Swaged, compressed, or wedge socket fittings are to be applied as recommended by the rope, crane, derrick, or fitting manufacturer.
- ii) Wire rope clips used in conjunction with wedge sockets are to be attached to the unloaded dead end of the rope only.
- iii) Wire rope clips shall not be used to form eyes in the working ends of single wire rope cargo falls.

CHAPTER 2 Guide for Certification of Cranes

SECTION 5 Loose Gear, Sheaves, and Hook Blocks

1 Loose Gear

1.1 General (2018)

All chains, rings, hooks, links, shackles, swivels, and blocks of crane are to be tested with a proof load at least equal to the following:

Article of Gear	Proof Load ⁽¹⁾
Chain, ring, hook, link, shackle or swivel	200% of the safe working load
Pulley blocks	
Single sheave hook block	200% of the safe working load ⁽²⁾
Multiple sheave block and container spreader with safe working load up to and including 196 kN (20 tf, 44100 lbf)	200% of the safe working load
Multiple sheave block and container spreader with safe working load over 196 kN (20 tf, 44100 lbf) up to and including 392 kN (40 tf, 88200 lbf)	196 kN (20 tf, 44100 lbf) more than the safe working load
Multiple sheave block and spreader with safe working load over 392 kN (40 tf, 88200 lbf)	150% of the safe working load

Notes:

- ⁽¹⁾ (1 September 2012) Alternatively, the proof tests as recommended in the latest applicable edition of the I.L.O. publication “Code of Practice on Safety and Health in Port” may be accepted where the items of gear are manufactured or tested or both to the requirements of those regulations and are intended for use on vessels under jurisdictions accepting them.
- ⁽²⁾ The safe working load to be marked on a single sheave block is to be the maximum load which can safely be lifted by the hook suspended from the body of the block .

Evidence of compliance with the proof load test requirements in this Section for all rings, hooks, links, shackles, swivels, blocks, and any other loose gear whether accessory to a machine or not, but which is used as crane gear is to be listed on an appropriate certificate as required by 2-5/1.3.

Loose gear are to undergo NDE after proof load testing in accordance with a recognized standard, such as DOE STD 1090, ASME B30.10, ASTM E709 (MT), and ASTM E165 (PT), by the loose gear manufacturer. Results are to be made available to the Surveyor upon request.

Structure, loose gear, and/or containers used solely for shipping or transferring equipment to offshore units are not subject to the requirements of this Section. The *ABS Guide for the Certification of Offshore Containers* may be applied for these items outside the scope of this Guide.

1.3 Certificates

Articles of loose gear are to have a certificate furnished by the manufacturer. The certificate is to show the distinguishing number or mark applied to the article of gear, description, kind of material, carbon content, date of test, proof load applied, and safe working load. Loose gear certificates are to be inserted in the Register of Lifting Appliances. See 2-8/1. The safe working load SWL is to be marked on the hoist blocks.

1.5 Special Components (2018)

Blocks of special nature, together with their connecting components, special lifting devices and components built into or for cranes, heavy lift gear, crane hooks or hoisting machinery which are specially designed for use with a particular lifting unit, the designs of which are submitted for approval as steel structural parts (including hook curves indicating the hook load reductions based on sling angle and eccentricity, as applicable), in accordance with Section 2-2, need not be considered loose gear for the purpose of certification. For material requirements, see 2-3/1. Surveys during construction at the component manufacturer's plant are to be carried out in accordance with 2-7/3; testing and examination are to be carried out with the gear as a unit, as required by 2-7/5.

For crane hooks, appropriate nondestructive examination, in accordance with a recognized standard, such as DOE STD 1090, ASME B30.10, ASTM E709 (MT), and ASTM E165 (PT), is to be performed after proof load testing to the satisfaction of the attending Surveyor.

Nondestructive examination will also be required for other components where visual inspection is considered to be inadequate.

3 Sheaves (1 July 2016)

- i) Sheaves grooves shall be smooth and free from surface defects which could cause rope damage. The cross-sectional radius at the bottom of the groove is to be such so as to form a saddle for the size of rope used; the sides of the groove are to be tapered outwardly to facilitate entrance of the rope into the groove. Flange corners are to be rounded and the rims should run true about the axis of rotation.
- ii) All sheaves including running blocks are to be provided with guards or other suitable devices to prevent the rope from coming out of the sheave groove.
- iii) Means are to be provided, if necessary, to prevent chafing of the ropes.
- iv) All sheave bearings are to be provided with means for lubrication. Permanently lubricated bearing are exempt from this requirement.
- v) Sheave pitch diameter to rope diameter ratio for crane running wire ropes is not to be less than 18, or 20 for sheaves used in motion compensation systems, and for standing rigging wire ropes is not to be less than 10.
- vi) The diameter inside of the sheave groove is to be in accordance with the wire rope manufacturer's instructions. In general, for steel sheaves this diameter is between 6% and 8%, and between 3% and 27% for cast nylon sheaves, larger than the rope diameter
- vii) Where sheaves are built into the structure of the crane need not be tested and certified as loose gear, but will be accepted based on verification of compliance with the requirements of to above, material verification in accordance with Section 2-3 and testing and examination with the gear as a unit in accordance with 2-7/5. Materials are to be as required in 2-3/5.11.
- viii) Sheaves of special nature which are specially designed for use with a particular lifting unit, the designs of which are submitted for approval as steel structural parts, are to be treated as special components in accordance with 2-5/1.5. For sheaves made of polymer materials known as Type 6 cast nylons, the allowable stresses for bending, shear, compression, bearing etc. are to be limited to 30% of the corresponding material strength for bending, shear, compression, bearing, etc. Materials are to be as required in 2-3/5.11.

5 Hooks and Hook Blocks (1 July 2016)

5.1 General

Hook blocks are to be of sufficient weight to overhaul the line from the highest hook position giving consideration to the boom length, jib length, as well as the number of parts of line in use.

Hook blocks are to be permanently labeled with their maximum rated capacity and weight.

Hooks are to be equipped with latches, unless equivalent means are provided to retain the rigging on the hook. When provided, the latch is to bridge the throat opening of the hook for the purpose of retaining slings or other lifting devices, under slack conditions.

When hooks and hook blocks are used for personnel lifting, they are to comply with the additional requirements of 2-9/5 of this Guide.

5.3 Shipboard Cranes

Main and auxiliary hook blocks and hooks for shipboard cranes may be accepted as loose gear on the basis of testing and manufacturer certification as per 2-5/1.1 and 2-5/1.3 of this Guide. Alternatively, they are to be certified as “Special Components” as per 2-5/1.5 of this Guide.

When hooks and hook blocks are certified as “Special Components”, the design load is to be calculated as per 2-2/7 of this Guide. The calculated stresses are to be in compliance with 2-2/5.

5.5 Offshore and Heavy Lift Cranes

5.5.1 General

Main and auxiliary hook blocks and hooks for offshore and heavy lift cranes are to be certified as “Special Components” as per 2-5/1.5 of this Guide.

For mass produced hook blocks, acceptance may be based on satisfactory ABS design review and manufacturer’s loose gear test certificate.

5.5.2 Design

For offshore cranes, the design loads for hooks and hook blocks are to be calculated as per 2-2/9 of this Guide.

For heavy lift cranes, the design loads for hooks and hook blocks are to be calculated as per 2-2/11 of this Guide.

The calculated stresses for hooks and hook blocks are to be in compliance with 2-2/5.

5.5.3 Hooks

Hooks are to meet a recognized standard for hooks such as DIN15400.

Hooks are to be fabricated from alloy steel and are to be produced as forgings or castings. They are to meet the requirements for structural material as specified in 2-2/1.1 of this Guide.

Hook materials are to comply with the following Charpy V-notch impact values when tested at 10°C (18°F) below the design service temperature:

- i) Minimum average energy for three (3) Charpy tests bars: 34 Joules (25 ft-lb)
- ii) Minimum Single Energy for each test: 20 Joules (15 ft-lb)

After proof load testing, hooks are to be inspected and undergo nondestructive examination, performed in accordance with a recognized standard, such as DOE STD 1090, ASME B30.10, ASTM E709 (MT), and ASTM E165 (PT), to the satisfaction of the attending Surveyor.

CHAPTER 2 Guide for Certification of Cranes

SECTION 6 Construction Standards for Crane Machinery, Piping and Electrical Systems (1 July 2016)

1 General (1 August 2014)

The mechanical, piping and electrical systems and components of the crane are subject to design review for compliance with the requirements of this Section. Plan submission is to be in accordance with 2-1/3 of this Guide. Such systems and components are to be certified in accordance with 2-1/9 TABLE 3.

3 Materials (1 July 2016)

Materials for machinery systems and components are to be in compliance with Section 2-3.

5 Electrical Systems (1 July 2016)

Electrical systems are to be designed, constructed, installed and tested to the requirements contained in this Guide, and as applicable, Part 4, Chapter 8, for services indicated in 4-8-3/15 TABLE 7 of the *Marine Vessel Rules*.

7 Piping Systems (1 July 2016)

In general, piping systems are to be designed, constructed, installed and tested to the requirements contained in this Guide, and as applicable, Part 4, Chapter 6 of the *Marine Vessel Rules*.

Hydraulic oil and pneumatic systems are to be designed, constructed, installed and tested to the requirements contained in this Guide, and as applicable, 4-6-7/1, 4-6-7/3 and 4-6-7/5, and the sections referenced therein, of the *Marine Vessel Rules*. For the purposes of this Guide, cranes are not to be considered as self-contained equipment.

Hydraulic oil tanks are to meet the requirements of section 4-6-7/3.3 of the *Marine Vessel Rules*. The aggregate area of the vent pipe(s) provided for the tank is to be at least 125% of the effective area of the filling or circulation line, whichever is greater, without having to meet the minimum size requirements of 4-6-4/9.3.3(a) of the *Marine Vessel Rules*.

9 Pressure Vessels (1 July 2016)

Pressure vessels are to be designed, constructed, installed and tested to the requirements contained in this Guide, and as applicable, Part 4, Chapter 4 of the *Marine Vessel Rules*.

11 Rotating Machines (1 July 2016)

Internal combustion engines, electrical motors, generators and other rotating machines whose failure would not result in loss of control of the load, as per section 2-1/7.65, are to be designed, constructed and equipped in accordance with good commercial and marine practice and are to meet the design requirements of the crane for items such as operating temperature, duty cycle, and angle of inclination, as specified in the crane capacity rating charts or designer's specification. Such equipment need not be inspected at the plant of the manufacturer, but will be accepted based on manufacturer's affidavit, verification of the nameplate data and satisfactory performance testing witnessed by the Surveyor after installation on the crane.

Electric motors and other rotating electrical machines that are used for transferring braking torque and/or whose failure would result in loss of control of the load are to comply with the following:

- i) When they have a rated power of 100 kW (135 hp) and over, are to be designed, constructed, installed and tested to the requirements contained in this Guide, and as applicable, of 4-8-3/3, for services indicated in 4-8-3/15 TABLE 7, of the *Marine Vessel Rules*.
- ii) When they have a rated power less than 100 kW (135 hp), are to be designed to the requirements contained in this Guide, and as applicable, of 4-8-3/3, for services indicated in 4-8-3/15 TABLE 7, of the *Marine Vessel Rules*. Such machines need not be inspected at the plant of the manufacturer. Manufacturer's tests, however, are to include at least the tests described in 4-8-3/3.15.2 through 4-8-3/3.15.11, regardless of the standard of construction. The test certificates are to be made available when requested by the Surveyor. Acceptance will be based on design review by ABS and satisfactory performance testing witnessed by the Surveyor after installation on the crane.

The minimum degree of protection of rotating electrical machines is to be in accordance with 4-8-3/15 TABLE 2 of the *Marine Vessel Rules*.

Internal combustion engines having a rated power of 100 kW (135 hp) and over are to be provided with safety features as per 4-2-1/7 of the *Marine Vessel Rules*.

Internal combustion engine exhaust manifolds are to be water jacketed or effectively insulated. Fuel tank fills and overflows are not to run close to exhausts. The exhaust is to be fitted with an effective means of spark arresting. Exhaust piping insulation is to be protected against possible absorption of oil or hydraulic fluid in areas or spaces where the exhaust piping may possibly be exposed to oil, oil vapors or hydraulic fluid leakage.

Note:

Internal combustion engines may be required to be in compliance with MARPOL Annex VI Regulations for the Prevention of Air Pollution from Ships. The designer should contact the applicable flag Administrations and Port State to determine requirements.

Gearboxes are to comply with the requirements of 2-6/23.

13 Computer-based Control Systems (1 July 2016)

Where fitted, computer-based control systems for cranes are to comply with the requirements of Section 4-9-3 (and the sections referenced therein) of the *Marine Vessel Rules*, as applicable, for Category I Systems in accordance with 4-9-3/7.1 TABLE 1.

For computer-based control systems of cranes intended for personnel lifting, refer to 2-9/15.

15 Low Temperature Operation (1 July 2016)

For cranes with a Design Service Temperature below -10°C ($+14^{\circ}\text{F}$), the manufacturers of the machinery systems are to demonstrate by way of testing or analysis that these systems will operate satisfactorily at the design service temperature.

17 Hazardous Locations (1 July 2016)

Electrical equipment, including all electrical power, control and safety devices and wiring on cranes installed in hazardous locations (where a flammable atmosphere may exist) are to be suitable for operation in such areas and are to be in compliance with the requirements of 4-8-4/27 of the *Marine Vessel Rules*.

Where essential for operational purposes, internal combustion engines and mechanical equipment may be installed in hazardous areas and such installation will be subject to special consideration.

In general, exhaust outlets are to discharge outside of all hazardous areas, air intakes are to be not less than 3 m (10 ft) from hazardous areas and any parts of equipment whose surface may exceed 200°C are to be effectively insulated, cooled or protected by other means.

19 Winches (1 July 2016)

19.1 General

Hoisting winches are to provide a line pull force, with the rope in the outer layer of the drum, calculated in accordance with 2-4/3.3 for a total load based on the Live Load.

Luffing winches are to provide a line pull force in the boom hoist wire rope, calculated in accordance with 2-4/3.3 for a total load based on the boom in-plane loading, which is to include, as applicable, the effects of the Live Load with the applicable vertical amplification factors, dead load with accelerations of the vessel or unit, wind loading on the boom and lifted load.

19.3 Drums

19.3.1 General

Not less than five (5) full wraps of wire rope are to remain on the drum under all operating conditions. When approval is sought for less than five (5) wraps of rope, a detailed stress analysis demonstrating that the rope end termination achieves the rated breaking strength of the rope is to be submitted for review.

Drums are to have a pitch diameter of not less than 18 times the nominal diameter of the wire rope. For drums used in motion compensation, the pitch diameter is not to be less than 20 times the nominal diameter of the wire rope.

Groove radii for grooved drums are to be in accordance with 2-5/3.vi.

Typically, a spooling device should be provided in front of the drum where the fleet angle is greater than 4° for single layered drums and 2° for multiple layered drums.

19.3.2 Hoop Stress

The hoop stress on the drum shell is to be calculated by the following formula:

$$\sigma_{hoop} = \frac{T_{stat} \times K_L}{t_{dr} \times p}$$

Where

σ_{hoop}	=	hoop stress on the drum shell, in N/mm ² (kgf/mm ² , psi)
p	=	pitch of wire rope coils on drum, as measured from the centers of two consecutive ropes, in mm (in.)
t_{dr}	=	thickness of the drum shell, in mm (in.); for grooved drums, up to the bottom of the groove. For drums having insert grooving systems (e.g., LeBus grooved sleeves), the thickness of the insert is not to be taken into account.
K_L	=	rope relaxation factor, as defined in 2-6/19.3.2 TABLE 1
T_{stat}	=	static line pull force in the wire rope, in N (kgf, lbf), calculated in accordance with 2-4/3.3 for the total loads indicated in 2-4/3.1

TABLE 1
Rope Relaxation Factor K_L (1 July 2016)

Number of Layers	1	2	3	4	5
K_L	1	1.8	2.3	2.7	3.0

Notes:

- i The rope relaxation factor is an effect of the transversal elastic modulus of the wire rope.
- ii For a number of layers greater than 2, special consideration may be given to lower factors, provided that the values are demonstrated by way of detailed analysis and/or testing.
- iii Drums with more than 5 layers of wire rope will be subject to special consideration.

The calculated hoop stress is not to exceed the allowable stress, F , calculated in accordance with 2-2/5.5, with an allowable stress coefficient equal with 0.85 ($S_c = 0.85$).

19.3.3 Combined Stress

The combined stress on the drum shell is to be calculated by the following formula:

$$\sigma_{cb} = \sqrt{(\sigma_{bl} + \sigma_{bg})^2 + (\sigma_{bl} + \sigma_{bg}) \times \frac{\sigma_{hoop}}{2} + \frac{\sigma_{hoop}^2}{4}}$$

where

- σ_{cb} = combined stress on the drum shell, in N/mm² (kgf/mm², psi)
- σ_{bg} = global bending stress on the drum shell, in N/mm² (kgf/mm², psi)

$$= \frac{M_{bend}}{\pi \times r_{mean}^2 \times t_{dr}}$$
- σ_{bl} = local bending stress on the drum shell, in N/mm² (kgf/mm², psi)

$$= \frac{0.7 \times T_{dyn}}{\sqrt{2 \times r_{mean} \times t_{dr}^3}}$$
- r_{mean} = mean radius of the drum shell, in mm (in.)

$$= r_{dr} - \frac{t_{dr}}{2}$$
- r_{dr} = outer radius of the drum shell, in mm (in); for grooved drums, up to the bottom of the groove. For drums having insert grooving systems (e.g., LeBus grooved sleeves), the thickness of the insert is not to be taken into account.
- M_{bend} = bending moment on the drum shell, in N-mm (kgf-mm, lbf-in), with the dynamic line pull force, T_{dyn} , acting at the middle of the span, ℓ_{span} , of the drum

$$= \frac{T_{dyn} \times \ell_{span}}{4}$$
- T_{dyn} = dynamic line pull force in the wire rope, in N (kgf, lbf), calculated in accordance with 2-4/3.3 for a total load for hoisting winches based on Live Load times the applicable vertical amplification factor, VAF (refer to Section 2-2); and for a total load for luffing winches based on the boom in-plane loading, which is to include, as applicable, the effects of the Live Load with the applicable vertical amplification factors, dead load with accelerations of the vessel or unit, wind loading on the boom and lifted load
- ℓ_{span} = span of the drum, in mm (in); as measured between drum supports

The calculated equivalent stress is not to exceed the allowable stress, F , calculated in accordance with 2-2/5.5, with an allowable stress coefficient equal with 0.66 ($S_c = 0.66$).

Where the expected number of hoisting cycles in the drum is above 10^5 , fatigue is to be taken into consideration.

19.3.4 Drum Flanges

The drum flanges of winches are to extend a minimum distance of 2.5 times the diameter of the rope over the outermost layer, unless additional means of keeping the rope on the drum are provided (such as keeper plates, rope guards, etc.).

Drum flanges and their connections to the drum shell are to withstand the horizontal components of the outward radial forces of the wire ropes, as calculated with the maximum number of wire rope layers on the drum and the static line pull force, T_{stat} , in the wire rope, as per 2-6/19.3.3. The calculated stresses are not to exceed the allowable stresses of 2-2/5.

The arrangement of the connection of the flange to the drum is to be such as to avoid stress concentration due to relative deformation of the flange and drum.

19.5 Brakes

19.5.1 General

Hoisting and luffing winches are to be provided with at least a static and a dynamic brake, which may act through the same load path.

Brakes are to be of a fail-safe design (are to engage automatically in case of control or power failure).

Mechanisms such as ratchets and pawls are not to be used as dynamic or static brakes.

The friction factor to be used in the calculation of the braking capacity of dynamic and static brakes is not to exceed 0.3.

Where dry friction is used, precautions are to be taken to avoid lubricants or moisture to contaminate brake disc or pads.

Brakes are to be provided with means of adjustment, where necessary, to compensate for wear and to maintain the spring force on spring-loaded brakes.

19.5.2 Dynamic Brakes

Dynamic brakes are to be capable of retarding and stopping the line pull force in the wire rope, without overheating or damage, which is to be demonstrated during crane testing (refer to Section 2-7).

The line pull force in the wire rope is to be calculated in accordance with 2-4/3.3 for the total loads indicated in 2-6/19.1; except the reeving efficiency may be taken as 1 ($E = 1$).

Dynamic brakes based on hydraulic restrictions, such as lock valves, are to be directly mounted to the hydraulic actuator without the use of hoses. Lock valves are to have a design rated pressure of at least 1.5 times the working pressure or as an alternative, are to be tested to at least 1.5 times the working pressure and a test certificate is to be submitted to ABS.

Where hydraulic circuits of closed type are used, additional precautions are to be taken in the setting of the valves to avoid the motor working against static brakes. This is to be demonstrated during crane testing (refer to Section 2-7).

Regenerative power braking mechanisms, which in case of failure in the electric power supply will automatically disengage, are to be combined with a fail-safe brake and will be subject to special consideration.

19.5.3 Static Brakes

For hoisting winches, static brakes are to be capable of holding 1.5 times the torque induced by the line pull force in the wire rope for a total load based on the Live Load.

For luffing winches, static brakes are to be capable of holding 1.5 times the maximum torque induced by the line pull force in the wire rope for a total load based on the boom in-plane loading, which is to include, as applicable, the effects of the Live Load with the applicable vertical amplification factors, dead load with accelerations of the vessel or unit, wind loading on the boom and lifted load.

The line pull force in the wire rope is to be calculated in accordance with 2-4/3.3; except the reeving efficiency may be taken as 1 ($E = 1$).

19.7 Winch Supporting Structure

Winch supporting structure is to be designed for the greatest of the following:

- Two (2) times the maximum reactions induced by the maximum tension in the rope in accordance with 2-4/3.1.
- The maximum reactions induced by the line pull force in the wire rope, calculated in accordance with 2-4/3.3, for a total load for hoisting winches based on Live Load times the applicable vertical amplification factor, VAF (refer to Section 2-2); and for a total load for luffing winches based on the boom in-plane loading, which is to include, as applicable, the effects of the Live Load with the applicable vertical amplification factors, dead load with accelerations of the vessel or unit, wind loading on the boom and lifted load.

The maximum reactions are to be calculated for the worst loading combination of line pull forces and inclinations of the wire rope, with the force applied on the outer layer of the drum. The calculated stresses are not to exceed the allowable stresses in 2-2/5.

Winch foundation bolts are to conform to the material requirements of 2-3/5.9. Bolt preloading is to be such so as contact between winch foundation and crane structure is maintained under all loading conditions.

When braking torque is applied on one side of the drum supporting structure, reactions due to torque are to be applied only to the side of the foundation containing the brake, unless it is demonstrated that supporting structure is rigid enough to evenly distribute the reactions on both sides.

21 Swing (Slewing) Mechanism (1 July 2016)

21.1 General

Swing (slewing) mechanisms are to be powered so as to rotate the crane in the most unfavorable combination of transverse loading due to the effects, as applicable, of Live Load, dead load with accelerations and inclinations of the vessel or unit, and wind loading on the boom and lifted load, during in-service and out-of-service, with boom not stowed, conditions.

21.3 Brakes

Swing (slewing) mechanisms are to be provided with at least a static brake.

Total installed static braking capacity is to be sufficient to hold the crane in the most unfavorable combination of transverse loading due to the effects, as applicable, of Live Load with the applicable vertical amplification factors, dead load with accelerations and inclinations of the vessel or unit, and wind loading on the boom and lifted load, during in-service and out-of-service, with boom not stowed, conditions.

23 Gearboxes (1 July 2016)

Gearboxes, including their couplings and shafts, are to be designed, constructed, installed and tested to the requirements contained in this Guide and Section 4-3-1 of the *Marine Vessel Rules*, as applicable for auxiliary gears. Refer also to 2-1/9 TABLE 3.

When gearboxes, including couplings and shafts, are used for transmitting the braking torque of static or dynamic brakes, they are to have a static strength of at least the braking capacity of the respective brake, as per 2-6/19 for gearboxes used in winches and 2-6/21 for gearboxes used in swing circle mechanisms.

25 Hydraulic Cylinders (1 July 2016)

25.1 General

Hydraulic cylinders that are used for luffing, folding and telescoping and all other cylinders that are considered as critical, in accordance with 2-1/7.65, are to be designed, constructed and tested to the requirements of this Section.

All other cylinders are to be designed to the requirements of 4-6-7/3.5.5 of the *Marine Vessel Rules*.

25.3 Design

25.3.1 General

Hydraulic cylinders are to be designed to the requirements for pressure vessels as per 2-6/9 and the requirements of this Section, taking into account the most severe loading in accordance with Section 2-2.

When more than one cylinder is used for each motion, such as luffing, folding and telescoping, arrangements are to be provided to equalize the pressure and exerted loading among the cylinders. Otherwise, it is to be demonstrated through design analysis that the most severe loading on each cylinder is taken into account for the design of the cylinders.

25.3.2 Buckling

The critical buckling load on each cylinder is to be at least 2 (two) times greater than the maximum design compressive load on the cylinder in accordance with 2-6/25.3.1.

The critical buckling load of pin mounted hydraulic cylinders is to be determined in accordance with the lowest-order solution of the following equation:

$$P_{cr} - \frac{3 \cdot \frac{L_1 + L_2}{L_1 \cdot L_2} \cdot K_1 \cdot K_2}{K_1 \cdot B_2 + K_2 \cdot B_1 + \frac{K_1 \cdot K_2}{K_3}} = 0$$

where

P_{cr} = critical buckling load, in N (kgf, lbf)

$$K_1 = \frac{E_1 \cdot I_1}{L_1}$$

$$K_2 = \frac{E_2 \cdot I_2}{L_2}$$

$$K_3 = \frac{E_2 \cdot I_2}{L_3}$$

$$B_1 = \frac{3 \cdot \left(1 - \frac{L_1/J_1}{\tan(L_1/J_1)} \right)}{(L_1/J_1)^2}$$

$$B_2 = \frac{3 \cdot \left(1 - \frac{L_2/J_2}{\tan(L_1/J_1)^2}\right)}{(L_2/J_2)^2}$$

$$J_1 = \sqrt{\frac{E_1 \cdot I_1}{P}}$$

$$J_2 = \sqrt{\frac{E_2 \cdot I_2}{P}}$$

P = estimate of critical buckling load for lowest-order solution, in N (kgf, lbf)

L_1 = effective cylinder tube length, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

L_2 = effective piston rod length, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

L_3 = length of the portion of rod situated inside the cylinder tube, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

D_1 = inside diameter of cylinder tube, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

D_2 = outside diameter of cylinder tube, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

D_3 = outside diameter of piston rod, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

D_4 = inside diameter of piston rod, in mm (in.), as shown in 2-6/25.3.2 FIGURE 1

E_1 = modulus of elasticity of cylinder tube material, in N/mm² (kgf/mm², psi)

E_2 = modulus of elasticity of piston rod material, in N/mm² (kgf/mm², psi)

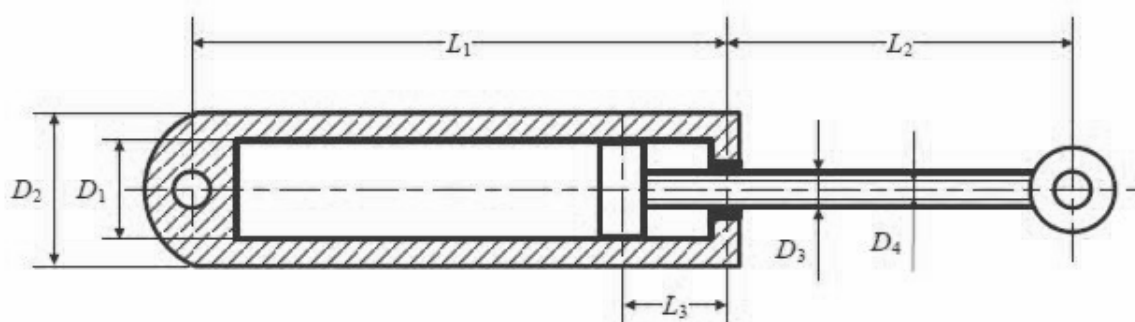
I_1 = moment of inertia of cylinder tube, in mm⁴ (in⁴)

$$= \pi \cdot \frac{D_2^4 - D_1^4}{64}$$

I_2 = moment of inertia of piston rod, in mm⁴ (in⁴)

$$= \pi \cdot \frac{D_3^4 - D_4^4}{64}$$

FIGURE 1
Cylinder Dimensions (1 July 2016)



For hydraulic cylinders with other end connections (e.g., hydraulic cylinders fixed at their two ends), the critical buckling load is to be determined using the methodology in ISO/TS 13725.

25.3.3 Lock Valves

Hydraulic cylinders used for luffing, folding or telescoping are to be provided with directly mounted lock valves that are capable of maintaining the position of the cylinder ram in the event

of loss of hydraulic power. These valves are to be directly mounted on the cylinders without the use of hoses.

The valves are to be capable of closing automatically when the control lever is returned to the neutral position or upon loss of hydraulic power.

The valves are to have a design rated pressure of at least 1.5 times the pressure induced by the most severe loading in accordance with Section 2-2. As an alternative, the valves are to be tested to at least 1.5 times the pressure induced by the most severe loading in accordance with Section 2-2 and a test certificate is to be submitted to ABS.

The valves are to be set to hold at least 1.1 times the pressure induced by the most severe loading in accordance with Section 2-2.

25.3.4 Lugs and other Primary Structural Members

Lugs and other primary structural members of hydraulic cylinders are to be designed in accordance with Section 2-2.

25.5 Materials

Materials of hydraulic cylinders are to comply with the requirements of 2-3/5.3.

25.7 Testing

Each individual unit is to be hydrostatically tested to 1.5 times the maximum allowable working pressure (2 times, for cast iron and nodular iron cylinders) in the presence of the attending Surveyor.

27 Crane Controls, Safety Devices and Features (1 July 2016)

27.1 General

Cranes are to be fitted with suitable controls, safety devices and features, as described in this Section and as applicable. The same are to be demonstrated to the attending Surveyor. See 2-7/5.3.

27.3 Crane Controls and Monitoring

Crane controls are to be clearly marked to show their functions. Lighting for controls is to be provided. Control levers for boom hoist, load hoist, swing, folding and telescoping, as applicable, are to return automatically to their center (neutral) positions on release.

Suitable monitoring of the crane's controls is to be provided. As appropriate, monitoring is to indicate availability of power, air pressure, hydraulic pressure, motor running and slewing brake mechanism engagement.

27.5 Safety Devices and Features (1 May 2018)

- i) A boom hoist limiter or shutoff is to be provided to automatically stop the boom hoist when the boom reaches a predetermined high and low angle.
- ii) Boom stops are to be provided to resist the boom from falling backwards in a high wind or sudden release of the load. Boom stops should be of one of the following types:
 - a) Fixed or telescoping bumper;
 - b) Shock absorbing bumper;
 - c) Hydraulic boom luffing cylinder(s).
- iii) Auxiliary jibs are to be restrained from backward overturning.

- iv) A load-moment or load-radius indicating device for main and auxiliary hoists readable from the operator's station is to be provided, preferably with an alarm or audible device to warn the operator of a possible overload condition; except for cranes designed for one SWL from minimum to maximum radii. Cranes having different SWLs when operating in different environmental conditions are to be provided with controls to prevent or warn that the maximum hook load is exceeded, without however, overriding the operator's control of the load or crane.
- v) An anti-two block system is to be provided to protect hoist ropes, structural components and machinery from damage.
- vi) An audible warning device, within easy reach of the operator, is to be provided. Shipboard cranes, davits, provision cranes, and monorail hoists/engine room overhead cranes, with SWL of less than 25t, may be exempted from this requirement, provided it is determined to the satisfaction of the attending Surveyor that the operator has a clear view throughout the crane operating area.
- vii) Aviation warning beacons and spotlights on the boom at night are to be as specified by the Owner.
- viii) Cranes are to be provided with an emergency stop system. An emergency stop button is to be located as a minimum at the primary control station. The emergency stop circuit is to be hardwired and independent of any control system signal.
- ix) When installed, Automatic and Manual Overload Protection Systems (**AOPS** and **MOPS**) are to meet the applicable requirements of a recognized industry standard. Electrical, piping and machinery systems are to be in accordance with Section 2-6 of this Guide.

CHAPTER 2 Guide for Certification of Cranes

SECTION 7 Surveys

1 General

Before being taken into use, all cranes, including all accessory gear, are to have been tested and examined by the crane manufacturer. The person performing the testing and examination is to be duly authorized by the manufacturer.

The Surveyor will witness tests during In-Plant, Initial, Annual, Retesting and Damage Surveys. The particulars of these tests and examinations will be entered on the applicable certificate and inserted in the Register of Lifting Appliances. See 2-8/1.

3 Surveys during Construction (*1 July 2016*)

3.1 General

All cranes are to be surveyed during construction. Surveys of cranes during construction are required to the extent necessary for the Surveyor to determine that the details, material, welding and workmanship are acceptable to ABS and are in accordance with the approved drawings.

The Surveyor is to have access to all material test certificates. All in-plant testing of the crane structural components or assembled cranes is to be witnessed and reported on by the attending Surveyor.

The survey during construction report is to identify all members of the crane that have thickness less than 6 mm (0.25 in.) and where special protective coatings were applied as per 2-2/3.5.

The manufacturer shall establish and maintain a quality control system to assure that all ABS requirements, including design approval, materials, verification, fabrication workmanship and nondestructive testing, are complete.

The quality control system should provide sufficient details of manufacturing and inspection to assure that manufacturer's inspections are performed at appropriate stages of fabrication. In the event of non-compliance, fabrication should be delayed for rectification.

The quality control system should fully document welding procedures and qualification of welding personnel. The quality control system should also detail the procedures and qualifications of nondestructive testing personnel to be employed in all stages of fabrication and manufacture. The manufacturer's quality control system should provide assurance that required heat treatments have been performed.

Nondestructive testing to be carried out in accordance with 2-3/15 TABLE 3 to the satisfaction of the attending Surveyor.

3.3 Slewing Ring Surveys

Surveys at the plant of the slewing ring manufacturer are required in order to verify that the following items are in accordance with the requirements of this Guide and the approved drawings:

- i) Material test certificates and documentation.
- ii) Dimensions of components.
- iii) Hardness, heat treatment, and material properties of each bearing ring and rollers.
- iv) Planarity (flatness) tolerances and surface finish.

- v) Verify that openings and corners in way of the raceway have a smooth machined radius in accordance with manufacturer's specifications.
- vi) Final fit-up of assembled slew bearing.
- vii) Witness manufacturer's acceptance testing.

For slewing rings manufactured using welded construction, in addition to the above requirements, the following will also apply:

- i) Welding procedure specifications and corresponding weld procedure qualification records to the extent deemed necessary by the attending Surveyor.
- ii) Welder's qualifications to the extent deemed necessary by the attending Surveyor.
- iii) Fit-up prior to major weldments.
- iv) Final weldments.
- v) Nondestructive Testing (NDT) of welds and records of NDT.

Hardened raceways are to be hardness tested in at least eight locations equally distributed along the circumference and the hardness values are to be within the range specified by the manufacturer. Evidence demonstrating that the hardness depth criteria have been met is to be furnished to the attending Surveyor.

3.5 Certification during Construction

Upon satisfactory fabrication, the Surveyor may issue a certificate certifying that the crane has been built in accordance with these requirements, the extent of testing witnessed, and showing the model and serial numbers, a description of the crane, and the date of issue. See 2-8/1.

5 Testing Cranes as a Unit

5.1 Test Loads

The crane is to be tested onboard to the following proof loads:

TABLE 1 (1 May 2018)

SWL of Assembled Crane at the Specified Working Radius, kN (tf, lbf)	Proof Load ⁽¹⁾		
	Shipboard and Heavy Lift Cranes	Offshore Cranes	
		Original Proof Load Test ⁽³⁾	Load Testing Subsequent to Original Test
Up to 196 kN (20 tf, 44100 lbf)	25% in excess of SWL	25% in excess of VL ⁽²⁾	25% in excess of SWL
196-490 kN (20-50 tf, 44100-110250 lbf)	49 kN (5 tf, 11025 lbf) in excess of SWL	49 kN (5 tf, 11025 lbf) in excess of VL ⁽²⁾	49 kN (5 tf, 11025 lbf) in excess of SWL
Over 490 kN (50 tf, 110250 lbf)	10% in excess of SWL	10% in excess of VL ⁽²⁾	10% in excess of SWL

Notes:

- 1 Proof load is not to be less than the overload protection (shutdown) setting of the crane.
- 2 (1 July 2016) $VL = 0.75 \times VAF \times SWL$, where VAF is the vertical amplification factor. See 2-2/9. For the purposes of this Section, VAF is not to be taken less than 1.33 ($VAF \geq 1.33$).
- 3 Original Proof Load Test – Test of the crane after installation on board prior to first use and performed within a harbor or sheltered area or in very mild environmental conditions.
- 4 The original proof load need not exceed the design load of the hoisting winch brakes calculated as per 2-6/19.5.

5.3 Proof Testing and Inspection

5.3.1 General (2018)

The purpose of the Proof Test is to test the crane in the most severe loading conditions.

Proof testing requirements for all cranes are as follows:

- i) For complex cranes, such as knuckle boom cranes, level luffing cranes and other multiple boom cranes, the following conditions are to be taken into consideration when choosing test locations:
 - Maximum overturning moment
 - Boom buckling and suspension
 - Boom hydraulic cylinder buckling
 - Hoist wire breaking strength
- ii) For fixed boom cranes without ABS approved proof test procedures, the crane is to be tested at least at the minimum, maximum, and intermediate radii.

For cranes contracted on or after 1 July 2016, the manufacturer is to identify proof load testing conditions based on most severe loading on each crane component and a general procedure that identifies the ranges of weights and radii that will test the crane in each identified condition is to be submitted for review, as per 2-1/3.3.1.

5.3.2 Proof Testing (2018)

The test radii are to be stated on the Certificate of Test together with the proof loads used. The proof load is to be lifted and held for at least five minutes.

The Proof Test is to also include a function test of all safety features, fail-safe and limiting devices, load-moment and boom-angle indicators, and optional systems.

The Proof Test is to include hoisting and lowering of the main hook, auxiliary hook and boom; slewing (swinging) and luffing with the proof test load on the hook, to the extent possible as noted below:

5.3.2(a) Cranes with Design Restrictions (2018)

- i) For Offshore cranes with Proof Test loads calculated using a vertical amplification factor, VAF, greater than 1.33, the Proof Test load should only be luffed and not hoisted nor slewed unless the manufacturer confirms that the crane design is rated for it.
- ii) For cranes when there is a built-in load limiting control or system and it is not possible to hoist the required proof-load, the proof load may be luffed or lifted by means other than hoisting. The built-in load limit control or system is not to be adjusted to hoist the proof load.
- iii) For cranes when there is a built-in load limiting control or system and it is not possible to slew the required proof-load, the crane is to slew a test load not less than the safe working load stated on the certificate. The built-in load limit control system is not to be adjusted to slew the proof load.
- iv) For cranes on floating structures where proof-load testing can create vessel inclinations greater than the rated design conditions, it is acceptable to test the slew the maximum load possible at inclinations no greater than those conforming with 2-6/21.1. In these cases, the proof load is to be lifted with the slew brakes set at conditions no greater than those conforming with 2-6/21.3.

5.3.2(b) Original Test of Cranes (2018)

Unless otherwise approved and as specified in 2-2/13, 2-7/9 and 2-8/7, the Original Proof Load Test is to be carried out using movable known weights.

5.3.2(c) For Testing of Cranes Subsequent to the Original Test (2018)

In the case of cranes when there is built-in load limiting control or system and it is not possible to lift the required proof-load, it will be sufficient to lift the greatest possible load. However, in no case is the test load to be less than the safe working load stated on the certificate.

Note:

: When the load lifted is less than the proof test load required in 2-7/5.1, a notation is to be made on the certificate that this load was the maximum possible load and that the adjusting devices or relief valves were found sealed.

5.3.2(d) Testing of Derrick Systems (Conventional Cargo Gear) (2018)

- i) Unless otherwise approved, the proof load is to be applied by hoisting movable weights with the cargo boom at an angle to the horizontal which is to be stated in the certificate of the test. This angle is not to be greater than 15 degrees to the horizontal for loads up to and including 10 tons and 25 degrees for loads above 10 tons, or the lowest angle approved in association with the design, or when these angles are impracticable, at the lowest practicable angle. After the proof load has been lifted, it is to be swung as far as possible in both directions. After being tested as aforesaid, all cargo gear, with the whole of the gear accessory thereto, and all chains, rings, hooks, links, shackles, swivels, pulley blocks or other loose gear is to be examined to see whether any part has been injured or permanently deformed by the test.
- ii) For union purchase, the proof load is to be applied by hoisting movable weights and is to be rigged as shown on the approved plans. The proof load is to be lifted to the approved hook height above the deck in such a manner that all the load is taken by one runner, then transferred along a path parallel to the deck until it reaches the other boom and the entire load is taken by the runner which had been slack. After being tested as aforesaid, the gear is to be rigged so that the inboard (hatch) boom will become the outboard (shore) boom and vice versa. The test is to then be repeated.

5.3.3 Post-test Examination after Proof Testing (2018)

After being tested, each lifting appliance, together with all critical accessories, is to be examined to see whether any part has been damaged or permanently deformed by the test. In addition to the list of structural components listed in 2-2/1, the Surveyor should examine at least the following items:

- i) Foundation, where required as per 2-2/5.21
- ii) Sheaves and rope guides
- iii) Wire ropes including end connections
- iv) Hoist machinery, brakes and clutches
- v) Hooks
- vi) Slewing assembly and bolting arrangements
- vii) Boom heel pins and brackets

5.5 Source of Electrical Power

Current for electrical winch operation during the test is to be taken through the vessel's cables. Shore current may be used when supplied through the main switchboard.

5.7 Brakes and Fail-safe Devices

The operation of all brakes and fail-safe devices is to be demonstrated under simulated loss of power conditions to the satisfaction of the Surveyor. The crane manufacturer shall prepare a test memorandum outlining the cautions and procedures for proper testing of the devices.

5.9 Machinery

General examination of machinery, piping and electrical equipment. See Section 2-6.

5.11 Marking of Assembled Crane (1 July 2016)

For single rated booms, the Safe Working Load (abbreviated “SWL”) for the assembled gear is to be marked on the legs of gantry cranes and on the heel of jib crane booms together with the minimum angle to the horizontal or radius and date of test for which the boom is certified. These letters and figures shall be in contrasting colors to the background and at least one inch in height.

Where the crane is approved for varying capacities, crane capacity rating chart indicating the maximum safe working loads are to be conspicuously posted near the controls and visible to the operator when working the gear. These charts should indicate the various working angles of the boom and the maximum and minimum radii at which the boom may be safely used, for each boom length intended. See 2-2/1.5.

The Safe Working Load for union purchase, SWL (U), for the assembled gear is to be marked on the heel of each of the booms in contrasting colors to the background, with the date of test. Letters and numbers are to be at least 25 mm (1 in.) high.

5.13 Record of Test

Copies of the initial and subsequent certificates of tests issued by the Surveyor are to be inserted in the Register of Lifting Appliances. See 2-8/1.

7 Initial Survey (1 July 2016)

During the Initial Survey, the original proof testing and examination should be conducted in accordance with 2-7/5 and the test conditions and results should be included in the Register of Lifting Appliances. See 2-8/1.

For cranes fitted with slewing rings, prior to mounting of the crane, the Surveyor is to witness flatness checks and surface finish requirements to verify compliance with the manufacturer’s specifications for the following:

- Crane attachment area for slewing ring.
- Slewing ring.
- Mounting flange on pedestal.

Shimming or surface leveling compounds are not to be used to attain the required level of flatness of the mounting surfaces

During installation, bolts are to be pretensioned by controlled means. Pretensioning, by bolt torque or by hydraulic tensioning device, is to be in accordance with the bearing manufacturer’s instructions, which are to be submitted for review. Elongation of the bolts is to be measured to verify pretensioning. At least 10 percent of the bolts, randomly selected, are to be measured to the satisfaction of the attending Surveyor.

Once the crane has been mounted, a “Rocking Test” taken in accordance with the bearing manufacturer’s instructions is to be conducted and the results are to be included in the Register of Lifting Appliances.

A load rating vs. boom angle chart with clearly legible letters and figures on durable material shall be securely fixed to the crane in a location easily visible to the operator. Where more than one boom length is supplied, or where more than one rating is applicable to a boom (e.g., static rating and dynamic rating), a chart should be supplied for each. See 2-7/5.11.

Where cranes are installed on a vessel or offshore unit during new construction and are placed in service before delivery of the vessel or offshore unit, a load test in accordance with 2-7/5 will be required to be carried out within 30 days of delivery of the vessel or offshore unit.

In addition to the Proof Load Testing, initial survey requirements are to include confirmatory testing to demonstrate the dynamic braking effectiveness. Dynamic braking is to be tested by cycling the luffing, hoisting and folding drives, as applicable, at their rated SWL and maximum design speed corresponding to that SWL, over a sufficient range of motion for a period of at least 5 minutes to demonstrate that the dynamic brakes have the ability to stop the maximum SWL on the hook.

For cranes with telescoping booms, is to be demonstrated that the sequence of telescoping is such that the thickest boom sections are extended first.

After proof load testing, 100% surface NDT on both sides of critical welds, such as circumferential welds, in the pedestal and transition pieces is to be carried out to the satisfaction of the attending Surveyor.

For offshore cranes, upon completion of proof tests, the critical welds of crane pedestals or kingposts are subject to the following nondestructive testing to the satisfaction of the attending Surveyor:

- 100% volumetric NDT of all critical butt welds in the crane pedestals or kingposts, including any transition pieces between the pedestal and crane slewing ring
- 100% surface NDT on both sides of critical fillet welds in the pedestal or kingpost and transition pieces.

For cranes that are to be certified for lifting of personnel, all applicable requirements for personnel lifting of Section 2-9 are to be examined and verified. All safety devices and features are to be tested and personnel emergency recovery, performed in accordance with the submitted manufacturer's procedures, is to be demonstrated to the attending Surveyor.

Upon satisfactory completion of survey and testing after installation, a Register of Lifting Appliances may be issued which will contain the in-plant certificate and reports.

9 Annual Survey (1 July 2016)

After undergoing the original test and examination required by 2-7/5, each crane is required to undergo an Annual Survey at intervals of 12 months. The Annual Survey should include the following:

- Visual inspection of the crane structure for deformation, excessive wear, corrosion, damage or fractures, as necessary. The boom is to be lowered for this examination.
- Visual examination of crane hooks for deformation, excessive wear or fractures.
- Nondestructive testing of crane hooks for fractures is to be carried out on all cranes used in the Offshore Drilling, Production and Construction industry and any crane used for personnel lifting.
- Visual external examination and operational test of crane machinery including prime mover, clutches, brakes; hoisting, slewing and luffing machinery.
- Visual inspection of wire rope including end attachments.
- The slewing ring, where applicable, is to be examined for slack bolts, damaged bearings and deformation or fractured weldments. Rocking Tests, in accordance with the bearing manufacturer's instructions, are to be taken every six months. The results of these tests are to be recorded in the Register of Lifting Appliances for review by the attending surveyor at each annual survey.

- Functional tests including main and auxiliary load hoisting and lowering, boom raising and lowering, slewing (swinging), safety protective (fail-safe) and limiting devices and load and boom angle or radius indicators.
- If the crane is certified for lifting of personnel, examination and verification of all the applicable requirements for personnel lifting of Section 2-9. All safety devices are to be tested and personnel emergency recovery, performed in accordance with the submitted manufacturer's procedures, is to be demonstrated to the attending Surveyor.

11 Retesting Survey (1 August 2018)

At intervals of five years, in addition to the requirements of the Annual Survey in 2-7/9 above, the crane is to undergo testing and examination as noted in 2-7/5. If movable weights are not available for proof tests, a dynamometer or load cell may be used in lieu of weights, provided that the tests are repeated at two locations, at opposite sides of the slewing circle. Attention is called to the Owner that certain Administrations require the Retesting Survey at four year intervals, and ABS is prepared to do such retesting and note it in the Register of Lifting Appliances.

11.1 Cranes

11.1.1 Requirements Prior to Load Testing

11.1.1(a) All Cranes

- i) The ABS Surveyor is to witness a Rocking Test.
 - The Rocking Test is to be performed in accordance with the bearing manufacturer's recommendations or procedures.
- ii) A grease sample is to be taken from the slew ring bearing for analysis.
 - The grease sample is to be obtained and analyzed in accordance with the slew ring bearing manufacturer's recommendations.
 - In the absence of other methods, the grease analysis for particulates is to be performed as per ASTM D1404.

If the results of the Rocking Test or grease samples indicate potential bearing wear in excess of the manufacturer's recommendation, the bearing is to be opened for internal examination or replaced.

11.1.1(b) Additional Requirements for Shipboard and Heavy Lift Cranes which Operate within a Harbor or Sheltered Area under Mild Environmental Conditions.

Cranes fitted with slew ring bearings are to undergo the following tests and examinations:

- i) *Cranes 18 ≤ Age < 21 Years Old.* 10 percent of the slew ring bolts are to be removed and nondestructively tested.
- ii) *Cranes 21 Years and Older.* 25 percent of all slew ring bolts are to be removed and nondestructively tested.

Notes:

- 1 The quantity of bolts subjected to nondestructive testing may be based on the age of the bolts rather than the age of the crane, if satisfactory evidence of the bolt age is provided to the attending Surveyor.
- 2 Bolts chosen for examination are to be taken from the most highly-loaded area of the slew ring, and their position is to be noted for future surveys. If any bolts are found with defects, additional bolts are to be removed to confirm suitability for continued use.
- 3 Alternative methods of testing of the slew ring and bolts may be specially considered.
- 4 Manufacturer's recommendations for bolt specifications are to be followed.
- 5 All bolts removed, whether replaced or reinstalled, are to be tested and the reports provided to the attending Surveyor.

11.1.1(c) Additional Requirements for Offshore Cranes and Heavy Lift Cranes which Operate at Open Sea in Environmental Conditions other than Mild and Certified in Accordance with 2-2/9.

The critical welds of offshore crane pedestals or kingposts are subject to the following nondestructive testing to the satisfaction of the attending Surveyor:

- i) Volumetric NDT of all critical butt welds in the crane pedestals or kingposts, including any transition pieces between the pedestal and crane slew ring.
Note: This may be omitted if both sides are accessible and 100% volumetric NDT has been previously completed in the crane's records.
- ii) 100% surface NDT on both sides of critical fillet welds in the pedestal or kingpost and transition pieces.

Offshore Cranes fitted with slew ring bearings are to undergo the following tests and examinations:

- i) *Cranes $5 < \text{Age} \leq 10$ Years Old.* 10 percent of the slew ring bolts are to be removed and nondestructively tested.
- ii) *Cranes $10 < \text{Age} \leq 15$ Years Old.* 15 percent of the slew ring bolts are to be removed and nondestructively tested.
- iii) *Cranes $15 < \text{Age} \leq 20$ Years Old.* 20 percent of the slew ring bolts are to be removed and nondestructively tested.
- iv) *Cranes > 20 years old.* 25 percent of all slew ring bolts are to be removed and nondestructively tested.

Notes:

- 1 The quantity of bolts subjected to nondestructive testing may be based on the age of the bolts rather than the age of the crane, if satisfactory evidence of the bolt age is provided to the attending Surveyor.
- 2 Bolts chosen for examination are to be taken from the most highly-loaded area of the slew ring, and their position is to be noted for future surveys. If any bolts are found with defects, additional bolts are to be removed to confirm suitability for continued use.
- 3 Alternative methods of testing of the slew ring and bolts may be specially considered.
- 4 Manufacturer's recommendations for bolt specifications are to be followed.
- 5 All bolts removed, whether replaced or reinstalled, are to be tested and the reports provided to the attending Surveyor.

11.1.2 Requirements Upon Completion of Proof Load Testing

Upon completion of proof load testing, in addition to the items noted in 2-7/5, the slew ring, including bolting arrangements and foundation, is to be examined for slack bolts, damaged bearings, and deformed or fractured weldments. Pretensioning of slew ring bolts is to be verified as required by the manufacturer's onboard documentation. Any bolts found to be suspect by the Surveyor are to be removed and examined by NDE.

Cranes with built-up sections with multiple layered plates, as per 2-2/5.9.1, are to have sufficient surface NDE conducted on any laminated sections for the Surveyor to verify that the sections are tightly adhered to prevent buckling and inter layer corrosion. Weld repairs are to be conducted only in accordance with manufacturer's welding procedures.

11.3 Conventional Cargo Gear

In the case of derrick systems, the lifting gear is to undergo the proof loads and examination stated in 2-7/5, together with removal of pins from sheaves and pulley blocks. Where the boom head and heel blocks are fitted with ball or roller bearings, the removal of the pins may be dispensed with at the discretion of the Surveyor. If movable weights are not available, a spring or hydraulic balance may be used

for testing for swinging loads. In the case of use of spring or hydraulic balance, the proof load is to be applied with the boom swung, as far as possible, first in one direction and then in the other. The Surveyor may at his discretion require the proof load to be applied with the boom at intermediate positions. The test should not be regarded as satisfactory unless the indicator remains constant for a period of at least five minutes. Certificate of survey is to be furnished and attached to Register of Lifting Appliances (see Section 2-8).

13 Inspection of Wire Rope (1 September 2012)

The crane owner or operator is to establish a wire rope inspection program taking into consideration the crane type, frequency of usage, history of maintenance, wire rope manufacturer's recommendations and crane manufacturer's recommendations.

The crane owner or operator is to examine the wire rope, including end connections, at frequent intervals between surveys. Inspection records are to be maintained by the crane owner or operator and are to be made available to the Surveyor during surveys.

All running wire ropes are to be visually inspected at each Annual and Retesting Survey. Wire rope inspection during surveys is to be in accordance with G.5.1.2b of API RP 2D (Operation and Maintenance of Offshore Cranes) or equivalent recognized national or international standards.

Wire rope is not to be used if in any length of ten diameters:

- The total number of visible broken wires exceeds 5 percent of the total number of wires,
- If there is more than one broken wire immediately adjacent to an end fitting,
- If the broken wires are concentrated in one area or one strand, or
- If the rope shows signs of excessive wear, corrosion, flattening, kinks, separation of the strands or wires, core failures or other defect which renders it unfit for use.

15 Repairs and Alterations

15.1 Crane Structure, Booms and Permanent Fittings (1 July 2016)

When repairs or renewals, including welding and or replacement of major structural components are required to be made to the load bearing structures or permanent fittings of cranes, the repairs are to be carried out to the satisfaction of the Surveyor. Any welding is to be done by an approved procedure. Tests and examination of the crane are to be carried out in accordance with 2-7/5. Tests are to be conducted in all positions unless the manufacturer identifies the positions required to test the repair or modification. If tests in all positions are conducted, the Owner should consider conducting a Retest survey.

Crane load ratings shall not be reduced based on damage or wastage.

Examples of load bearing structures requiring retest are:

- i) Booms, or jibs including chords and lacing
- ii) Center post, gantry, mast, "A"-frame, or back leg
- iii) Pedestal or kingpost
- iv) Foundation
- v) Revolving upper structure
- vi) Swing circle (slew bearing) assembly
- vii) Pins and shafts
- viii) Eye plates and brackets

15.3 Repairs to Loose Gear

Welding is not to be used to lengthen, alter or repair chains, hooks, links, shackles or swivels.

CHAPTER 2 Guide for Certification of Cranes

SECTION 8 Register of Lifting Appliances

1 General (1 July 2016)

The Register of Lifting Appliances is to be available onboard for endorsement by the Surveyor at the time of periodical and damage surveys. See 2-7/7 and 2-7/9. In it is to be kept the diagram of the arrangement of the assembled crane, loose gear location and marking list, crane capacity rating charts (load charts), the particulars and location of special materials and welding procedures and record of periodical surveys. Also, attached to it are to be copies of certificates covering original and replacement loose gear, original tests to cranes and repairs or addition to cranes. An approved copy of the crane capacity rating chart is also to be included in the Register of Lifting Appliances as required in 2-2/1.5.

3 Certificates and Forms (1 July 2016)

The following certificates and forms are usually provided by the builder, manufacturer, testing authority or the firm undertaking annealing (when required). Copies as required and appropriate in each case are to be made available for inclusion in the Register. See 2-8/1.

- Form 4 (ILO Form No. 3 or ABS Form CHG-4) – Certificate of Test and Examination of Chains, Rings, Hooks, Shackles, Swivels and Pulley Blocks
- Form 5 (ILO Form No. 4 or ABS Form CHG-5) – Certificate of Examination and Test of Wire Rope Before Being Taken Into Use.
- Manufacturer's bolt and torque standards for slewing ring
- Approved crane capacity rating chart and corresponding wire rope reeving diagrams
- Manufacturer's procedures for proof-testing of cranes including overriding of limiting devices (where required) to achieve full proof load

The following forms and reports are provided and issued by the Surveyors (as applicable) upon completion of prescribed tests and surveys. Copies are to be included in the Register. See 2-8/1.

- Form 1 – Cover for Register of Lifting Appliances
- Form 3 (ILO Form No. 2 or ABS Form CHG-3) – Certificates of Test and Examination of Cranes or Hoists and Their Accessory Gear: Before Being Taken Into Use. Retesting Surveys and Tests Associated with Repairs
- Form 7 (ILO Part II or ABS Form CHG-7) – Certificate of Annual Thorough Examination of Gear and for Annual Inspection of Cranes. Reports covering the construction of the crane and any tests carried out at the manufacturer's plant during construction

5 Owner's Overhaul and Inspection Record (1 July 2016)

A record is to be kept onboard the vessel or unit which is to show particulars of all overhauls, inspections, repairs and replacements carried out by the crane Owner or Operator. This record is to be made available to the Surveyor at all times and in addition to the above requirements is to have specific sections that include:

- A log of the "Rocking Test" results required by 2-7/5 and 2-7/7, showing the manufacturer's tolerances and the remaining slew bearing clearances calculated from the Rocking Test results.
- A record of the slew bolts inspected, as required by 2-7/9, showing the location of the bolts and a copy of the bolt manufacturing record or certificate, if the bolts have been renewed.
- A copy of the NDT records of all critical weld inspections after proof load testing, as required by 2-7/5 and 2-7/9.

7 Repairs and Alterations

Certificates covering tests are to be inserted in the Register. See 2-8/1.

9 Addition of New Gear and Wire Rope

Replacement wire rope and loose gear is to be supplied with manufacturer's certificate conforming to tests in accordance with 2-4/5 and 2-7/1. The wire rope and loose gear certificates are to be inserted in the Register (see 2-8/1), and each article and certificate is to be identified as to location in the crane assembly. Certificates covering discarded loose gear are to be removed from the Register.

CHAPTER 2 Guide for Certification of Cranes

SECTION 9 Personnel Lifting *(1 July 2016)*

1 General

Cranes intended to be certified for lifting or moving of personnel are to be equipped with the specific features given in the subsequent paragraphs, in addition to the other requirements of this Guide.

3 Personnel Rated Loads

For lifting appliances used for non-personnel and personnel lifting, the personnel SWL rating is not to exceed fifty percent (50%) of the corresponding non-personnel SWL rating.

For lifting appliances dedicated to lifting of personnel, the load to be considered in the design and analysis of a lifting appliance dedicated to lifting of personnel is to be twice the personnel SWL rating.

The personnel Safe Working Load (SWL) ratings of the crane are to be supplied on the crane capacity rating chart (see 2-2/1.5) for all personnel lifting working radii, significant wave heights and wind velocities. The personnel net or basket is to be considered part of the rated load.

5 Personnel Hoist System

Load blocks used for personnel lifting are to be permanently marked with the maximum SWL to be used for lifting personnel. Load blocks used for both non-personnel and personnel lifting are to be permanently marked with both the maximum non-personnel SWL and personnel SWL.

Load blocks dedicated to lifting of personnel are to be designed for a load at least twice the personnel SWL.

The hooks used for personnel lifting are to be provided with latches fitted with positive locking means, whereby inadvertent opening of the latch is prevented. A locking device and/or an arrangement which operates under a retaining spring force may not be considered as a positive locking means as the latch may inadvertently open due to vibrations during operations, due to a failure of the retaining spring, etc. The latch is not intended to support the lifted load.

Loose gear dedicated to lifting of personnel are to be tested for a safe working load at least twice the proof load of 2-5/1.1.

7 Winch Brakes

Hoisting and luffing winches used for lifting of personnel are to be equipped with at least a static and a dynamic brake, which are to be mechanically and operationally independent, with separate control circuits. Each brake is preferably to act directly on the winch drum but a fully independent load path will be considered on a case by case basis.

Means is to be provided for the user to conduct an individual test of each brake.

The brakes used only for lifting of personnel are to fulfill the requirements given in 2-6/19.5, except that the Live Load is to be based on the Personnel SWL, when calculating the applicable line pull force.

9 Cylinders

Where cylinders are used for luffing, folding or telescoping, each motion is to be provided with one of the following:

- i) One cylinder with double seals at the piston head and rod.

- ii) Two independent cylinders, where each cylinder is to be independently capable of holding the rated capacity for personnel lifting.

11 Mode Selection for Personnel Lifting

Where cranes are fitted with any of the following systems:

- Automatic Overload Protection Systems (AOPS)
- Manual Overload Protection Systems (MOPS)
- Active Heave Compensation Systems
- Active Rope Tensioning Systems
- Passive Heave Compensation Systems
- Passive Rope Tensioning Systems

and the hoisting and/or luffing system is commonly used for both personnel and non-personnel lifts, the control station is to be equipped with a manual switch for selection between cargo and personnel lifting modes. The switch is to have a warning light continuously illuminating when personnel lift mode is activated. Means is to be provided to prevent inadvertent change between modes. Such means does not include posted instruction plates or placards.

When the mode for personnel lifting is selected, the following functions are to be maintained:

- i) All brakes are to be automatically activated when the controls are in neutral position and in case of emergency stop being activated or the event of power failure.
- ii) Where fitted, all automatic overload protection systems (AOPS) and manual overload protection systems (MOPS) are to be overridden and locked out.
- iii) Where fitted, active heave compensation systems, active rope tensioning systems, passive heave compensation systems and passive rope tensioning systems are to be overridden and locked out.

13 Personnel Emergency Recovery

13.1 General

Cranes are to be fitted with an emergency recovery system in compliance with the requirements of this Section.

13.3 Emergency Recovery System for PL notation

The crane is to be fitted with its own independent means for controlled luff down and lowering operations in the event of a single failure in the power or control system. Such means is to provide controlled lowering and stopping of the winch drums and cylinders under all load conditions.

13.5 Emergency Recovery System for PL+ notation

The crane is to be fitted with its own independent means for controlled slew, luff down, and lowering operations in the event of a single failure in the power or control system. Such means is to provide controlled slewing of the crane and lowering and stopping of the winch drums and cylinders under all load conditions.

13.7 Emergency Recovery System for PL++ notation

The crane is to be fitted with its own independent means for performing all main functions, such as slewing, luffing up and down, hoisting up and down, folding and unfolding, telescoping in and out, etc., in the event of a single failure in the power or control system, under all load conditions.

13.9 System Requirements

For the above emergency recovery systems, the following apply:

- i) Components that are used only for transfer of power or signals from the power unit to the actuators (motors, cylinders, etc.), such as pipes, flexible hoses and electric cables, need not to be taken into consideration in the single failure of the power and control system.
- ii) When the crane is fitted with a secondary power and/or independent control system, the manual activation switches or handles for the emergency operation system shall be of a “hold to run type” and clearly and permanently marked for their purpose.
- iii) When means for lowering are based on gravitational forces, the minimum load to enable lowering of the hook is to be determined by the manufacturer and included in the personnel lifting crane capacity rating chart.
- iv) Operational instructions for the emergency recovery system are to be distinctly posted at the operator’s station.

15 Computer-based Control Systems

Where fitted, computer-based control systems of cranes intended for personnel lifting are to comply with the requirements of Section 4-9-3 (and the sections referenced therein) of the *Marine Vessel Rules*, as applicable, for Category II Systems in accordance with 4-9-3/7.1 TABLE 1.

CHAPTER 2 Guide for Certification of Cranes

SECTION 10 Maintenance/Service Baskets (1 July 2016)

1 General

Maintenance or Service Baskets: Are baskets that are intended for lifting or lowering of personnel in order to provide them with access to work positions. These baskets can be separately attached to a lifting appliance or can be an integral part of a lifting appliance (i.e., the lifting appliance and basket are permanently attached to each other).

When these baskets are to be certified, they are to comply with the requirements of 2-10/3 through 2-10/7 below. As an alternative, these baskets may also be certified to the requirements of recognized industry standards, provided the industry standards are not less effective than the requirements of 2-10/3 through 2-10/7 below.

3 Basket Structure

- i) Materials, welding and NDE of the basket structure are to meet the applicable requirements of Section 2-3 of this Guide.
- ii) The structural members of the basket are to have a minimum thickness of 4 mm (0.16 in.).
- iii) The interior of hollow sections of the basket is to be either coated or the ends of the hollow sections are to be sealed so as to prevent the ingress of water.
- iv) The dimensional sizing of the basket is to be based on the maximum number of personnel and working tools that the basket is expected to accommodate. Additional guidance on dimensional sizing is provided in the *ABS Guidance Notes on the Application of Ergonomics to Marine Systems*.
- v) The basket is to be designed for the worst case static and dynamic loads for the intended service. The allowable stresses for the design are to be calculated as per 2-2/5.5 of this Guide. As an alternative, the basket may be designed to the structural requirements of a recognized industry standard such as EN 280.
- vi) The basket is to be fitted with a permanently installed nameplate indicating the manufacturer's name, serial number, year it was built, Safe Working Load (SWL), maximum number of personnel that it is designed to carry, and the certification authority.
- vii) When an access gate (such as a sliding or folding type gate) is installed on the basket, they are to be provided with a positive-acting device that will restrain the gate from accidental opening. Swinging type access gates are to open only to the interior of the basket.
- viii) The basket is to be provided with anchor point for attachment of personnel fall protection lanyards.

5 Mechanical Components, Piping and Electrical Systems

- i) Mechanical components, piping and electrical systems are to meet the applicable requirements of Section 2-6 of this Guide.
- ii) All load control systems/mechanisms (such as the brakes, hydraulic cylinders, slewing arrangements, etc.) are to be fail-safe in order to ensure positive control of the load at all times.
- iii) Control levers for the basket control system are to return automatically to their center (neutral) positions upon release.

- iv) All brakes are to be capable of stopping and holding the basket at all operating speeds and configurations. Brakes are to automatically engage when the control lever is returned to the neutral position.
- v) Means are to be provided to facilitate an emergency stop of the basket operations by the operator(s) at the basket control station or at a remote control station and by the personnel in the basket.
- vi) Means are to be provided for emergency recovery of the basket personnel from any operational position of the basket, in the event of power or control systems failure.

7 Surveys

All the applicable requirements of Section 2-7 of this Guide for the survey of maintenance/service baskets are to be complied with. Testing of the basket is to be carried out to the satisfaction of the attending Surveyor. The following test loads are to be used for the initial and re-testing surveys:

<i>Test</i>	<i>Test Load</i>
Static Load Testing of the Basket	125% of SWL
Functional Load Testing of the Basket and Systems	100% of SWL
Brake Holding Test	100% of SWL
Emergency Load Lowering Test	100% of SWL

CHAPTER 2 Guide for Certification of Cranes

SECTION 11 Subsea Lifting (1 July 2016)

1 Scope

This Section covers the subsea lifting of unmanned objects (non-personnel rated loads) by offshore or heavy lift cranes, excluding launch and recovery systems.

For launch and recovery systems (handling systems), refer to the *ABS Rules for Building and Classing Underwater Vehicles, Systems and Hyperbaric Facilities*.

3 General

Subsea lifting refers to the operation of a crane in which a load is lowered through the splash zone into the water column and is either held at an intermediate level, lowered to or released on the seabed, or is retrieved back to the vessel/unit.

Offshore and heavy lift cranes intended for subsea lifting are to meet the requirements of this section as well as the applicable in-air requirements of this Guide for offshore cranes or heavy lift cranes.

5 In-air Lifting

The crane structure, machinery, piping, electrical and control systems are to be designed, fabricated and tested to comply with the requirements of Chapter 2 of this Guide for offshore or heavy lift cranes, as applicable.

7 Subsea Lifting

In addition to the requirements of 2-11/3 above for in-air lifting, the following requirements are to be met for subsea lifting:

7.1 Design

- i) The manufacturer/operator is to specify the following design/operational parameters for subsea lifting:
 - Safe working load(s)
 - Rated vertical depth (maximum vertical lowering depth) of the load
 - Maximum offlead and sidelead angles
 - Maximum heel and trim angles
 - Load geometry (maximum anticipated dimensions)
 - Worst case environmental conditions for operation (such as the sea state, significant wave heights, current speeds, temperature, etc.)
 - Any specific operational restrictions for equipment such as motion compensation systems
 - Mooring or dynamic positioning requirements for the vessel/offshore facility from which the subsea lifting is carried out
- ii) For subsea lifting, the design of the crane is to be based on the worst case anticipated operating conditions and as a minimum, is to take into consideration the following:
 - Dynamic forces at the boom tip due to motion of the vessel and the subsea load
 - Splash zone loads (e.g., slamming loads)

- Weight of the fully extended rope (up to the maximum lowering depth) and loose gear items
 - Added mass
 - Buoyancy
 - Current speeds
 - Drag
 - Entrained water/mud within the load
 - Seabed suction (for cases where the load is lifted from the seabed)
- iii)* For subsea lifting, amplified/shock loading under the following conditions are to be also taken into consideration. Alternatively, suitable means are to be provided to mitigate this loading:
- Snap loading due to poor synchronization between the heaving motion of the subsea load versus the heaving motion of the vessel.
 - Resonance when the frequency of the vessel/wave motion matches the natural frequency of the hoisting system.
- iv)* When heave compensation systems are installed, the following are to be taken into consideration:
- If the heave compensated condition is used to improve the load rating of the crane, then, the potential for shock loading and/or additional structural loading due to heave compensation system failure or synchronization issues are to be also addressed in the design.
 - In general, heave compensation systems will subject crane components (such as the running ropes, sheaves, etc.) to higher fatigue cycles over the lifetime of the crane. Where applicable, this is to be addressed in the design.
- v)* For subsea lifting, the factors of safety for the design are to be in compliance with Chapter 2 of this Guide for offshore or heavy lift cranes, as applicable.

7.3 Load Charts for Subsea Lifting

Load charts for subsea lifting are to be prepared and submitted to ABS for review. These are to be based on the design considerations under 2-11/7.1 above. The subsea lifting rated loads are not to exceed the respective rated loads of the in-air load charts.

7.5 Corrosion

Crane components (e.g., sheaves, winch drums, etc.) that are in direct contact with the running ropes used for subsea lifting are to be fabricated from corrosion resistant materials, in order to protect these components from the corrosive effects of salt water carried by the ropes. Alternatively, consideration is to be given to providing means of corrosion control for these components.

7.7 Machinery and Systems

For subsea lifting, the crane machinery and systems are to meet the following requirements in addition to Section 2-6 of this Guide.

7.7.1 Load Hoisting Winches

- i)* Load hoisting winches of the single drum type or traction/capstan and storage type may be used for subsea lifting.
- ii)* The winch manufacturer is to demonstrate that the design of the winch is suitable for subsea lifting. The design is to take into consideration the unique aspects associated with subsea lifting, such as increased loading on winch drums and flanges due to multilayer spooling of ropes.
- iii)* Single drums or storage drums are to be designed for accommodating the full length of rope that is required for subsea lifting.

- iv) When single drum winches are intended for retrieval of an empty hook (after releasing the subsea load), then for synthetic fiber ropes, appropriate means are to be provided for tensioning the rope while spooling it on the drum.

7.7.2 Control Systems, Computer-based Control Systems

When computer-based control systems are used for subsea lifting, they are to comply with the requirements of Section 4-9-3 (and the sections referenced therein) of the *Marine Vessel Rules*, as applicable, for Category I Systems in accordance with 4-9-3/7.1 TABLE 1.

7.7.3 Emergency Recovery

The crane is to be fitted with an emergency means to recover the load from any operational position, in the event of a single failure in the power or control systems. As an alternative, a secondary power supply source and an independent control system for facilitating crane emergency functions may be provided for recovering the load from any operational position.

An instruction plate giving detailed instructions for emergency recovery is to be provided at the crane operator's control station.

7.9 Motion Compensation

When motion compensation systems are installed, they are to comply with the requirements of Section 2-12 of this Guide.

When rope tensioning systems are installed, they are to comply with the requirements of Section 2-13 of this Guide.

7.11 Equipment

For subsea lifting, the following equipment is to be provided:

- Means for monitoring the length of running rope paid-out by load hoisting winches
- Means for monitoring the vertical depth of the load from the surface

Note:

For subsea lifting, the above specified parameters need to be independently monitored by the operator in order to confirm that there is no significant rope stretch / elongation.

7.13 Ropes

7.13.1 Wire Ropes

Wire ropes are to meet the following requirements in addition to the applicable requirements of Chapter 2 of this Guide:

7.13.1(a) Lubrication of Running Ropes. The entire rope is to be lubricated as per the manufacturer's specifications. Lubrication is to be applied whenever it is necessary. Records of lubrication application are to be maintained and are to be made available to the Surveyor upon request.

7.13.1(b) Rope Inspection During Annual and Retesting Surveys. In addition to the rope inspection as per 2-7/11 of this Guide, wire ropes are to be examined using suitable NDE methods (such as the magnetic flux leakage method) during annual and retesting surveys. The NDE is to comply with a recognized industry standard such as ASTM E1571.

Where deemed necessary by the Surveyor, additional breaking strength testing of a sample of wire rope may also be required.

Rope NDE records and breaking strength testing records are to be maintained and are to be made available to the Surveyor upon request.

7.13.2 Synthetic Fiber Ropes

The use of synthetic fiber ropes for subsea lifting will be subject to special consideration based on submission of detailed supporting documentation that demonstrates suitability of the ropes for the intended application. As a minimum, the supporting documentation is to address the time, temperature and tension characteristics of the ropes over their anticipated service life.

7.13.3 Service Life of Ropes

The service life of ropes are to be evaluated on the basis of manufacturer's recommendations, operational factors known to reduce the life of ropes (Refer to the note below) and periodic inspections in accordance with the rope inspection program (Refer to 2-7/11 of this Guide).

It is the responsibility of the operator to replace damaged ropes or ropes that have reached the end of their service life.

Note:

For subsea lifting, the service life of the ropes will vary significantly depending on operational factors such as the reeving arrangement, number of duty cycles, rope temperature, ingress of salt water within the rope core, corrosion, wear, mechanical damage, etc. The use of active heave compensation systems often leads to accelerated fatigue damage due to repeated bending cycles over multiple sheaves and increased temperature of the ropes.

7.15 Testing

For subsea lifting, the crane is to meet the following testing requirements in addition to Section 2-7 of this Guide:

7.15.1 Functional Testing

After installation on the vessel/unit, the crane is to be functionally tested to the satisfaction of the Surveyor and in accordance with the crane manufacturer's recommendations. This functional testing is to be carried out during the initial survey as well as the subsequent retesting surveys.

Functional testing is to include lowering the safe working load (SWL) to the rated vertical depth (of the crane for subsea lifting) and retrieval of the SWL from the rated vertical depth. Where this is not practicable, consideration may be given to the following on a case-by-case basis:

- i) Lowering of the SWL to the maximum available water depth in the vicinity of the vessel/unit's location
- or
- ii) Simulated test using a constant tension winch or traction winch to replicate the SWL.

Functional testing is to also include verification of the rope spooling capability of the load hoisting winch, when there is no load on the hook.

7.15.2 Hook and Block Examination

Hooks and blocks used for subsea lifting are to be opened up, examined and non-destructively tested annually in the presence of a Surveyor.

7.17 Subsea Lifting Certification

Certification of the crane for subsea lifting is limited to the design/operating parameters specified by the manufacturer/operator under 2-11/7.1.i above.

It is the responsibility of the owner/operator to ensure that these parameters are not exceeded during subsea lifting operations.

9 Position Keeping for Support Vessels/Offshore Facilities

Support vessels/offshore facilities used for subsea lifting are to be capable of maintaining their positions safely during subsea lifting operations. The means to maintain position may be a mooring system with anchors or a dynamic positioning system.

CHAPTER 2 Guide for Certification of Cranes

SECTION 12 Motion Compensation Systems for Cranes (1 July 2016)

1 Scope

This Section addresses motion compensation systems that are installed on cranes. This includes passive heave compensation systems and active heave compensation systems.

3 General Requirements

3.1 Design

- i) The manufacturer is to specify the design/operational parameters of the motion compensation systems, including any specific operational limitations.
- ii) Motion compensation systems are to be designed so that a single failure in the system does not cause loss of control of the load. Compliance with this requirement is to be verified by means of a risk analysis (See 2-12/3.3 below) or equivalent means.
- iii) When motion compensation systems subject components (such as the sheaves) and ropes to higher fatigue cycles over the lifetime of the crane, the manufacturer is to demonstrate suitability of these components and ropes for the anticipated fatigue cycles. When wire ropes are used, the sheaves and winch drums of motion compensation systems are to have a pitch diameter of not less than 20 times the nominal diameter of the wire rope.
- iv) The effect of adding a motion compensation system to the crane is to be taken into account in the design of the crane. This could include additional loading on the structural and/or mechanical components of the crane.

3.3 Risk Analysis

For motion compensation systems, a risk analysis is to be carried-out for evaluating and mitigating the potential risks associated with the malfunctioning or failure of compensation system components. The risk analysis is to be conducted as per the *ABS Guidance Notes on Risk Assessment Applications for the Marine and Offshore Oil and Gas Industries* or equivalent recognized national or international standards.

3.5 Structural Members, Machinery, Mechanical Components and Systems

Structural members, machinery, mechanical components, piping systems, electrical and control systems used for motion compensation are to meet the applicable requirements of Section 2-2 of this Guide and the requirements of this Section.

5 Passive Heave Compensation Systems

- i) Passive heave compensation systems are to be designed to operate using stored energy.
- ii) When the passive heave compensation system employs hydraulic/pneumatic stored energy, then the pressure retaining components of the system (such as the accumulators, cylinders and piping systems) are to be designed for the maximum pressure corresponding to the worst case anticipated loading on the system, including dynamic loading where applicable.
- iii) Passive heave compensation system components that are located in the primary load path (such as in-line hydraulic cylinders) are to be also designed to meet the applicable structural factors of safety of Section 2-2 of this Guide, when subjected to the worst case anticipated loading, including dynamic loading.

- iv) Passive heave compensation systems utilizing hydraulic/pneumatic cylinders and accumulators are to have a position indicator in order to provide the operator with visual indication of the position of the system with reference to its operating range.

7 Active Heave Compensation Systems

- i) Active heave compensation systems are to be provided with two independent control systems and power supplies. Alternatively, they are to be provided with a back-up means (such as a passive heave compensation system) to prevent shock loading or structural overloading of the crane in the event of failure of the active heave compensation system.
- ii) Active heave compensation systems are to operate when the boom tip is in the offboard condition. Appropriate means are to be provided to prevent operation of the heave compensation system when the boom tip is in the onboard condition.
- iii) Appropriate means are to be provided for continuous monitoring and recording of the crane load and load moment during operation of the active heave compensation system.
- iv) Audio-visual alarms are to be provided for warning the operator in the event of equipment failure or abnormal operation of the active heave compensation system.
- v) When computer-based control systems are used for motion compensation systems, they are to comply with the requirements of Section 4-9-3 (and the sections referenced therein) of the *Marine Vessel Rules*, as applicable, for Category I Systems in accordance with 4-9-3/7.1 TABLE 1.
- vi) When active heave compensation systems use synthetic fiber ropes, means are to be provided for monitoring the temperature of the rope. The operating temperature of the rope is to be in accordance with the rope manufacturer's specification. Where there is potential for rope overheating, means are to be provided for cooling the section of rope in-way of the active heave compensation system.

9 Testing

Motion compensation systems are to meet the following testing requirements in addition to Section 2-7 of this Guide.

9.1 In-Shop Testing

Motion compensation systems are to be tested to the satisfaction of the Surveyor in accordance with the manufacturer specified factory acceptance testing requirements.

For active heave compensation systems, the testing is to also include simulated testing (such as by using a simulation program to simulate the sensor feedback to the control system) in order to demonstrate the ability of the heave compensation system to maintain the position of the suspended load with reference to a fixed reference frame, under the worst case operating conditions.

9.3 On-Board Functional Testing

After installation of the crane on the vessel/offshore facility, the motion compensation systems are to be functionally tested to the satisfaction of the Surveyor in accordance with the manufacturer's testing requirements. This functional testing is to be carried out during the initial survey as well as the subsequent retesting surveys. This testing need not be conducted to the maximum safe working load of the crane.

CHAPTER 2 Guide for Certification of Cranes

SECTION 13 Rope Tensioning Systems for Cranes (1 July 2016)

1 Scope

This Section addresses rope tensioning systems that are installed on cranes in order to maintain a constant tension on the rope. This includes passive rope tensioning systems and active rope tensioning systems.

3 General Requirements

3.1 Design

- i) The manufacturer is to specify the design/operational parameters of the rope tensioning system, including any specific operational limitations.
- ii) Rope tensioning systems are to be capable of maintaining constant tension on the rope under normal operating conditions of the crane.
- iii) Rope tensioning systems are to be designed so that a single failure in the system does not cause loss of control of the load. Compliance with this requirement is to be verified by means of a risk analysis (See 2-13/3.3 below) or equivalent means.
- iv) When rope tensioning systems subject components (such as the sheaves) and ropes to higher fatigue cycles over the lifetime of the crane, the manufacturer is to demonstrate suitability of these components and ropes for the anticipated fatigue cycles. When wire ropes are used, the sheaves and winch drums of rope tensioning systems are to have a pitch diameter of not less than 20 times the nominal diameter of the wire rope.
- v) The effect of adding a rope tensioning system to the crane is to be taken into account in the design of the crane. This could include additional loading on the structural and/or mechanical components of the crane.

3.3 Risk Analysis

For rope tensioning systems, a risk analysis is to be carried-out for evaluating and mitigating the potential risks associated with the malfunctioning or failure of tensioning system components. The risk analysis is to be conducted as per the *ABS Guidance Notes on Risk Assessment Applications for the Marine and Offshore Oil and Gas Industries* or equivalent recognized national or international standards.

3.5 Structural Members, Machinery, Mechanical Components and Systems

Structural members, machinery, mechanical components, piping systems, electrical and control systems used for rope tensioning are to meet the applicable requirements of Section 2-2 of this Guide and the requirements of this Section.

5 Passive Rope Tensioning Systems

- i) Passive rope tensioning systems are to be designed to operate using stored energy.
- ii) When the passive rope tensioning system employs hydraulic/pneumatic stored energy, then the pressure retaining components of the system (such as the accumulators, cylinders and piping systems) are to be designed for the maximum pressure corresponding to the worst case anticipated loading on the system, including dynamic loading where applicable.
- iii) Passive rope tensioning system components that are located in the primary load path are to be also designed to meet the applicable structural factors of safety of Section 2-2 of this Guide, when subjected to the worst case anticipated loading, including dynamic loading where applicable.

- iv) Passive rope tensioning systems are to have a position indicator in order to provide the operator with visual indication of the position of the system with reference to its operating range.

7 Active Rope Tensioning Systems

- i) Active rope tensioning systems are to be provided with two independent control systems and power supplies. Alternatively, they are to be provided with a backup means (such as a passive rope tensioning system) to prevent shock loading or structural overloading of the crane in the event of failure of the active rope tensioning system.
- ii) Active rope tensioning systems are to operate when the boom tip is in the offboard condition. Appropriate means are to be provided to prevent operation of the active rope tensioning system when the boom tip is in the onboard condition.
- iii) Appropriate means are to be provided for continuous monitoring and recording of the crane load and load moment during operation of the active rope tensioning system.
- iv) Audio-visual alarms are to be provided for warning the operator in the event of equipment failure or abnormal operation of the active rope tensioning system.
- v) When computer-based control systems are used for active rope tensioning systems, they are to comply with the requirements of Section 4-9-3 (and the sections referenced therein) of the *Marine Vessel Rules*, as applicable, for Category I Systems in accordance with 4-9-3/7.1 TABLE 1.
- vi) When active rope tensioning systems use synthetic fiber ropes, means are to be provided for monitoring the temperature of the rope. The operating temperature of the rope is to be in accordance with the rope manufacturer's specification. Where there is potential for rope overheating, means are to be provided for cooling the section of rope in-way of the rope tensioning system.

9 Testing

Rope tensioning systems are to meet the following testing requirements in addition to Section 2-7 of this Guide:

9.1 In-Shop Testing

Rope tensioning systems are to be tested to the satisfaction of the Surveyor in accordance with the manufacturer specified factory acceptance testing requirements.

For active rope tensioning systems, the testing is to also include simulated testing that demonstrates the ability of the tensioning system to maintain constant rope tension, under the worst case operating conditions.

9.3 On-Board Functional Testing

After installation of the crane on the vessel/offshore facility, rope tensioning systems are to be functionally tested to the satisfaction of the Surveyor in accordance with the manufacturer's testing requirements. This functional testing is to be carried out during the initial survey as well as the subsequent retesting surveys. This testing need not be conducted to the maximum safe working load of the crane.

CHAPTER 3 Guide for Certification of Base-Mounted Manriding Winches

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CHAPTER **3** **Guide for Certification of Base-Mounted Manriding Winches**

SECTION **1** **General**

1 **Scope**

This Chapter addresses winches that are base-mounted and are used for lifting personnel.

3 **Submission of Plans**

Submission of plans is to be in accordance with 2-1/3 of this Guide, as applicable.

CHAPTER 3 Guide for Certification of Base-Mounted Manriding Winches

SECTION 2 Design

1 Design Loads

The winch is to be designed for the worst case loads that are anticipated during operation. As a minimum, these loads are to include the following:

- Maximum line pull, giving consideration to the drum size, layers of rope and specified winch speed
- Dynamic forces due to motion of the unit (where applicable)
- Forces due to dynamic braking of the winch
- Weight of the rope and rigging

3 Rated Capacity

The rated capacity (safe working load) of the winch for personnel lifting is not to exceed 50% of the design line pull of the winch.

5 Load Elevation

For cases where the final elevation of the live load being lifted becomes higher than the winch elevation, the weight of the spooled-out rope between the winch and the sheave is not to exceed the combined weight of the live load and the weight of the rope from the sheave to the live load.

7 Design Analysis

Design calculations for the winch, base and other load bearing structural/mechanical components are to be based on recognized standards or recognized engineering methods such as those in the American Institute of Steel Construction (AISC) Manual of Steel Construction. The calculated stresses are not to exceed the allowable stresses specified below:

$$F_a = F_y / 1.33 \quad \text{when } F_y / F_u \leq 0.7$$

$$F_a = (F_y + F_u) / 3.25 \quad \text{when } F_y / F_u > 0.7$$

$$F_s = 0.577 F_a$$

$$F = F_{cr} / 1.25 \quad \text{for flat members}$$

$$= F_{cr} / 1.55 \quad \text{for curved members}$$

where

$$F_a = \text{allowable stress in tension or compression}$$

$$F = \text{allowable stress for buckling}$$

$$F_s = \text{allowable shear stress}$$

$$F_y = \text{material yield stress}$$

$$F_u = \text{material ultimate stress}$$

$$F_{cr} = \text{critical buckling stress}$$

In addition, any combined stresses are not to exceed F_a .

CHAPTER 3 **Guide for Certification of Base-Mounted Manriding Winches**

SECTION 3 **Materials, Fabrication, and NDE**

1 General

Materials, welding and NDE are to meet the applicable requirements of Section 2-3 of this Guide.

3 Steel

Load bearing mechanical components, whose failure could terminate the load-carrying capabilities of the winch, are to be made of steel.

5 Ductile Iron/Aluminum

Use of ductile iron for gears and drums and the use of aluminum for fabrication will be specially considered.

7 Marking

Manriding winches are to be permanently marked with their safe working load (SWL) for personnel lifting and with the words “Manrider Only”.

CHAPTER 3 Guide for Certification of Base-Mounted Manriding Winches

SECTION 4 Mechanical Components, Piping and Electrical Systems

1 General

- i) Mechanical components, piping and electrical systems are to meet the applicable requirements of Section 2-6 of this Guide.
- ii) Gears and couplings are to be suitable for their intended service in terms of maximum power rating, service life and minimum operating temperature.
- iii) All load control systems/mechanisms (such as the brakes) are to be fail-safe in order to ensure positive control of the load at all times.
- iv) Control levers for the winch control system are to return automatically to their center (neutral) positions upon release. All positions of the control levers are to be clearly marked to indicate their function.
- v) An emergency means of lowering personnel is to be provided in the event of control systems or power supply failure.
- vi) A clutch capable of disengaging is not to be fitted.

3 Brakes

- i) In addition to the normal brakes, manriding winches are to be equipped with a mechanically and operationally independent secondary brake. The secondary brake is to act directly on the winch drum. Means are to be provided for the user to conduct an individual test of the secondary brake.
- ii) Brakes are to set automatically upon loss of power or when the winch control lever is returned to the neutral position.
- iii) Brakes are to have the ability to stop and hold 100% of the design load with the outermost layer of rope on the drum.
- iv) Thermal capacity of the brakes as outlined in the manufacturer's ratings or charts is to be suitable for the intended service.
- v) Brake linings containing Asbestos are not to be used.

5 Drums

- i) The drum capacity is to be suitable for accommodating the recommended rope size and length necessary to perform the intended service.
- ii) Plain or grooved drums will normally be considered acceptable, provided no less than five (5) full wraps of rope remain on the drum with the load in its lowest possible position.
- iii) The drum end of the rope is to be anchored by a clamp attached to the drum or by a socket arrangement, as specified by the winch or rope manufacturer.
- iv) The drum flange is to extend a minimum distance of 2.5 times the diameter of the rope over the outermost layer, unless additional means of keeping the rope on the drum are provided (keeper plates, rope guards, etc.).
- v) The diameter of the drum is to provide a first layer rope pitch diameter of not less than 18 times the nominal diameter of the wire rope used.

7 Pneumatic Manriding Winches

When manriding winches are pneumatically driven, they are to meet the following additional requirements:

- i) The compressed air supply line is to be appropriately sized so as to permit the winch to handle the safe working load (SWL) at rated speed.
- ii) The pneumatic winch is to be provided with the appropriate valves to permit isolation from the compressed air supply and exhaust lines.
- iii) The motor exhaust is to be vented to a location where it will not present a hazard to personnel.
- iv) Noise reduction devices are to be provided at the outlet of pneumatic exhaust lines.
- v) The compressed air supply line serving the pneumatic winch is to be fitted with the appropriate non-return valve and water separator/filter, before the operating valve at the winch.
- vi) The compressed air supply line to the winch is to be provided with an air regulator and pressure relief valve, in order to limit the air supply pressure to the winch. These are to be located upstream of the non-return valve.

CHAPTER 3 **Guide for Certification of Base-Mounted Manriding Winches**

SECTION 5 **Wire Ropes**

1 General

Wire ropes are to be constructed in accordance with a recognized standard applicable to the intended service, such as API Specification 9A or equivalent.

3 Factor of Safety

The wire rope safety factor for manriding winches is not to be less than 10. The safety factor is to be based on the minimum rope breaking strength versus the safe working load (SWL) for personnel lifting.

5 Rope Maintenance

Rope usage records such as ton-mile records are to be maintained and the wire rope is to be changed out in accordance with manufacturer's recommendations.

CHAPTER 3 Guide for Certification of Base-Mounted Manriding Winches

SECTION 6 Surveys

1 Initial and Retesting Surveys

During the Initial Survey, the original proof testing and examination shall be conducted as required below and the test conditions and results shall be included in the Register of Lifting Appliances. See 2-8/1.

At intervals of five years, in addition to the requirements of the Annual Survey in 3-6/3 below, the crane is to undergo testing and examination as follows.

Testing of the winch is to be carried out to the satisfaction of the attending Surveyor. The following test loads are to be used for the initial and retesting surveys:

<i>Test</i>	<i>Test Load</i>
Static Load Testing of the Winch	125% of SWL
Functional Load Testing of the Winch	100% of SWL
Brake Testing	100% of SWL
Emergency Load Lowering Test	100% of SWL

The Initial and Retesting Surveys should also include the following:

- Verify operation of secondary brake
- Operate the emergency means of lowering the load
- All position levers should be labeled to indicate their function.

Upon satisfactory Initial Survey and load test the Manriding Winch is to be entered into the ABS Register of Lifting Appliances.

3 Annual Surveys

After undergoing the original test and examination required by 3-6/3, each manriding winch is required to undergo an Annual Survey at intervals of 12 months. The Annual Survey should include the following:

- Inspection of the wire rope for damage/broken wires.
- Check the winch foundation and securing arrangement (nuts and bolts).
- Verify that all safety guards and shields are in place and that any limiting functions are operational (as fit).
- Verify that the winch is permanently marked with the Safe Working Load (SWL).
- Pneumatic winches should include a noise reduction device at the air outlet.
- Verify that the piping on the inlet airline includes: isolation valve, pressure regulator and water/separator filter.
- Verify that the control levers for the winch control systems will return to the neutral position automatically upon release.

CHAPTER **3** **Guide for Certification of Base-Mounted Manriding Winches**

SECTION **7** **Register of Lifting Appliances**

1 **General**

All applicable requirements of Section 2-8 of this Guide are to be complied with.

CHAPTER 4 **Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels**

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CHAPTER 4 Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels

SECTION 1 General

1 Scope (1 July 2016)

This Guide provides requirements for the certification of self-unloading cargo gear on vessels classed with the ABS for services on the Great Lakes.

Where the cargo gear has been reviewed and surveyed for compliance with the applicable requirements, and ABS Register of Cargo Gear will be issued as evidence of compliance with these requirements.

These requirements do not apply to conveyors, elevators and other equipment used to transfer cargo to the conveyor boom.

3 Definitions

3.1 Cargo Gear

3.1.1 Conveyor Boom

The structure, which supports a conveyor belt or similar device by means of which bulk cargo is discharged.

3.1.2 Supporting Structure

The “A”-frames, elevator casings, saddles and other supporting structures to which may be attached such tackle or other device as is employed to lift, swing or otherwise position the boom defined above.

3.1.3 Auxiliary Devices

The devices employed in luffing, slewing or otherwise positioning the boom including actuators and their piping to the power units, winches and spreaders.

3.1.4 Loose Gear

Hook, ring, shackle, link, sling, lifting beam, lifting frame or any similar article of equipment by means of which a force can be transmitted to a cargo gear and which does not form an integral part of the appliance or load.

3.3 Safe Working Load of Components

The *Safe Working Load, SWL*, on which the design or any component part of the cargo gear is to be based is to be taken as the maximum resultant load upon the component for the design conditions assumed.

3.5 Working Load of Assembled Gear

The *Working Load of Assembled Gear* is the load which each complete assembly is approved to lift excluding the weight of the gear itself (i.e., the load on the conveyor). This load is the safe working load, SWL, which is to appear on the certificate of Cargo Gear Test, (see 4-5/7.11) and is to be expressed in kilogram force (pound) per running meter (foot) together with total in metric ton (long ton).

3.7 Ton

Ton means a metric ton of 1000 kgf or a long ton of 2240 lbf.

CHAPTER 4 **Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels**

SECTION 2 **Structural Requirements for New Cargo Gear**

1 General

The requirements in this Section apply to new cargo gear. For the initial certification of existing cargo gear, the requirements in 4-5/9 are to be complied with.

3 Plans

3.1 Design Plans

General arrangement and design plans showing a complete design with sizes, sections and the relative locations of the various members, together with rigging details, is to be submitted for approval.

They are to indicate the type or types of construction to be employed, and they are to be supplemented by stress analysis and load diagrams and by such data concerning the assumed loads, shears, moments and axial forces to be resisted by all members and their connections as may be required for a complete review of the design. The physical and chemical specifications for the materials to be used are to be indicated.

Where computers are used for the determination of stresses the input and output data, in a form which can be readily interpreted, may be submitted in lieu of stress analysis calculations.

3.3 Other Plans

Plans showing joint details, the location, type and size of all rivets, bolts and welds, are to be submitted for approval, unless all such information is included on the design plans.

3.5 Arrangement Diagram

A sketch showing the arrangement, working load of the assembled gear and indicating the approved safe working load for each component part, is to be submitted for approval and a copy inserted in the Register of Cargo Gear. See 4-1/3.3 and 4-1/3.5. Where concentrated loads are expected (i.e., in way of wash boxes, chutes, etc.) these loads are to be indicated on the diagram.

The sketch is to include a section through the conveyor boom showing the geometry of the conveyor and the volume per unit length for a range of material heights on the belt. The sketch should also show the loaded length of the boom belt.

5 Design Criteria

5.1 Standards

All cargo gear metal structural parts are to be designed with consideration being given to the provisions of 4-2/5.3, 4-2/5.5 and 4-2/5.7, as appropriate, and are to be in accordance with recognized standards listed below which are to be identified on the plans submitted for approval and in the accompanying calculations. In the application of these standards, consideration will be given to the ratio of yield point to ultimate strength of the material.

For steels having a yield point not in excess of 70 kgf/mm² (100,000 psi) the yield point for design purposes is not to be considered greater than 72% of the ultimate strength. Steels having yield points in excess of 70 kgf/mm² (100,000 psi) and aluminum alloys will be specially considered.

Design criteria such as is published in the following specifications, as they are appropriate, taken in association with suitable design assumptions as outlined in 4-2/5.3 of this Guide will be considered as “recognized standards” mentioned earlier.

- i) *Specification for Structural Steel Building – Allowable Stress Design and Plastic Design*, Part 5, dated June 1, 1989 with commentary, published by American Institute of Steel Construction, Inc.
- ii) *Specifications for Aluminum Structures* (Construction Manual Series, Section 1), 1986 published by The Aluminum Association.
- iii) *Welding Handbook* latest edition, published by the American Welding Society.

5.3 Loads

The structural components of cargo gear are to be proportioned for the following loads and forces, the assumptions for which are to be indicated as required by 4-2/5.1.

5.3.1 Dead Load

The minimum dead load to be assumed in design is to consist of the weight of the structural parts and all material permanently fastened thereto or supported thereby.

5.3.2 Live Load

The minimum live load to be assumed in design is to be based on the cross sectional area of a loaded belt assuming the maximum density of material to be handled and is to be expressed in pounds or tons per running foot.

5.3.3 Impact Load

A minimum amount of 15% of the live load is to be assumed as a part of the impact load for the entire length of the boom. In addition to this load, for the non-cantilever section of the boom, a minimum amount of 5% of the applicable dead load and for the cantilever section of the boom, a minimum amount of 10% of the applicable dead load is to be assumed as a part of the impact load.

5.3.4 Longitudinal Forces

In the design of the boom structure, provision is to be made for longitudinal forces resulting from the conveyor belt pull or other pieces of machinery capable of inducing such forces.

5.3.5 Wind Forces

It is recommended that a minimum wind velocity of 27 m/sec (60 mph) be considered as a design assumption with due regard being given to the shape of the sections used in construction.

5.3.6 Lateral Forces on the Boom Structure

It is recommended that a minimum list of 2 degrees of the vessel be considered as a design assumption.

5.3.7 Ice

The additional loads as the result of icing are to be specially considered where it is specified as a design condition.

Maximum possible forces due to a combination of the appropriate loads listed above are to be used in determining the sizes of structural members.

5.5 Factors of Safety

Unless otherwise specified by the provisions of this Guide, the following safety factors are to be used:

- For chains 4.5
- For running wire rope 3.5
- For fixed wire rope 3.0
- For fiber rope
 - When intended for running rigging 7.0
 - When intended for fixed gear and vangs 5.0

5.7 Stowage Arrangement

The basic loads to be taken into account in the calculations of the saddle and supporting structure for the stowage of the self-unloading boom while in transit are as follows: Static gravitational forces, dynamic forces associated with ship motions (roll, pitch and heave), wind forces and ice.

The wind force when stowed is to be based on a 45 m/sec (100 mph) wind.

The saddle and supporting structure for the stowed self-unloading boom is to be designed to withstand the worst anticipated loading. Due consideration is to be given in selecting the location of the saddle for boom stowage.

7 Materials

7.1 General

Structural materials used in the construction of the conveyor boom, supporting structure and auxiliary devices are to be in accordance with the approved drawings and are to be certified by the producing mill as to the chemical and mechanical test results. Material is to be clearly identified by the steel manufacturer with the specification, grade and heat number and the identification maintained to the satisfaction of the attending Surveyor.

Forgings and castings forming a part of the boom or those structures for controlling or supporting the boom are to be manufactured and tested in accordance with the *ABS Rules for Building and Classing Marine Vessels*.

7.3 Steel

The steel is to be made by one or more of the following processes: open-hearth, basic oxygen, electric-furnace, or such other processes as may be specially approved. The mechanical properties and weldability characteristics of the steels are to be equivalent to those of the American Bureau of Shipping Structural Grade Steels and are to be in accordance with the specification of a recognized society. Other steels may be specially considered.

7.5 Aluminum

Aluminum used in the construction of conveyor booms and associated parts is generally to be of the 5000 series of aluminum alloys for welded construction. Other alloys of aluminum will be specially considered.

Welding of alloy 6061-T6 will be acceptable provided that welding and heat treatment are in accordance with 2-5-A1/1.1 and Section 2-5-4, respectively, of the *ABS Rules for Materials and Welding (Part 2) – Aluminum and Fiber Reinforced Plastics (FRP)*.

CHAPTER 4 Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels

SECTION 3 Loose Gear, Wire Ropes and Chains

1 Loose Gear Test

1.1 Proof Test

1.1.1 Test Load

All chains, rings, hooks, links, shackles, swivels and blocks of cargo gear are to be tested with a proof load at least equal to that shown against the article in the following table:

<i>Article of Gear</i>	<i>Proof Load</i>
Chain, ring, hook, link shackle or swivel	100% in excess of the safe working load
Pulley blocks:	
Single sheave block	300% in excess of the safe working load (See Note)
Multiple sheave block with safe working load up to and including 20 tons	100% in excess of the safe working load
Multiple sheave block with safe working load over 20 tons up to and including 40 tons	20 tons in excess of the safe working load
Multiple sheaves block with safe working load over 40 tons	50% in excess of the safe working load

Note:

The safe working load of a single sheave block is to be the maximum load which can safely be lifted by the block when the load is attached to a rope which passes around the sheave of the block.

In the case of a single-sheave block where the load is attached directly to the block instead of to a rope passing around the sheave, it is permissible to lift a load equal to twice the safe working load of the block as defined in this note.

1.1.2 Examination

After being tested, all the gear is to be examined, the sheaves and the pins of the pulley blocks being removed for the purpose, to see whether any part has been injured or permanently deformed by the test.

1.3 Certificate

Articles of loose gear are to have a certificate furnished by the manufacturer or recognized testing facilities. The certificate is to show the distinguishing number or mark applied to the article of gear, description of particular article of gear, kind of material, carbon content, date of test, proof of load applied and safe working load and it is to be attached to the Register of Cargo Gear required by 4-7/3.3. The safe working load, SWL, is to be marked on the blocks.

1.5 Special Lifting Devices

Special lifting devices and components built into cranes or hoisting machinery, the designs of which are submitted for approval, need not be considered loose gear for the purpose of certification. They are, however, to be tested and examined with the gear as a unit, as required by 4-5/7.

3 Wire Rope and Chain

3.1 Wire Rope Test

All wire rope of cargo gear is to have a certificate of test furnished by the manufacturer or recognized testing facilities showing that the breaking test of a sample is at least $3\frac{1}{2}$ times the safe working load for running ropes and at least 3 times the safe working load for fixed ropes.

If the above certificate is not available, an ABS Surveyor may witness the wire rope tests and issue the certificates.

3.3 Certificate

Above certificate is also to show size of rope in inches, number of strands, number of wires per strand, grade of wires and date of test and is to be attached to the Register of Cargo Gear required by 4-7/3.3.

3.5 Splicing of Wire Rope

A thimble or loop splice made in any wire rope is to have at least three (3) tucks with a whole strand of the rope and two (2) tucks with one-half of the wires cut out of each strand, provided that this requirement does not prevent the use of another form of splice which can be shown to be as efficient as that laid down in this Paragraph.

3.7 Condition of Wire Rope

No wire rope is to be used if in any length of eight (8) diameters, the total number of visible broken wires exceeds 10% of the total number of wires, or if the rope shows signs of excessive wear, corrosion, or other defects which render it unfit for use.

CHAPTER 4 Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels

SECTION 4 Pressure Vessels, Piping and Electrical Systems for New Cargo Gear

1 General

The requirements in this Section apply to new cargo gear. For the initial certification of existing cargo gear, the requirements in 4-5/9 are to be complied with.

Pressure vessels, cylinders, slewing gear, piping and electrical systems in luffing and slewing systems for self-unloading cargo gear are subject to design review and survey during installation for compliance with these requirements. In addition, these pressure vessels, cylinders and gears are also subject to survey during manufacture unless they form part of an independently manufactured and assembled unit that is surveyed during manufacturing.

3 Plans to be Submitted (2011)

The following plans are to be submitted and approved before proceeding with fabrication. Plans should generally be submitted electronically to ABS. However, hard copies will also be accepted.

- General arrangement showing equipment location.
- Detailed diagrammatic plans of piping system. Hydraulic systems which form part of a standardized unit which is independently manufactured and certified and assembled need only identify the type and material of valves and fittings. For all other piping systems (shipyard installed), the plan is also to be accompanied by lists of size, wall thickness, maximum working pressure and material of all pipes and the type, size, pressure rating design basis (ANSI, JIS, etc.) and material of valves and fittings. Rating of pumps is also to be included.
- Detailed diagrammatic plans of electrical wiring systems including complete feeder lists, type of wire or cable, rating or setting of circuit breakers, rating of fuses and switches, interrupting capacity of circuit breakers and fuses. Rating information of motors is also to be included.
- Details of controls, alarms and instrumentation arrangements
- Details of pressure vessels, accumulators and fluid power cylinders and attachment details.
- Slewing gear details including dimensional details, gear tooth geometry and full material specifications.

5 Design Acceptance Criteria

5.1 General

Items defined in 4-4/1 are to be designed, constructed and tested to the requirements contained in this Section and the applicable Sections of the *ABS Rules for Building and Classing Marine Vessels*, as indicated below. Systems which are shown to be designed, constructed and tested to other recognized standards or codes of practice (such as ANSI, ASME, IEEE, IEC, etc.) may be accepted on that basis, provided the alternative standard is not less effective than the ABS requirements.

7 Manufacture and Installation

Pressure vessels, cylinders and slewing gear covered under 4-4/1 are to be manufactured, and installed to the satisfaction of the Surveyor in accordance with approved plans and the following. Materials are to be certified by the mill and such certification verified by the Surveyor at his discretion.

9 Pressure Vessels

Pressure vessels under the scope of this Section are to comply with Part 4, Chapter 4 of the *ABS Rules for Building and Classing Marine Vessels*, except that material testing may be in accordance with 4-4/7 of this Guide.

11 Luffing and Slewing Gear

11.1 Cylinders

Luffing and slewing cylinders are to comply with 4-6-7/3.5.5 of the *ABS Rules for Building and Classing Marine Vessels*. The cylinder connections are to comply with a recognized standard. All nuts are to be positively locked. Where nuts are pre-stressed for locking purpose, a safety factor of 2.0 against loosening is to be attained without exceeding 90% of the yield strength of the material.

11.3 Slewing Gear

Slewing gear is to be designed in accordance with a recognized standard, such as AGMA.

13 Hydraulic Piping

13.1 General

Hydraulic piping systems in luffing and slewing systems are to comply with 4-6-7/3 of the *ABS Rules for Building and Classing Marine Vessels*. The pumps of the unit are to be provided with arrangements to prevent rotating of an inoperative pump in the opposite direction or with automatic arrangements for securing the flow through the inoperative pump.

13.3 Pipe Installation

The passage of self-unloader system hydraulic pipes through cargo holds and tanks is to be limited to only that which is necessary for operational purposes. Pipes installed within cargo holds and tanks are to be protected from mechanical damage. System connection to other hydraulic systems is subject to special consideration.

Failure in any one part of the self-unloading hydraulic system is not to cause the failure of other parts of the self-unloading system or of other vessel's systems.

13.5 Hydrostatic Testing

The hydraulic piping is to be tested in accordance with 4-6-2/7.3.3 of the *ABS Rules for Building and Classing Marine Vessels*.

15 Electrical

Electrical equipment in luffing and slewing systems is to be designed, manufactured, installed and tested in accordance with Part 4, Chapter 8 of the *ABS Rules for Building and Classing Marine Vessels*.

17 Hazardous Locations

Machinery, all electrical power, control and safety devices and wiring installed in locations where a flammable atmosphere is expected to exist (as may occur in spaces for coal or grain) are to be suitable for operation in Class II (combustible dust) hazardous (classified) locations as defined in NEC (500.5).

Where essential for operation purposes, internal combustion engines may be installed in hazardous areas and such installation will be subject to special consideration. In all instances, exhaust outlets are to be outside of all hazardous areas and air intakes are to be not less than 3 m (10 ft) from hazardous areas.

19 Fail-safe Arrangements and Safety Devices

Fail-safe arrangements and safety devices of approved types are to be provided on the luffing and slewing equipment. A system is considered fail-safe if a component failure or loss of power supply will result in a controlled securing of the equipment or control of movement so as not to endanger personnel.

21 Controls and Alarms

21.1 General

Controls are to be provided for the safe operation of the cargo gear. These controls are to be clearly marked to show their functions. Energizing the power unit at a location other than cargo control station is not to set the gear in motion.

Where remote controls are provided for the cargo gear operation, these are also to be arranged for local operation. Control systems and monitoring systems are also to be arranged for local operation. Control systems and monitoring systems are to be independent of any other systems and, when hydraulic, are to be supplied with fluid from their own tanks.

21.3 Monitors

As appropriate, monitoring is to indicate system operating status (operating or not operating), availability of power, overload alarm, air pressure, electrical power or current, motor running and motor overload and brake mechanism engagement.

21.5 Remote Shutdowns

Remote shutdowns are to be provided outside of the power unit space so that they may be stopped in the event of fire or other emergency.

CHAPTER 4 **Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels**

SECTION 5 **Tests and Surveys for Initial Certification**

1 General

The requirements in 4-5/3 through 4-5/7 apply to the initial certification of all cargo gears except as modified by 4-5/9 for existing cargo gear.

3 Survey During Manufacture

Certification of conveyor boom, supporting structure and auxiliary devices as defined in 4-1/3.1 is to be subject to survey by the Surveyor at the plants of the manufacturer of component parts.

In-plant surveys of the cargo gear are required to the extent necessary for the Surveyor to determine that the details, materials, welding and workmanship are acceptable to ABS and are in accordance with the approved drawings. It is the responsibility of the primary contractor to inform the Surveyor prior to the commencement of construction, of the location of any and all sub-contractors so that the necessary surveys at the various sub-contractors may be properly carried out.

The Surveyor is to be furnished with all material test certificates. Machining and assembly of important forgings and castings are to be witnessed and reported on by the attending Surveyor.

Modifications or repairs (welding, metal spraying, weld build-up, etc.) are to be reviewed and approved by the attending Surveyor prior to commencing work and examined upon completion.

5 Manufacturer's Quality Assurance

The Surveyor is to satisfy himself that the manufacturer, including subcontractors, of the items mentioned in 4-5/3 can, through an established and well maintained quality control, comply with all ABS requirements, including material verification, fabrication, workmanship and nondestructive testing in the production.

This will include verification by the Surveyor of at least the following items:

- i) Manufacturer's inspections are performed at appropriate stages of fabrication by a skilled inspector to an acceptable extent.
- ii) Welding procedures and welder's qualification are fully documented.
- iii) Procedures for nondestructive testing are adequate with qualified personnel.
- iv) Procedures and facilities for required heat treatment are adequate.
- v) Other items deemed necessary by the Surveyor.

7 Initial Test of the Gear as a Unit

7.1 Load Test

After installation and before the cargo gear is placed in service, it is to be tested to a load equal to 125% of the working load of the assembled gear. The boom is to be positioned during the test to both the minimum operating angle and to an angle equal to the maximum operating angle or 10 degrees above the horizontal, whichever is less. After being tested as aforesaid, all of the cargo gear with the whole of the gear accessory thereto, and all chains, rings, hooks, links, shackles, swivels, pulley blocks or other loose gear are to be visually examined in place to see whether any part has been damaged or permanently deformed by the test.

If any damage or deformed condition is noted, further examination and rectification is to be effected to the satisfaction of the attending Surveyor. A means of access is to be provided to facilitate the required examinations.

Surveys are to be conducted during daylight hours unless adequate artificial lighting is provided.

7.3 Operation Test

The boom is to be luffed and slewed from side-to-side without load to the limits shown on the approved plans and the leads of all cables are to be observed to ensure lack of interference with any structure. The conveying system is to be demonstrated under load.

7.5 Source of Electric Power

Power for operation of the luffing and slewing equipment during the test is to be taken through the vessel's cables. Shore power may be used when supplied through the main switchboard.

7.7 Brakes and Fail-Safe Devices

The operation of all brakes and fail-safe devices are to be demonstrated under simulated loss of power conditions to the satisfaction of the Surveyor. A test memorandum is to be prepared outlining the cautions and procedures for proper testing of the devices.

7.9 Marking of Assembled Gear

The maximum and minimum angles to the horizontal for which the gear is designed to operate are to be indicated by markings at the boom pivot.

7.11 Record of Cargo Gear Test

A copy of the certificate of cargo gear test issued by the Surveyor is to be attached to the Register of Cargo Gear required by 4-7/3.3.

7.13 Measuring Gauge

A means is to be provided for measuring the height of the material on the belt during tests together with a means of access to facilitate the required measurements. See 4-2/3.5.

7.15 Special Installations – Shuttle Booms and Cement Unloading Booms

Testing procedures for special installations such as shuttle booms and cement unloading booms are to be submitted for approval for each of those vessels having such gear, to ensure compliance with the intent of these requirements.

9 Existing Cargo Gear

9.1 Existing Cargo Gear with Recognized Register

For cargo gear having a Register issued by a recognized organization, evidence of previous design approval will be required. Suitable evidence of the design approval would be drawings of the arrangement and drawings of the arrangement and details which bear an approval stamp, or are specifically covered by an approval letter from the authority issuing the previous Register. An ABS Register of Cargo Gear may be issued after review of above data and a test and examination in accordance with the requirements of 4-6/1.3.

9.3 Existing Cargo Gear without Recognized Register

For existing cargo gear that do not have a Register issued by a recognized classification society, or a recognized cargo gear organization, submission of information as noted in 4-2/3 with verification of material, will be required. Existing cargo gear may be certified subject to satisfactory plan review. general

examination, operation test including luffing, slewing, test of safety devices and proof testing of the cargo gear as a unit as required by 4-5/7. The general examination shall include visual inspection for excessive wear, damage, corrosion and fractures. Nondestructive testing or verification of material may be required at the discretion of the Surveyor. The boom slewing and luffing gear are to be examined as deemed necessary by the attending Surveyor.

CHAPTER 4 Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels

SECTION 6 Surveys After Initial Certification

1 Periodical Surveys

Should the Surveyor find occasion during any survey to recommend repairs or further examination, notification is to be given immediately to the Owner or his representative in order that appropriate action may be taken.

1.1 Annual Surveys

1.1.1 General

After undergoing the original test and inspection as required by 4-5/7 or 4-5/9, the cargo gear is to be surveyed annually by the Surveyor.

1.1.2 Survey Details

The following parts are to be visually examined in place at each Annual Survey. Dismantling of the gear may be required where damaged or deformed condition is noted.

- i) Boom slewing tackle blocks, shackles, padeyes, rings, tables, cable connections, etc.
- ii) Boom slewing and luffing cables.
- iii) Boom slewing and luffing winches.
- iv) Boom structure, "A"-frame and other supporting structures to which may be attached such tackle or other device as is employed to luff, swing or otherwise position the boom.
- v) Gear for securing boom in stowed position.
- vi) Slewing and luffing equipment including safety devices and limit switches.
- vii) Valves, cocks, pipes, strainers and cylinders.

1.1.3 Access

Means of access are to be provided to facilitate the required examination.

1.1.4 Certification

Where any gear is dismantled for inspection as required by 4-6/1.1.2 or for other repairs, a report will be furnished by the Surveyor covering the surveys carried out which is to be attached to the Register of Cargo Gear as required by 4-7/3.3.

1.3 Retesting Surveys

1.3.1 General

The first Retesting Survey of new installations is to be due five (5) years from date of original installation, and subsequent Retesting Surveys at intervals of five (5) years thereafter.

1.3.2 Load Test

Before the Retesting Survey is credited, the application of a test load of at least equal to 110% of the design safe working load of the assembled gear is required. Where a test load less than 110% of the design safe working load is applied, the boom will be certified for the corresponding safe working load. A general, careful examination of all accessible parts of the assembled gear is to be carried out after the load test. Where damaged or deformed condition is noted, parts are to be further examined to determine the condition of the affected parts.

1.3.3 Close-up Examination

At each Retesting Survey, in addition to the requirements of the Annual Survey, a close-up examination of all self-unloading structure, luffing structural connections, multiple sheave blocks, spreaders, hydraulic cylinders and all other load bearing parts is to be carried out prior to crediting the Retesting Survey. Suitable safe means of access are to be provided to facilitate this close-up examination. Any load-carrying parts that display indications of damage or deformation shall be further examined as deemed necessary by the attending Surveyor.

Close-up is defined as being approximately within arm's length of the item being examined.

The close-up examination of self-unloading structures may be carried out not more than three (3) months before or after the load test. This time span will facilitate both the requirements of close-up examination and availability of suitable load test material.

Hydraulic cylinders are to be examined under operating conditions. Associated relief and pressure control valves are to be proved operable.

1.3.4 Certification

A certificate of survey is to be furnished upon completion of Retesting Survey and is to be attached to the Register of Cargo Gear as required by 4-7/3.3.

1.3.5 Visibility

Surveys are to be conducted during daylight hours unless adequate artificial lighting is provided.

1.3.6 Year of Grace

Where the vessel has been granted a Year of Grace to complete the Classification Special Periodical and Continuous Surveys, the Cargo Gear Retesting Survey may also be granted a Year of Grace provided an examination of the gear at least equivalent to that of an Annual Survey (4-6/1.1) finds the gear satisfactory and a review of the record shows no history of problems with the gear.

The Year of Grace would extend for one year from the expiration date of the vessel's existing Retesting Survey Certificate and the survey can be carried out a maximum of three months before the Retesting Survey due date or at the time of the Classification Year of Grace Survey.

This provision applies to vessels classed **Great Lakes** or **Great Lakes & St. Lawrence River Service** only.

3 Monthly Inspection by Vessel's Personnel

A monthly inspection of the cargo gear is to be made by members of the vessel's personnel as designated by the Master and a record kept of the findings of the inspection and the repairs and renewals resulting from this inspection. This record is to be in or kept with the cargo gear register.

5 Repairs

5.1 General

Renewal or damage to the conveyor boom, supporting structure or auxiliary devices which affects or may affect certification, is to be submitted by the Owners or their representatives for examination by the Surveyor.

5.3 Conveyor Boom, Supporting Structure and Auxiliary Devices

When repairs or renewals are required to be made to the booms, "A"-frames and other supporting structure, permanent fittings of cargo gear and hydraulic cylinders, the repairs are to be carried out to the

satisfaction of the Surveyor. A certificate of survey is to be furnished and is to be attached to the Register of Cargo Gear as required by 4-7/3.3.

For major repairs, test and examination of particular cargo gear as may be deemed necessary are to be carried out in accordance with 4-5/7.

For minor repairs, test and examination are to be carried out in accordance with 4-5/7 except that the test load may be equal to 110% of the working load of the assembled gear. A minor repair is defined as repairs to bent boom struts or diagonal members, cracked welds, replacement of pins or normal overhaul of existing hydraulic cylinders.

5.5 Repairs to Loose Gear

When welding is used to lengthen, alter or repair items of loose gear, they are to be properly heat treated and before being again put in use, are to be adequately tested and examined in accordance with 4-3/1.1 and certificates are to be furnished. The certificates are to be attached to the Register of Cargo Gear required by 4-7/3.3.

5.7 Plans

Where major modification to the original design is involved, plans and other data as required by 4-2/3 are to be submitted for approval prior to the commencement of the work.

7 Additions to Cargo Gear

When articles of loose gear and wire rope conforming with tests in accordance with 4-3/1 and 4-3/3 are supplied from time to time, the vessel's officer designated by the Master is to enter and initial such replacements in the record noted in 4-7/5 kept with the Register of Cargo Gear required by 4-7/3.3, identifying each article and certificate of same. Certificates, where required, are to be placed in the Register of Cargo Gear.

CHAPTER 4 **Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels**

SECTION 7 **Register of Cargo Gear**

1 Certificates

1.1 Certificates Issued by the Surveyor

Certificates in the prescribed forms and containing the prescribed particulars with regard to the tests, examinations and surveys in 4-5/7, 4-5/9, 4-6/1.1, 4-6/1.3 and 4-6/5.3 are to be issued by the Surveyor and attached to the Register of Cargo Gear as required by 4-7/3.3.

1.3 Other Certificates

Certificates covering the loose gear test (4-3/1.1), wire rope test (4-3/3.1), repairs to loose gear (4-6/5.5) and additions to cargo gear (4-6/7) are to be supplied by the manufacturers or the Surveyor on Form CHG-4 G.L., Form CHG-5 G.L. or Form CHG-7 G.L., as the case may be. These forms are substantially those recommended by the International Labor Office and forms essentially in accordance therewith will also be accepted.

3 Register of Cargo Gear

3.1 Issuance

When all necessary certificates and records are obtained, the self-unloading cargo gear is installed aboard the vessel and proof testing is carried out to the satisfaction of the Surveyor, the Register of Cargo Gear and initial endorsement will be issued.

3.3 Availability

Every vessel is to carry a Register of Cargo Gear, which is to be open to inspection by proper authority and available for endorsement by the Surveyor at the time of periodical inspections. See 4-6/1.1 and 4-6/1.3. In it are to be kept the particulars of periodical inspections and attached to it are to be copies of certificated covering original tests to cargo gear and repairs and additions to cargo gear as required in 4-3/1.3, 4-3/3.3, 4-5/7.11, 4-6/5.5 and 4-6/7.

5 Other Records

A record is also to be kept which is to show particulars of all overhauls and replacements to cargo gear.

CHAPTER 5 Guide for Certification of Shipboard Elevators

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CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 1 General

1 Scope (1 July 2016)

This Guide provides requirements for the certification of shipboard elevators on vessels classed with ABS. The requirements contained herein are applicable to personnel and passenger elevators of the traction and winding drum type driven by electric or hydraulic motors. They apply also (with modifications as noted) to elevators of the direct-plunger hydraulic type, roped hydraulic type and rack-and-pinion type. They do not apply to lifts for the vertical movement of cargo or to other devices such as dumbwaiters, all of which are subject to special consideration. Personnel and passenger elevators certified in accordance with the requirements of this Guide may be used to transport vessel's stores and equipment.

3 Submission of Design Plans and Data (2011)

Plans, specifications and design data are to be submitted for approval as indicated below:

- Rated load, rated speed and operating conditions.
- Hoistway construction and arrangement details including size and location of structural members, machine beams, buffer supports, guide rails and brackets, etc., together with a load diagram indicating magnitude, direction and point application of loads incident to elevator installations. Also, details of openings, doors and fire integrity of enclosure.
- Car construction details including entrances and doors, guides and net inside platform area.
- Counterweight construction details.
- Details of driving machines, brakes and buffers.
- Wire rope data (as indicated in 5-4/21.9).
- Electric power installation details including traction or hoisting motors, motor generator sets, controls, wiring and protective devices.
- Details of lighting, alarms, controls, interlocks, safety devices, communication systems and ventilation.
- Hydraulic and control piping system details, including cylinders, pumps and hydraulic motors as required for hydraulic installations.
- Arrangements for emergency operations, including means of escape, manual control and operation of car and counterweight safeties.
- Ventilation arrangements for the elevator car and hoistway.

Plans should generally be submitted electronically to ABS. However, hard copies will also be accepted.

5 Design Criteria

5.1 Operating Conditions

Elevators, together with ancillary equipment and controls, are to be capable of satisfactory operation with the vessel in motion under the following conditions inherent to the installation location:

- i) Continuous vibrations: 2 mm (0.08 in.) peak to peak of frequency 0 to 25 Hz
±10 degrees, period 10 seconds
- ii) Rolling: ±5 degrees, period 7 seconds
- iii) Pitching: period 10 seconds, calculated by the formula:
- iv) Heaving amplitude, A :

$$A = 3.8 - 0.01(L - 250) \text{ m}$$

$$A = 12.5 - 0.01(L - 820) \text{ ft}$$

where L is the length of the vessel in m (ft). See 5-2/21. The heaving amplitude, A , need not be taken to be greater than 3.8 m (12.5 ft).

The manufacturer is to certify the maximum conditions of roll and pitch for which the elevator can remain in operation, and when these limits are exceeded, the elevator is not to be operated. In addition to the operational limits noted above, the elevator and ancillary equipment are to be capable of sustaining without damage (in the out-of-service condition) ship motions as follows.

- i) Rolling: ±30 degrees, period 10 seconds
- ii) Pitching: ±10 degrees, period 7 seconds

5.3 Control Systems

Control systems are to be designed to operate satisfactorily under conditions of vibration, voltage regulation and frequency variation present in the vessel (see Part 4, Chapter 9 of the *Marine Vessel Rules*).

5.5 Corrosion Resistance

All equipment is to be designed to withstand corrosion conditions inherent in the marine environment.

5.7 Rated Speed

Generally, rated speeds for elevators are not to exceed 60 m (200 ft) per minute. Rated speeds for elevators of the winding drum type are not to exceed 30 m (100 ft) per minute (see 5-4/19.3). Other types of elevators having rated speeds in excess of 60 m (200 ft) per minute will be subject to special consideration.

5.9 Rated Load

Rated load for elevators is the lifting capacity and is to be based on the inside net platform area. The rated load is to be not less than shown in the following table.

<i>Inside Net Platform Area</i>		<i>Rated Load</i>		
m^2	ft^2	N	kgf	lbf
0.65	7.0	2250	230	500
0.77	8.3	2 650	270	600
0.89	9.6	3150	320	700
1.23	13.3	4400	450	1000
1.45	15.6	5400	550	1200
1.76	18.9	6850	700	1500
2.05	22.1	7850	800	1800
2.25	24.2	8850	900	2000
2.70	29.1	11300	1150	2500
3.13	33.7	13250	1350	3000

<i>Inside Net Platform Area</i>		<i>Rated Load</i>		
<i>m²</i>	<i>ft²</i>	<i>N</i>	<i>kgf</i>	<i>lbf</i>
3.53	38.0	15700	1600	3500
3.92	42.2	17650	1800	4000
4.29	46.2	19600	2000	4500
4.65	50.0	22050	2250	5000

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 2 Definitions

The following definitions of terms are to be understood (in the absence of other specifications) where they are used in this Guide.

1 Buffer

A *Buffer* is a device designed to stop a descending car or counterweight beyond its normal limit of travel by storing or absorbing and dissipating the kinetic energy of the car or counterweight. A spring buffer utilizes one or more springs to cushion the impact force of the descending car or counterweight. An oil buffer uses oil as a medium to absorb and dissipate the kinetic energy of the car or counterweight.

3 Car

An *Elevator Car* is the load-carrying unit including its platform, car frame, enclosure and car door.

5 Driving Machine

A *Driving Machine* is the power unit which applies the energy necessary to raise and lower an elevator.

5.1 Traction Driving Machine

A *Traction Machine* is a direct-drive machine in which the motion of the car is obtained through friction between the suspension ropes and a traction sheave.

5.3 Winding Drum Driving Machine

A *Winding Drum Machine* is a gear-drive machine in which the suspension ropes are fastened to wind on a drum.

5.5 Hydraulic Driving Machine

A *Hydraulic Machine* is one in which energy is applied by means of a liquid under pressure in a cylinder equipped with a plunger or piston.

5.5.1 Direct-plunger Hydraulic Driving Machine

A *Direct-plunger Hydraulic Machine* is a hydraulic driving machine in which the plunger or cylinder is directly attached to the car frame or platform.

5.5.2 Roped Hydraulic Driving Machine

A *Roped Hydraulic Machine* is a hydraulic driving machine in which the plunger or piston is connected to the car by means of wire ropes or indirectly coupled to the car by means of wire ropes and sheaves.

5.7 Rack-and-Pinion Driving Machine

A *Rack-and-Pinion Machine* is an electric driving machine in which the motion of the car is obtained by power driving pinion(s) mounted on the car, traveling on a stationary rack mounted in the hoistway.

7 Elevator

As used herein, the term *Elevator* denotes lifting equipment for the vertical transportation of crew, passengers, visitors or others having business with the vessel, as well as vessel's stores and equipment (provided the load rating is not exceeded), which is permanently installed in the vessel, serves defined

landing levels and comprises an enclosed car running between rigid guides, the dimensions and means of construction of which permit access of persons.

9 Factor of Safety

Factor of Safety is the ratio of ultimate strength to the working stress of a member under maximum static loading.

11 Governor

A *Speed Governor* is a continuously operating speed monitoring and detection device which, at predetermined speeds, provides signals to the controller and imparts a retarding force to activate the car or counterweight safety.

13 Hatch

A *Hatch* is a horizontally or vertically positioned door in the trunk or roof of the car.

15 Headroom

The hoistway *Headroom* is the clear space between the top of the car, at its highest landing, and the overhead structure in the hoistway.

17 Hoistway

A *Hoistway* is an opening through a structure for the travel of elevators, extending from the pit floor to the roof or floor above. The hoistway enclosure is the fixed structure consisting of vertical walls or partitions, which isolates the hoistway from all other areas or from an adjacent hoistway and in which the hoistway doors and door assemblies are assembled.

19 Landing

An *Elevator Landing* is the portion of a deck or platform used to receive and discharge persons. The bottom terminal landing is the lowest landing served by the elevator. The top terminal landing is the highest landing served by the elevator.

21 Length (of Vessel)

The *Length of the Vessel*, for the purpose of this Guide, is the length, in meters (feet), measured between perpendiculars taken at the extremities of the deepest subdivision load line.

23 Lift

Elevator, see 5-2/7.

25 Passenger

A *Passenger* is every person other than the Master and members of the crew or other persons employed or engaged in any capacity onboard a vessel for the business of that vessel.

27 Pit

The *Elevator Pit* is the portion of the hoistway extending from the sill level of the lowest landing to the floor at the bottom of the hoistway.

29 Rated Load

Rated Load is the load which the elevator is designed and installed to lift at the rated speed.

31 Rated Speed

Rated Speed is the speed at which the elevator is designed to operate in the upward position with rated load in the car.

33 Rope

A *Suspension (Hoisting) Rope* is the wire rope used to raise and lower an elevator car or its counterweight, or both. A compensating rope is a wire rope used to counterbalance, or partially counterbalance, the weight of the suspension ropes.

35 Safety

A *Car or Counterweight Safety* is a mechanical device attached to the car frame or to the counterweight frame, to stop and hold the car or counterweight under conditions of overspeed, free-fall or slackening of the suspension ropes.

37 Stroke (of Buffer)

Spring Buffer Stroke is the distance the contact end of the spring can move under a compressive load until all coils are essentially in contact with each other or until a fixed stop is reached. Oil buffer stroke is the oil-displacing movement of the buffer plunger or piston.

39 Travel

Travel is the vertical distance between the bottom terminal landing and the top terminal landing.

41 Traveling Cable

A *Traveling Cable* is made up of electrical conductors which provide electrical connection between an elevator and a fixed outlet in the hoistway or machine room.

43 Trunk

Hoistway, see 5-2/17.

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 3 Materials

1 Material Standards (1 July 2016)

Materials intended for use in the construction of elevators are to be manufactured and tested in accordance with 2-3 of this Guide.

3 Gray Cast Iron

Gray cast iron is not to be used for parts subject to tension or shear including machinery or equipment supports, worms, gears, shafts or any parts of the machinery which are in motion. Gray cast iron is not to be used in the construction of car frames, platforms or safeties. Ductile (nodular) iron conforming to the requirements of Chapter 3 of the *ABS Rules for Materials and Welding (Part 2)* may, in general, be used without limitation.

5 Non-combustible Materials

All materials used in the construction of the hoistway, car frame and car and machine room (see 5-4/17) are to be incombustible except that material of low flame spread may be used for decorative trim within the car.

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 4 Construction

1 Hoistway

1.1 General

Each elevator is to operate in a hoistway (trunk) entirely enclosed over all its height by means of a solid steel enclosure and complying with the following requirements.

1.3 Strength of Enclosure

The hoistway enclosure is to be of sufficient strength to prevent contact between the enclosure and the car or counterweight when the enclosure is subjected to a force of 1112 N (113 kgf, 250 lbf) applied at right angles at any point over an area of 102 mm (4 in.) by 102 mm (4 in.).

1.5 Fire Protection

1.5.1 Passenger Vessels

For passenger vessels, the fire integrity of the hoistway enclosure is to be in accordance with Chapter II-2, Part A, Regulation 2 or Part C, Regulation 9 of the International Convention for the Safety of Life at Sea (SOLAS) 1974 and Amendments in force, as applicable. The hoistway is also to comply with Chapter II-2, Regulation 13.

1.5.2 Cargo Vessels

For cargo vessels, including tankers, the fire integrity of the hoistway enclosure is to be in accordance with Chapter II-2, Part A, Regulation 2 or Part C, Regulation 9 of the International Convention for the Safety of Life at Sea (SOLAS) 1974 and Amendments in force, as applicable. The hoistway is also to comply with Chapter II-2, Regulation 13.

1.5.3 Mobile Offshore Drilling Units

For mobile offshore drilling units, the fire integrity of the hoistway enclosure is to be in accordance with 5-1-1/3 of the *ABS Rules for Building and Classing Mobile Offshore Units*. The hoistway is also to comply with 5-1-1/5.5 of the *ABS Rules for Building and Classing Mobile Offshore Units*.

1.7 Elevators Traveling within a Single Compartment

Hoistways for elevators which serve one or more grating levels and which pierce no solid decks (as for engine rooms, cargo holds or pump rooms) may be of the open type, suitably enclosed with wire mesh or expanded metal having openings the maximum of 25 mm (1 in.).

Elevators in atriums on passenger vessels serving multiple decks may be of an open type.

1.9 Multiple Elevators in Single Hoistway

Where two or more elevators are fitted in one hoistway, the car and counterweight of each elevator is to be separated from those of other elevators by means of sheet steel, which need not be fire rated, over the full height of the hoistway. Wire mesh is not permitted for this purpose.

1.11 Bottom and Top Car Clearance

When the car is resting on its fully compressed buffers, the free distance between the pit floor and the underneath of the car floor is to be at least 600 mm (24 in.).

For traction lifts, when the counterweight is resting on its fully compressed buffers or, for positive drive lifts, when the car is stopped at its highest possible position, the free distance above the roof of the car is to be at least 750 mm (29.5 in.). Additionally, an unobstructed area of not less than 0.5 m² (5.4 ft²) is to be provided at the top of the enclosure for refuge space. This space is to measure not less than 600 mm (24 in.) on any side and have a height of no less than 1100 mm (43 in.) when the car has reached its maximum upward movement.

1.13 Openings in Hoistway

Openings in hoistway bulkheads are to be protected by doors of like construction and fire-resistive rating as the bulkheads.

1.15 Protection Against Flooding

Hoistway enclosures are to be constructed and located so as to prevent the entrance of water and hoistway doors are not to be exposed to the open deck.

1.17 Ventilation

The hoistway is not to be used as part of the ventilation ducting for the vessel, but it is to be ventilated by an independent system complying with 5-7/5.1.

1.19 Escape Ladder

The hoistway is to be fitted with a fixed ladder or pole steps over its entire height, giving access to landing doors and to the escape hatch, if any, in the headroom (see 5-4/13.3 and 5-5/17.3).

1.21 Equipment Permitted in Hoistway

Only equipment which forms part of the elevator installation is to be permitted on the interior of the hoistway enclosure.

1.23 Traveling Cables

Traveling cables inside the hoistway are to be protected against damage by an internal smooth metal trough, the width of which is to permit passage of the free hanging loop of the traveling cable and which is to be provided with a slot having round edges, permitting the free passage of the cables coming from the elevator car. See also 5-6/7.

3 Guide Rails

3.1 General

Elevators are to be provided with car guide rails and counterweight guide rails (where counterweights are fitted) which are to extend so that guiding members cannot travel beyond the ends of the guide rails with the car in extreme positions of travel.

3.3 Materials

Guide rails, brackets, rail clips, fishplates and their fastenings are to be of steel construction.

3.5 Spacing of Brackets

Guide rail brackets, suitably supported, are to be provided and are to be spaced not more than 2.4 m (8 ft) apart.

3.7 Strength and Deflection

Car and counterweight rails are to be capable of withstanding loads resulting from operation of the car or counterweight safeties (see 5-4/9) under test conditions, or from loads imposed by motion of the vessel as

described in 5-1/5.1, without permanent deformation. Deflection of car and counterweight guide rails is not to exceed 3 mm (0.12 in.) for operation under the conditions outlined in 5-1/5.1.

5 Hoistway Doors

5.1 General (2018)

Hoistway doors are to be of the single or multiple double panel, horizontal sliding type or single section swinging type, and may be either manually or power operated. They are to be guided top and bottom and are to completely close the hoistway opening. Other types of hoistway doors (i.e., vertical sliding, combination) will be considered provided the design and installation is not less effective.

5.3 Restraint Systems

Doors are to be provided with restraint systems so that they will be held closed or held open (as the case may be) against maximum motion of the vessel specified in 5-1/5.1.

5.5 Opening of Hoistway Doors

Doors are to be openable from the hoistway interior without special tools. They are to be openable from the landing side only by a special key.

5.7 Closing of Hoistway Doors

Doors are to be arranged to close automatically if the car leaves the landing for any reason. Doors are to be interlocked with the control system to prevent operation of the car unless the doors are closed. See 5-5/3.

5.9 Vision Panels (2018)

Each manually operated or self-closing door of the sliding type is to be provided with a vision panel of clear wire inserted glass not less than 6 mm (0.25 in.) thick having an area not less than 0.015 m², (24 in²) except at landings of automatic elevators where a hall position indicator is provided. Swinging doors are to be provided with vision panels. Alternatively, an indication is to be provided at each landing to show when the car is at the landing and the door is to be interlocked with the control system to prevent opening of the door between landings, in lieu of providing the vision panel to the swinging doors. The total area of vision panels in any hoistway door is not to be greater than 0.055 m² (80 in²).

5.11 Size of Hoistway Entrances

The clear opening of each hoistway entrance is to be not less than 800 mm (31.5 in.) wide and 2030 mm (80 in.) high.

5.13 Escape Doors

In general, an emergency escape door is to be provided at every third deck, but not more than 11 m (36 ft) apart from sill-to-sill. Emergency or access doors for inspection and maintenance may be horizontal swinging type, in which case they are to open outward. All such doors are to be of steel construction and are to be interlocked with the elevator control system to prevent operation of the elevator unless they are in the closed position. See 5-5/3. For elevators of the direct-plunger hydraulic type, emergency doors are required only when car safeties are provided.

5.15 Location of Hoistway Entrances (2018)

Hoistway doors are not to be located with direct access to machinery spaces of category A, except as noted below, or hazardous areas. See 5-9 for hazardous areas.

Alternatively, direct access to machinery spaces of category A is acceptable in cargo vessels provided the following requirements are complied with:

- i) All other requirements of 5-4 are to be complied with.

- ii) The elevator hoistway and the engine room are to be separated by bulkheads and doors insulated to A-60 class standard.
- iii) Hoistway doors opening into the machinery spaces of category A are to be self-closing and to be of A-60 steel construction.
- iv) The arrangement of the elevator trunk is to be in compliance with Chapter II-2/Regulation 9 of the SOLAS as amended.

5.17 Illumination at Entrances

For lighting requirements, see 5-6/3.7.

5.19 Flooring

Deck areas at entrances to elevators are to be slip resistant.

7 Car Frame and Enclosure

7.1 General

Car frames, platforms and enclosures are to be of steel construction designed to withstand forces resulting from rated loads and from motion of the vessel as outlined in 5-1/5.1.

Materials other than steel may be considered for elevators for the compartments as specified in 5-4/1.7. The arrangement and details are to be submitted for review.

7.3 Guides

Car frames are to be guided on each guide rail by upper and lower guide shoes or rollers attached to the frame. Guide shoes or rollers are to be of a proven design modified and reinforced as necessary to provide for loading resulting from motion of the vessel.

Cars are also to be fitted with a guidance medium independent of the normal guide shoes or rollers. This may be achieved by an independently fixed steel plate which will locate onto the guide rails in the event of primary guidance failure. Where the rail and guidance system are arranged such that the guide rails will not become disengaged under the worst case operating and static conditions, a secondary guidance system will not be required.

7.5 Car Platforms

Car platforms and enclosures are to be non-perforated, properly stiffened and attached to the car frame.

7.7 Car Doors

Car doors are to be of the single or double panel, horizontal sliding type of a construction similar to that specified for hoistway doors in 5-4/5, including restraint systems and interlocks, but excluding the requirements for fire resistive rating. Vision panels are not required, but if provided, they are to comply with 5-4/5.9. Other types of closures will be subject to special consideration. Each power operated door is to be fitted with a protective device on each leaf which will reopen the car door and the hoistway door in the event of obstruction. This device is to extend for the full length of the door.

7.9 Escape Hatch

An escape hatch is to be provided in the overhead of the elevator car. The escape hatch is to have an area of at least 0.26 m² (400 in²) and is to measure not less than 400 mm (16 in.) on any side. Also refer to 5-5/17.9.

7.11 Ventilation

For ventilation requirements, see 5-7/5.3.

7.13 Illumination of Cars

For lighting requirements, see 5-6/3.1.

7.15 Handrails

Handrails are to be provided around the interior of the car except in way of the entrance.

7.17 Flooring

Cars are to be provided with slip resistant flooring.

9 Car Safety

9.1 General

A car safety is required for each car that is suspended by wire ropes and the safety is to be mounted on the car frame. A car safety is also required for each rack-and-pinion elevator (see 5-4/9.13).

9.3 Operation of Safeties

Safeties are to operate on overspeed, free-fall or slackening of the suspension ropes. They are to act by applying pressure on the guide rails and are to be applied mechanically. Electric, hydraulic or pneumatic devices are not to be used to apply safeties nor to hold safeties in a retracted position.

9.5 Release of Safeties

Safeties are to be released only by upward movement of the car.

9.7 Stopping Distances and Governor Tripping Speeds

Stopping distances and governor tripping speeds are to be in accordance with the following table:

<i>Rated Speed</i>		<i>Maximum Governor Trip Speed</i>		<i>Maximum Stopping Distance</i>	
<i>m per minute</i>	<i>ft per minute</i>	<i>m per minute</i>	<i>ft per minute</i>	<i>mm</i>	<i>in.</i>
38 or less	125 or less	54	175	380	15
45	150	63	210	406	16
52	175	75	250	483	19
60	200	84	280	559	22

9.9 Marking Plates

A metal plate is to be attached to each safety indicating the maximum tripping speed for which the safety may be used and the maximum weight for which the safety is designed and installed to stop and sustain.

9.11 Car Safeties for Direct-Plunger Hydraulic Elevators

When car safeties are provided, they are to comply with 5-4/9.3 through 5-4/9.9.

9.13 Car Safeties for Rack-and-Pinion Elevators

Elevators of the rack-and-pinion type are to be provided with a safety complying with 5-4/9.3 through 5-4/9.9 or with a rack-and-pinion safety. Rack-and-pinion safeties are safeties in which a freely rotating pinion travels on a stationary rack mounted vertically on the hoist structure. The rotating pinion drives the governor. When the speed of the car reaches the tripping value, the rotating governor actuates the safety. Stopping distances and governor tripping speeds for rack-and-pinion safeties are to be in accordance with the following table:

<i>Rated Speed</i>		<i>Maximum Governor Trip Speed</i>		<i>Maximum Stopping Distance</i>	
<i>m per minute</i>	<i>ft per minute</i>	<i>m per minute</i>	<i>ft per minute</i>	<i>mm</i>	<i>in.</i>
37.8 or less	125 or less	52.8	175	1639	64.54
45.6	150	63.6	210	1704	67.07
53.4	175	82.2	250	1791	70.52
60.6	200	85.2	280	1867	73.50

11 Counterweights

11.1 General

Counterweights for traction elevators are to be provided with rigid steel frames so designed as to retain the filler weights securely in place. Concrete fillers in counterweights are not permitted.

11.3 Guides

Counterweight frames are to be provided with primary and secondary guides similar to those specified for car frames (see 5-4/7.3).

11.5 Counterweight Safety

A safety similar in operation to those specified for elevator cars (see 5-4/9) is to be provided and mounted on the frame of each counterweight.

11.7 Counterweight Runways

Counterweight runways are to be guarded within the pit area by wire mesh enclosures with removable panels for access and inspection.

13 Elevator Pit and Headroom

13.1 General

The headroom and pit are to permit a person in the hoistway to be protected when the car is at its highest or lowest position.

13.3 Depth of Pit

The depth of the pit is to be sufficient for installation of and access to all elevator accessories located therein and to allow for run by of the elevator car and compression of buffers.

13.5 Access to Pit

Access to the pit may be from the lowest hoistway door or a separate access door may be provided. Where a separate access door is provided, it is to be self-closing with a spring type lock arranged to permit the door to be opened from inside the pit without a key. Such doors are to be normally locked from the outside and are to open outward unless they do not interfere with moving equipment within the pit when opened inward.

13.7 Strength of Pit Base

The base of the pit is to be designed for an imposed load of not less than 5000 N/m² (510 kgf/m², 105 lbf/ft²).

13.9 Illumination of Pit

Each pit is to be provided with a permanent lighting fixture. See 5-6/3.9.

13.11 Stop Switch in Pit

There is to be provided in the pit of each elevator a manually operated enclosed switch. When opened, this switch is to cause the electric power to be removed from the driving machine and brake. The switch is to be accessible from the pit access door.

13.13 Headroom Escape Hatch

For elevators reserved for the crew, the headroom of the hoistway is to be provided with an escape hatch with an area of at least 0.26 m² (400 in²) and is to measure not less than 400 mm (16 in.) on any side. Also see 5-5/17.7.

15 Buffers

15.1 General

Buffers of spring, oil or other approved types are to be installed under all elevator cars and counterweights and are to be mounted on a suitable structure of the vessel.

15.3 Spring Buffers

15.3.1 Stroke

The stroke of the buffer spring is to be in accordance with the following:

<i>Rated Car Speed</i>		<i>Minimum Stroke</i>	
<i>m per minute</i>	<i>ft per minute</i>	<i>mm</i>	<i>in.</i>
30 or less	100 or less	38	1.5
30.6 to 45	101 to 150	63	2.5
45.6 to 60	151 to 200	100	4.0

15.3.2 Load Rating

Buffers for cars and counterweights are to be capable of supporting, without being compressed solid or to a fixed stop, a static load of a minimum of two times the total weight of the car plus its rated load for car buffers or the counterweight for counterweight buffers. Buffers are to be compressed solid or to a fixed stop with a static load of three times the total weight of the car plus its rated load for car buffers or the counterweight for counterweight buffers.

15.3.3 Marking Plates

Each spring buffer is to be provided with a marking plate indicating its load rating and stroke and the number of springs.

15.5 Oil Buffers

15.5.1 Stroke

The minimum stroke for oil buffers is to be such that the car or counterweight, on striking the buffer at 115% of the rated speed, will be brought to rest with an average retardation of not more than 9.81 m/s² (32.2 ft/s²). Peak retardation is not to exceed 24.5 m/s² (80.5 ft/s²).

15.5.2 Load Rating

The minimum load rating is to be not greater than the total weight of the car plus 686 N (70 kgf, 154 lbf) for car oil buffers or the weight of the counterweight for counterweight oil buffers. The maximum load rating is to be not less than the total weight of the car plus the rated load for car oil buffers or the weight of the counterweight for counterweight oil buffers.

15.5.3 Marking Plates

Each oil buffer is to be provided with a marking plate indicating the maximum and minimum loads and maximum striking speeds for which the buffer may be used and the stroke of the buffer.

15.7 Buffers for Direct-Plunger Hydraulic Elevators

Elevators of the direct-plunger hydraulic type are to be provided with car buffers complying with 5-4/15.1 through 5-4/15.5, except that where oil buffers are used, the minimum stroke of the buffer is to be such that the car, on striking the buffer at 115% of the maximum speed in the downward direction, will be brought to rest with an average retardation of not more than 9.81 m/s^2 (32.2 ft/s^2). Car buffers are to be located so that the car will come to rest on the fully compressed buffers or fixed stop before the plunger reaches its downward limit of travel.

17 Machine Room

A machine room is to be provided to accommodate the driving machine and other equipment and controls necessary for operation of the elevator. The machine room is to be of steel construction with a permanent and safe means of access and provided with permanent lighting (see 5-6/3.3). Only equipment directly associated with the operation of the elevator is to be located in the machine room.

19 Driving Machines

19.1 Traction Driving Machines

Driving machines of the traction type may be driven by electric or hydraulic motors and are to have a rated speed not exceeding 60 m (200 ft) per minute. Traction drive elevators are to be fitted with a device to cause the elevator to stop and keep it stopped in the event that a start is initiated but the lift does not rotate, or the car (or counterweight) is stopped in downward movement by an obstacle which causes the ropes to slip on the driving sheave. The device is to function within a time not to exceed the lesser of 45 seconds or the time for traveling the full travel plus 10 seconds, with a minimum of 20 seconds if the full travel time is less than 10 seconds. The device is not to affect operation from the top inspection station or electric recall operation, if any.

19.3 Winding Drum Driving Machines

Driving machines of the winding drum type may be driven by electric or hydraulic motors and be used for limited service applications such as access to cargo holds, pump rooms, etc., for rated loads not exceeding 5480 N (550 kgf, 1200 lbf). They are not to be used for transport of passengers. Winding drum machines are not to be fitted with counterweights and are restricted to a rated speed not exceeding 15 m (50 ft) per minute and a travel not exceeding 12.5 m (40 ft). Winding drum machines are to have positive means of removing power from the machine in the event of over-travel. See also 5-5/7.

19.5 Hydraulic Driving Machines (Direct-Plunger and Roped Hydraulic)

Power units and equipment for direct-plunger hydraulic type and roped hydraulic type elevators are to comply with 4-6-7/3 of the *Marine Vessel Rules* or other relevant standard, provided it is not less effective. The hydraulic system is to be provided with an automatic check valve which will hold the car with rated load at any point when the pump stops or the maintained pressure drops below the minimum operating pressure. In addition, a manually operated valve which permits lowering the car at a speed not exceeding 6.0 m (20 ft) per minute is to be provided and is to be located in an easily accessible area.

For roped-hydraulic elevators, the ratio of driving machine speed to car speed is not to exceed 1:2. See also 5-5/7.

19.7 Rack-and-Pinion Driving Machines

Rack-and-pinion driving machines are to consist of one or more power-driven rotating pinions mounted on the car and arranged to travel on a stationary rack mounted on the supporting structure. The drive is to

have at least one pinion, one rack and two backup rollers, which act on the same section of rack as the drive pinion. The rack and pinion are to be designed in accordance with a recognized standard such as AGMA or ISO.

19.9 Driving Machine Brakes

Each driving machine is to be equipped with a spring or gravity-applied friction brake capable of holding the rated load plus 25% in excess of the rated load. The brake is to be released by application of electric or hydraulic power (as the case may be) to the driving machine.

19.11 Manual Operation

Driving machines are to be provided with a manual means of operation, allowing the car to be moved to the nearest landing in the event of a power failure. This is to be done by having the end of the drive shaft arranged to receive a hand crank or by other suitable means. The manual effort to move the car is not to exceed 400 N (41 kgf, 90 lbf). A metal plate with instructions for operation of the device is to be permanently mounted in the elevator machine room.

19.13 Factors of Safety for Driving Machines and Sheaves

The factors of safety, based on the ultimate strength of the material, to be used in the design of the driving machines and in the design of sheaves used with suspension and compensating ropes are to be not less than the following:

- i) 8 for steel, bronze or other metals having an elongation of at least 14% in a length of 50 mm (2 in.)
- ii) 10 for cast iron or other metals having an elongation of less than 14% in a length of 50 mm (2 in.)

The load to be used to determine the factor of safety is the total weight of the elevator plus the rated load.

19.15 Diameter of Sheaves

Sheaves and drums are to have a pitch diameter of not less than 40 times the diameter of the rope where used with suspension ropes and 32 times the diameter of the ropes where used with compensating ropes.

19.17 Other Arrangements

Hoisting arrangements other than those noted above will be subject to special consideration.

21 Hoisting Ropes

21.1 General

Hoisting ropes are to be of steel wire and are to be certified by the manufacturer that they are suitable for elevator service.

21.3 Number of Ropes

The minimum number of hoisting ropes to be used for traction type elevators is three. The minimum number of hoisting ropes to be used for winding drum elevators and for roped hydraulic elevators is two.

21.5 Diameter of Ropes (1 October 2018)

Minimum diameter for hoisting ropes is to be 8 mm (0.315 in.). Outer wires of ropes are to be not less than 0.48 mm (0.019 in.) in diameter.

21.7 Factor of Safety (1 October 2018)

The minimum factor of safety for hoisting ropes is to be in accordance with the following table, except that the factor of safety of steel wire hoisting ropes with diameters equal to or greater than 8 mm (0.315 in.) but less than 9.5 mm (0.375 in.) is to be not less than 12:

Rope Speed		Minimum Factor of Safety
<i>m per minute</i>	<i>ft per minute</i>	
15.2	50	7.60
22.2	75	7.75
30.0	100	7.97
37.2	125	8.10
45.0	150	8.25
52.2	175	8.40
60.0	200	8.60

The factor of safety is to be calculated by the following formula:

$$f = \frac{S \times N}{W}$$

where

- N = number of wire rope parts (runs) supporting the local load
- S = manufacturer's rated breaking force of one wire rope, in kN (lbf)
- W = maximum static load, in kN (lbf), imposed on all suspension members with the car and its rated load at any position in the hoistway

21.9 Wire Rope Data

A data plate is to be attached to the car frame with the following information:

- Number of ropes
- Diameter, in mm (in.)
- Manufacturer's rated breaking strength per rope, in kN (kg, lb)

A data tag is to be provided for each set of ropes with the following information:

- Diameter, in mm (in.)
- Type, (grade of material, construction classification)
- Month and year of installation
- Name of rope manufacturer

The tag is to be secured to one of the wire rope fastenings, and a new tag is to be installed at each renewal of wire ropes.

21.11 Repair and Replacement of Ropes

Hoisting ropes are not to be repaired or lengthened by splicing. When replacement of one or more of the hoisting ropes is required, the entire set is to be replaced.

21.13 Ropes for Winding Drum Machines

Winding drum type elevators are to have at least two full turns of hoisting rope on the drum when the car is resting on its fully compressed buffers.

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 5 Operation and Control

1 Control System

1.1 Normal Terminal Stopping Devices

A system for control and operation of the elevator is to be arranged to automatically slow down and stop the car at the uppermost and lowest landing and to prevent operation past these points.

1.3 Final Terminal Stopping Device

Limit switches or other mechanically operated devices are to be provided and arranged to remove power from the driving machine and brake in the event that the car travels beyond the uppermost or lowest landing. Such devices are to function independently of the normal terminal stopping devices. Where spring buffers are provided, the device is to function before the buffer is engaged. Final terminal stopping devices are not required for elevators of the hydraulic type.

1.5 Computer-based Control Systems (1 July 2016)

Where fitted, computer-based control systems for personnel elevators are to comply with the requirements of Section 4-9-3 (and the sections referenced therein) of the *Marine Vessel Rules*, as applicable, for Category II Systems in accordance with 4-9-3/7.1 TABLE 1.

3 Interlocks

All hoistway doors, access and emergency openings, elevator car doors and car escape hatches are to be interlocked with the control system to prevent operation of the elevator unless all such units are in the closed position.

5 Top-of-Car Operating Device

Means are to be provided to operate the elevator from on top of the car during adjustment, inspection, maintenance and repair. The operating means are to be of the continuous-pressure type, capable of operating the car at a speed not exceeding 45.7 m (150 ft) per minute, and arranged so that when operative, movement of the car is to be solely under the control of this device. The means for transferring control of the elevator to the top-of-car operating device is to be located on the car top and is to be of the manually closed type and be positively opened mechanically.

7 Slack Rope Switch

Winding drum machines are to be provided with a slack rope switch of the manually reset type which will remove power from the driving machine and brake in the event the hoisting ropes become slack. Roped hydraulic elevators are to be provided with a similar slack rope switch which will remove power from the pump motor and control valves in the event any rope becomes slack.

9 Stop Switches

An emergency stop switch is to be provided in each elevator car. Operation of this device is to cause power to be removed from the driving machine and brake. Stop switches are also to be provided on top of every elevator and in every elevator pit (see 5-4/13.11).

11 Phase-reversal and Failure Protection

For elevators with polyphase alternating current power supply, means are to be provided to prevent operation in the event of incorrect phase rotation or failure of any phase.

13 Release and Application of Driving Machine Brakes

Driving machine brakes are not to be electrically released until power has been applied to the driving machine motor. All power feed lines to the brake are to be opened and the brake is to apply automatically when the operating device of a car-switch or continuous-pressure elevator is in the stop position, a floor stop device functions, or any of the electrical protective devices functions.

15 Indicators

A light is to be provided at each landing to indicate when the elevator car is in use. Additionally, sufficiently visible notices or signals are to be provided to permit persons in the car to know at which landing the elevator has stopped.

17 Means of Escape

17.1 General

In case of emergency, it is to be possible to rescue vessel's passengers from the elevator car. The vessel's crew is to be able to escape from the elevator car and hoistway by their own resources.

17.3 Hoistway Escape Ladder

A vertical steel ladder is to be permanently installed for the full height of each hoistway and is to be so arranged as to give access to the hoistway escape doors required by 5-4/5.13. This ladder is to be accessible also from the escape hatch of the car required by 5-4/7.9.

17.5 Car Escape Ladder

A ladder is to be provided for entering the car through the emergency hatch in the car roof (see 5-4/7.9). The ladder is to be kept in a watchkeeping room or a room to which only the vessel's crew has access. For elevators reserved for the crew, a fixed ladder or similar device is to be provided in the car.

17.7 Headroom Escape Hatch

The escape hatch required by 5-4/13.13 in elevators for crew only is to open outward. The opening of the escape hatch is to be possible from the inside without a key. From the outside, opening is to be possible only by means of a special key placed in a box in the immediate vicinity of the hatch accessible in case of emergency (for instance, a break-glass-to-open box), when the exit from the hoistway leads to an area accessible to passengers.

17.9 Car Escape Hatch

The escape hatch required by 5-4/7.9 in cars for passengers is to be fitted with a mechanical latch-type lock with a handle on the outside only. The escape hatch required by 5-4/7.9 in cars for crew only is to be fitted with a mechanical latch-type lock with handles on both inside and outside.

17.11 Safety Circuit (2018)

Opening of the escape hatches referred to in 5-5/17.7 and 5-5/17.9 is to automatically break the safety circuit and thereby cause the car to stop. The safety circuit is to remain broken even when the escape hatch is subsequently closed. Resumption of service is to be possible only after manual resetting of the circuit inside the elevator car from controls in a locked compartment accessible by a key. The key is to be kept in a machine room or other secure location.

17.13 Escape Route Notices

Notices in at least two relevant languages and pictographs describing the escape routing are to be fixed in the following locations:

- i)* Inside the car
- ii)* On the car roof
- iii)* Inside the hoistway, adjacent to every exit
- iv)* In the elevator machine room

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 6 Electrical Power, Lighting and Communication

1 General

Electrical power, lighting and communication systems are to comply with the requirements of IEC Publication 60092 "Electrical Installations in Ships" and, as applicable, Part 4, Chapter 8 of the *Marine Vessel Rules*. The driving machines are to be supplied by circuits which are not subject to load shedding. For passenger vessels, the driving machines are to be supplied by an emergency source of power for a period of half-an-hour to bring the elevator car to deck level for the escape of passengers.

3 Lighting

3.1 Cars

Car illumination is to be provided by not less than two lights. Light intensity at the car floor is to be not less than 54 lux (5 ft-candles). Lighting fixtures are to be shock resistant of a type suitable for elevator service.

3.3 Machine Room

The machine room is to have normal illumination by more than one light to an intensity of not less than 54 lux (5 ft-candles).

3.5 Hoistway

Permanently installed lighting fixtures are to be provided in the hoistway at every escape door (see 5-4/5.13).

3.7 Elevator Landings

Elevator landings are to be illuminated to an intensity of not less than 50 lux (5 ft-candles). In locations where illumination to such an intensity would interfere with the normal working environment of the space (e.g., wheelhouse darkened at nighttime), special consideration will be given to alternate arrangements.

3.9 Pit

The hoistway pit is to be illuminated to an intensity of not less than 100 lux (10 ft-candles) at the pit floor. Light bulbs are to be adequately protected from mechanical damage and the light switch is to be accessible from the pit access door.

5 Emergency Lighting

The car, hoistway and machine room are to be provided with emergency lighting fed from the emergency source of power. In addition, a battery operated emergency light with rechargeable batteries and automatic charger is to be provided in the car. This emergency light is to be capable of providing illumination in the event of failure of the normal and emergency lighting circuits for a period of at least one hour.

7 Traveling Cables

Traveling cables for electrical supply, control and communication to the elevator car are to have a flame retardant and moisture resistant outer cover and are to be of a flexible type constructed to an applicable recognized standard suitable for this service.

9 Communication

9.1 Alarm

An alarm device, which can be activated from the inside of each elevator car and will produce an audible and visual display in a manned control center, is to be provided and is to be independent of the power and control systems.

9.3 Telephone

In all cars, a telephone is to be permanently installed and connected to a permanently manned area. The telephone may be sound powered, battery operated or electrically powered from the emergency source of power and is to be independent of the ship's service electrical power and control circuits.

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 7 Piping and Ventilation

1 Piping

All hydraulic, control and other piping is to comply with the applicable requirements of Part 4, Chapter 6 of the *Marine Vessel Rules*.

3 Hydraulic Oil Storage Tanks

Storage tanks for hydraulic oil are to be constructed in such a manner to prevent spillage of hydraulic oil under the following conditions inherent to the installation location.

- i) Rolling: ± 45 degrees.
- ii) Pitching: ± 10 degrees.

5 Ventilation

5.1 Hoistway

The hoistway is to be ventilated by a mechanical ventilating system capable of providing five air changes per hour based on the gross volume of the hoistway.

5.3 Cars

Elevator cars are to be provided with screened ventilation openings and an electric fan drawing from or exhausting to the hoistway. A switch to shut down the fan is to be provided inside the car.

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 8 Surveys (2016)

1 General

Before being taken into use, all elevators are to have been tested and examined by the elevator manufacturer. The person performing the testing and examination is to be duly authorized by the manufacturer.

The Surveyor will witness tests during In-Plant, Initial, Annual, Retesting and Damage Surveys. The particulars of these tests and examinations are to be made available onboard. See 5-8/1.1.

1.1 On-board Documentation

The details of the elevator construction, diagram of the arrangement of the completed elevator, ratings of the elevator, etc., shall be onboard for the use of the Surveyor. Copies of certificates covering original and replacement wire ropes, original tests to elevators, and tests following repairs to elevators are to be maintained onboard.

The ABS issued Shipboard Elevator Certificate is to be available onboard for endorsement by the Surveyor at the time of periodical surveys.

A record is to be kept onboard the vessel or unit which is to show particulars of all overhauls, inspections, repairs, and replacements carried out by the elevator manufacturer, Owner, or Operator between surveys.

3 In-Plant Surveys and Certification

All elevators are to be surveyed at the elevator manufacturer's plant during construction. In-plant surveys of the elevators during construction are required to the extent necessary for the Surveyor to determine that the details, material, welding and workmanship are acceptable to ABS and are in accordance with the approved drawings.

The Surveyor is to have access to all material test certificates. All in-plant testing of the elevator's structural components or assembled elevators is to be witnessed and reported on by the attending Surveyor.

Upon satisfactory fabrication, the Surveyor may issue a certificate certifying that the elevator and/or its components have been built in accordance with these requirements, the extent of testing witnessed, and showing the model and serial numbers, a description of the elevator, and the date of issue.

5 Initial Survey

New elevators, after completion and before being placed in service, are to be subjected to acceptance tests and inspections on the vessel to determine that the installation conforms to the requirements of this Guide and that all safety equipment functions as required. Acceptance tests are to be witnessed by the Surveyor. In addition to the Annual survey requirements, the following tests are to be included in the test program:

- i) Operational tests with rated load in car:
 - Car safeties
 - Counterweight safeties
 - Governor tripping speed
 - Hoistway, car door interlocks and escape hatch interlocks
 - Function of entire installation including check of car and position indicators

- Manual hoisting
- Emergency terminal stopping and speed limiting
- Power operation of doors
- Leveling zone and leveling speed
- Inner landing zone
- ii) Operational tests with no load
 - Buffers
- iii) Overload tests with 125% of rated load:
 - Braking system
 - Standby or emergency power operation
 - Emergency stopping distance

5.1 Capacity Plate and Data Plate

A capacity plate of engraved metal is to be permanently installed in each elevator car and is to indicate the safe capacity of the car, in N (kgf, lbf), and number of persons.

A data plate of engraved metal is to be permanently mounted on each car frame and is to indicate the following.

- Weight of complete car including safety and all auxiliary equipment attached to car
- Rated load and speed
- Wire rope data as per 5-4/21.9
- Manufacturer's name and date of installation

7 Annual Survey

After undergoing the initial survey and tests per 5-8/5, each elevator is required to undergo an Annual Survey at intervals of 12 months. Annual Survey should include the following:

7.1 All Elevators

Inspection is to be made of the entire installation at this time with particular attention to the following items as applicable:

- i) Hoisting cables
- ii) Braking system
- iii) Safeties
- iv) Telephone and alarm
- v) Emergency and battery lighting
- vi) Escape arrangements
- vii) Guide rails and guide shoes or rollers
- viii) Operational tests with no load of:
 - Car and counterweight safeties
 - Normal and final terminal stopping devices
 - Standby or emergency power operation

- Power operation of door system
- Broken rope, tape, or chain switches.
- ix) Manual operational test of governors with no load
- x) Manual operational test of slack rope devices or winding drum machinery
- xi) Test of firefighters' emergency operation with rated load.

7.3 Hydraulic Elevators

In addition to above requirements for all elevators, the following tests shall be conducted:

- Function test of relief valve setting and system pressure test to <1.5 times working pressure
- Endurance test of cylinders at rated load for 15 minutes.
- Endurance tests of flexible hose and fitting assemblies to relief valve setting pressure for 30 seconds
- Function test of pressure switch at rated load

9 Intermediate Survey at Second or Third Annual Survey (Hydraulic Elevators only)

In addition to the above annual survey requirements, the following shall be conducted:

- Visual examination of unexposed portions of pistons
- Visual examination of pressure vessels at 1.5 times the working pressure rating for 1 minute.

11 Retesting Survey

At intervals of five years, in addition to the requirements of the Annual Survey in 5-8/7 above, the elevator is to undergo testing and examination as noted below.

11.1 All Elevators

- i) Examination of the entire installation is to be conducted with particular attention to the following:
 - Guide rails and guide shoes or rollers
 - Manual operation of oil buffers with no load
- ii) Operational tests with rated load in car:
 - Car safeties
 - Counterweight safeties
 - Governor
 - Emergency terminal stopping and speed limiting devices
 - Power operation of doors
 - Leveling zone and leveling speed
 - Inner landing zone
- iii) Overload tests with 125% of rated load:
 - Braking system
 - Standby or emergency power operation
 - Emergency stopping distance

11.3 Hydraulic Elevators

In addition to above requirements for all elevators the following items are required for hydraulic elevators:

- Visual examination of unexposed portions of pistons
- Visual examination of pressure vessels at 1.5 times the working pressure rating for 1 minute.

13 Repairs and Alterations

Renewal, damage or alterations to the elevator, hoist way, guide rails, doors, elevator car, etc., which affects or may affect certification, is to be submitted by the Owners or their representatives for examination by the Surveyor. When important repairs or renewals are required to be made to the elevator, the repairs are to be carried out under the attendance and to the satisfaction of the Surveyor.

Tests and examination of the elevator may be required following repairs and to the satisfaction of the attending Surveyor.

Reports/certificates covering these tests are to be in the Owner's Overhaul and Inspection record. See also 5-8/1.1.

13.1 Replacement of Wire Rope

Replacement wire rope is to be supplied with manufacturer's certificate conforming to tests in accordance with 5-4/21.1. The wire rope certificates are to be included in the Owner's Overhaul and Inspection record in accordance with 5-8/1.

CHAPTER 5 Guide for Certification of Shipboard Elevators

SECTION 9 Elevators in Hazardous Locations

1 Scope

The provisions of this Section are applicable to elevators installed in cargo pump rooms of oil carriers. They are supplementary to the requirements of Sections 1 through 8. Elevators installed in other hazardous locations will be subject to special consideration.

3 Design Review

Plans and design data supplemental to that required by 5-1/3 are to be submitted for review in accordance with the following list:

- Description of hazardous equipment
- Location of elevator
- Precautions against static discharge or sparking

5 Materials

Impacting metal and metal in rubbing contact, as well as hoisting cables, are to be non-sparking in all cases (i.e., steel to brass or bronze, bronze to bronze, etc.). The use of non-conducting materials is to be restricted to areas where no other material is suitable (gaskets, seals, etc.) and where the extent of the non-conducting material is not deemed to present any danger due to static discharge. The use of aluminum for any purpose is not permitted.

7 Electrical Installation

The electrical installation is subject to special consideration but in general is to comply with the requirements of Part 4, Chapter 8 of the *Marine Vessel Rules*. All conducting materials are to be suitably bonded and grounded to prevent the buildup of potential differences. Special provision is to be made for grounding of hoisting and governor cables. Traveling cables are to have outer conducting sheath or other means for dissipating static charges. Grounding and bonding cables are to be of extra flexible construction, uninsulated and of a size not less than 5.5 mm² (0.009 in²) cross sectional area (No. 10 AWG).

CHAPTER 6 Guide for Certification of Bow, Stern and Sideport Ramps and Moveable Platforms (Decks)

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CHAPTER 6 **Guide for Certification of Bow, Stern and Sideport Ramps and Moveable Platforms (Decks)**

SECTION 1 **General**

1 **Scope (1 July 2016)**

This Guide provides requirements for the certification of stern, bow and sideport ramps and moveable platforms (decks) on vessel classed with ABS.

3 **Submission of Design Plans and Data**

3.1 **Stern, Bow and Sideport Ramps**

Plans, specifications and design data are to be submitted for approval as indicated below:

- Details of ramp loading conditions, including ramp self weight and center of gravity.
- Maximum loading of ramp during the transit of vehicles (i.e., the most adverse vehicle positions), number of vehicles and traffic lanes and axle weight on the ramp at any one instant, including tractor axle loads.
- Any impact loads due to the movement of vehicles.
- Maximum reactions on ramp hinges, suspension stays and on ramp flaps on the quay.
- Any limits to ramp elevation, angle or vessel heel and trim with respect to the quay.
- Calculations and detailed structural drawings.
- Ramp general arrangement, load diagrams and testing plan suitable for insertion in the Register of Lifting Appliances are to be submitted.
- Operations and Maintenance manual.

3.3 **Moveable Platforms (Decks) (2011)**

Plans should generally be submitted electronically to ABS. However, hard copies will also be accepted.

- Details of moveable platform (deck) loading conditions, including moveable platforms (decks) self weight and center of gravity.
- Arrangements and details of supporting/securing means.
- Calculations and detailed structural drawings.
- Moveable platform (deck) general arrangement, load diagrams and testing plan suitable for insertion in the Register of Lifting Appliances.
- Operations and Maintenance manual.

If moveable platforms (decks) are arranged in ro-ro spaces, similar drawings of ramps for vehicle loading are to be submitted.

CHAPTER 6 Guide for Certification of Bow, Stern and Sideport Ramps and Moveable Platforms (Decks)

SECTION 2 Design Criteria

1 General

The strength of ramps and moveable platforms (decks) is to comply with the following design criteria.

3 Stern, Bow and Sideport Ramps (1 July 2016)

Design calculations for the ramp structure are to be submitted in support of the above loading conditions in accordance with:

- i) 3-2-3/5 TABLE 1, Equation C of the *Marine Vessel Rules* for platform decks in enclosed cargo spaces.
- ii) 3-2-3/5.17 of the *Marine Vessel Rules* for forklift trucks.
- iii) 3-2-3/7.1 and 3-2-3/7.3 of the *Marine Vessel Rules* for decks of higher-strength material.
- iv) Manual of the American Institute of Steel Construction, eighth or later edition, Sections 1.5 and 1.6 and other applicable sections.
- v) Where the various strength members are subjected to compressive or shear stresses, the stability of the local plate panels and the supporting members is to be checked against buckling. Calculations, showing that adequate strength has been provided against buckling, are to be submitted for review. For column buckling, see 2-2/5.7, of this Guide.
- vi) For operational conditions, ramps are to be reviewed to the self weight and applied loads multiplied by the submitted corresponding dynamic amplification factors. The dynamic amplification factors need not be verified by ABS through an independent analysis, unless specifically requested by the submitter.

5 Moveable Platforms (Decks)

5.1 Loading

The following loading criteria are to be taken into account:

- i) Assume free end supports for beams and girders unless ends are effectively fixed.
- ii) For uniform cargo loading, use plating thickness required by 3-2-3/5 TABLE 1, Equation C of the *Marine Vessels Rules* for platforms decks in enclosed cargo spaces.
- iii) For vehicles, use plating thickness required by 3-2-15/13.7, 3-2-3/5.17 and 3-2-3/7.3 of the *Marine Vessel Rules* for forklift trucks on hatch covers.
- iv) Use static load and imprint submitted by designer.
- v) Check each member for the worst possible loading condition.
- vi) Dynamic load increases due to rolling, pitching and heaving accelerations are disregarded.
- vii) Special attention is to be paid to supporting details and attachments to ship structure.

5.3 Allowable Stresses

Moveable platforms (decks) are to comply with the following maximum allowable stresses:

<i>i)</i>	Maximum allowable bending stress for beams and girders	14.0 kN/cm ² (1415 kg/cm ² , 20,160 psi).
<i>ii)</i>	Maximum allowable shear stress for beams and girders	10.5 kN/cm ² (1055 kg/cm ² , 15,000 psi).
<i>iii)</i>	Maximum allowable bearing stress for beams and girders	21. 0 kN/cm ² (2150 kg/cm ² , 30,600 psi).
<i>iv)</i>	Maximum allowable resisting tearing failure for beams and girders	12.0 kN/cm ² (1225 kg/cm ² , 17,400 psi).

CHAPTER 6 Guide for Certification of Bow, Stern and Sideport Ramps and Moveable Platforms (Decks)

SECTION 3 Tests for New Construction

1 Loose Gear Test

1.1 Proof Test

1.1.1 Test Load

All chains, rings, links, shackles, swivels and blocks of ramps and moveable platforms (decks), as applicable, are to be tested with a proof load at least equal to that shown against the article in the following table:

<i>Article of Gear</i>	<i>Proof Load ⁽¹⁾</i>
Chain, ring, link shackle or swivel	100% in excess of the safe working load
Single sheave block	300% in excess of the safe working load ⁽²⁾
Multiple sheave block with safe working load up to and including 20 tons	100% in excess of the safe working load
Multiple sheave block with safe working load over 20 tons up to and including 40 tons	20 tons in excess of the safe working load
Multiple sheaves block with safe working load over 40 tons	50% in excess of the safe working load

Notes:

- 1 Alternatively, the proof tests as required in "Code Practice on Safety and Health in Port" may be accepted where the items of gear are manufactured or tested or both and intended for use on vessels under jurisdictions accepting these requirements.
- 2 The safe working load to be marked on a single sheave block is to be the maximum load which can safely be lifted by the block when the load is attached to a rope which passes around the sheave of the block. In the case of a single sheave block where the load is attached directly to the block instead of to a rope passing around the sheave, it is permissible to lift a load equal to twice the marked safe working load of the block as defined in this note.

1.3 Inspection

After being tested, all the gear is to be examined, the sheaves and the pins of the pulley blocks being removed for the purpose, to see whether any part has been injured or permanently deformed by the test.

1.5 Certificates

Articles of gear are to have a certificate furnished by the manufacturer or the surveying authority. The certificate is to show the distinguishing number or mark applied to the article of gear, description of particular article of gear, kind of material, carbon content, date of test, proof load applied and safe working load and is to be attached to the Register of Lifting Appliances (see Section 2-8). The safe working load SWL is to be marked on the blocks.

1.7 Special Components

Blocks of special nature, together with their connecting components, special lifting devices and components built into or hoisting machinery which are specially designed for use with a particular lifting

unit, the designs of which are submitted for approval as steel structural parts, need not be considered loose gear for the purpose of certification. They are, however, to be tested and examined with the gear as a unit, as required by 6-3/5. Appropriate nondestructive methods of examination will be required where visual inspection is considered to be inadequate.

3 Wire Rope Test

All wire rope of lifting devices for ramps and moveable platforms (decks) is to have a certificate of test, furnished by the manufacturer or the surveying authority, showing at least the following breaking test load for sample:

<i>Lifting Capacity in Tons</i>	<i>Breaking Test Load for Sample</i>
10 or less	5 x SWL
13 or more	4 x SWL

For gear with capacities between 10 and 13 tons, intermediate values of factors of safety may be used. This certificate is to show also size of rope, in mm (in.), number of strands, number of wires per strand, quality of wires and date of test and is to be attached to the Register of Lifting Appliances (see Section 2-8).

5 Proof Test to Gear as a Unit

5.1 Test Loads

Before the lifting devices for ramps and moveable platforms (decks) are placed in service, they are to be tested on the vessel to the following proof loads:

<i>Working Load of Assembled Gear in Tons</i>	<i>Proof Load</i>
Up to 20	25% in excess
20-50	5 tons in excess
Over 50	10% in excess

5.3 Testing and Inspection Details

The ramp proof load test and the positioning of the test weights is to be conducted in accordance with the approved test load procedures. Unless otherwise approved, the proof load is to be applied by hoisting the ramp or moveable platform with the moveable testing weight up to the position where the angle of the ramp is horizontal, or for moveable platforms, at least 1 meter (3.3 feet) above the resting position and maintain the position for 5 minutes before putting it back to the resting position. Fixed ramps or movable decks are to be tested in accordance with the approved test load procedures at their angle. After being tested, ramp or movable platform structure, together with any hinged connection points including cantilever hinges (if applicable) and all hydraulic cylinders, chains, rings, links, shackles, swivels, pulley blocks hoisting wires or other loose gear is to be examined to see whether any part has been injured or permanently deformed by the test. All securing, supporting and locking devices are to be examined and tested.

5.5 Portable Ramps

If portable ramps are included as part of the certification, they are to be proof load tested in accordance with the approved test procedures. Where the portable ramp is designed to be attached to the side ramp or stern ramp at ends and/or sides then the portable ramp is to be tested at each location where it may be connected to the ramp(s). Test weights are to be placed on the portable ramp at positions indicated in the approved test load procedures. Unless otherwise approved, the proof load is to be applied for at least five

(5) minutes. Upon completion of testing the portable ramp, portable ramp structure, ramp structure and all hinged and fixed connection points are to be examined to determine if part has been damaged or deformed.

5.7 Source of Electrical Power

Current for electrical winch operation during the test is to be taken through the vessel's cables. Shore current may be used when connected to the main switchboard.

5.9 Braking Requirements

On all types of winches, efficient means are to be provided to stop and hold the load in any position and such means shall be demonstrated. Where electrical winches are fitted with efficient electromagnetic brakes, mechanical brakes for manual operation will not be required, but if fitted, are to be in operating condition.

5.11 Ramp Monitoring Systems

If ramp monitoring/alarm systems are fitted as part of the certification due to the operation of the ramp they are to be calibrated and tested in accordance with the approved test load procedures.

5.13 Marking of Assembled Gear

The Safe Working Load, SWL, for the assembled gear is to be marked on a visible location on the ramp, movable deck or portable ramp in contrasting colors to the background, with minimum angle to the horizontal at which this load may be applied and date of test. Letters and numbers are to be at least 25 mm (1 in.) high.

In addition, if the ramp has been approved for use in specific environmental conditions then these conditions should be noted on the cargo gear certificate.

5.15 Record of Cargo Gear Test

A copy of the certificate of cargo gear test issued by the Surveyor is to be attached to the Register of Lifting Appliances (see Section 2-8).

CHAPTER 6 Guide for Certification of Bow, Stern and Sideport Ramps and Moveable Platforms (Decks)

SECTION 4 Periodical Surveys

1 Annual Inspection

After undergoing the original test and examination required by 6-3/5, every vessel is required to undergo an inspection by the Surveyor at intervals of 12 months, at which time the lifting devices of ramps, moveable platforms (decks) and portable ramps are to be examined, operationally tested including a thorough examination of the gear which does not require to be periodically heat treated, and the certificate of inspection furnished to be attached to Register of Lifting Appliances (see Section 2-8).

The annual survey should include the following:

- i) A close visual inspection of all securing supporting and locking devices of ramps and moveable platforms (decks). If accessible, clearances are to be measured in accordance with manufacturer's Operation and Maintenance manual.
- ii) Close up survey of hinges, bearings and supporting structure. If accessible, bearing clearances are to be measured in accordance with manufacturer's Operation and Maintenance manual.
- iii) Nondestructive testing of hinges, pins and supporting structure in accordance with manufacturer requirements contained in the approved Operation and Maintenance Manual. If the manual contains no specific instructions for NDT, then the attending Surveyor is to recommend random NDT be carried out.
- iv) If corrosion is noted on the ramp, movable platform or portable ramp structures including hinges and supporting structure then thickness measurements are to be taken to determine extent of corrosion and results submitted to an ABS Engineering office for assessment.
- v) Function test of safety protective devices including where applicable ramp monitoring systems.

3 Retesting Survey

At intervals of five years, in addition to the applicable requirements of the Annual Survey in 6-4/1, the lifting devices of ramps, moveable platforms (decks) and portable ramps are to undergo the proof loads and examination stated in 6-3/5 together with removal of pins from hinges, sheaves and pulley blocks for examination including by NDT. Certificate of survey is to be furnished and attached to Register of Lifting Appliances (see Section 2-8).

A close visual inspection together with representative nondestructive testing is to be carried out of securing, supporting and locking devices as well as measurement of clearances.

Where applicable thickness measurements are to be carried out as per the approved Operation and Maintenance Manual.

Attention is called to the Owner that certain Administrations require the Retesting Survey at four year intervals, and ABS is prepared to do such retesting and note it in the Register of Lifting Appliances.

CHAPTER 6 **Guide for Certification of Bow, Stern and Sideport Ramps and Moveable Platforms (Decks)**

SECTION 5 **Maintenance**

1 Repairs

When important repairs or renewals are required to be made to the lifting devices of ramps, moveable platforms (decks) and portable ramps, the repairs are to be carried out under the attendance and to the satisfaction of the Surveyor. Tests and examination of the particular lifting devices as may be deemed necessary are to be carried out in accordance with 6-3/5. Certificates covering tests are to be attached to Register of Lifting Appliances (see Section 2-8).

When welding is used to lengthen, alter or repair chains, rings, links, shackles or swivels, they are to be properly heat treated and are to be adequately tested and examined in accordance with 6-3/1 and certificate furnished before being again put in use. The certificates are to be attached to the Register of Lifting Appliances (see Section 2-8).

3 Addition of New Gear and Wire Rope

When articles of loose gear and wire rope conforming with tests in accordance with 6-3/1 and 6-3/3 are supplied from time to time, the vessel's officer designated by the Master is to enter and initial such replacements in the record noted in Section 2-8 kept with the Register of Lifting Appliances (See Section 2-8), identifying each article and certificate of same.

5 Splicing of Wire Rope

A thimble or loop splice made in any wire rope is to have at least three (3) tucks with a whole strand of the rope and two (2) tucks with one-half of the wires cut out of each strand, provided that this requirement does not prevent the use of another form of splice which can be shown to be as efficient as that required in this Section. Clips for splicing wire rope are not acceptable.

7 Condition of Wire Rope

No wire rope is to be used if in any length of eight (8) diameters, the total number of visible broken wires exceeds 10% of the total number of wires, or if the rope shows signs of excessive wear, corrosion or other defect which renders it unfit for use.

9 Knots in Chain

Chains are not to be shortened by tying knots in them.

11 Annealing of Chains and Connecting Elements

Chains, rings, links, shackles and swivels of wrought iron used in lifting operations are to be annealed at the following intervals.

Chains and gear in general use and of 12.7 mm (0.5 in.) or less, once at least in every six months.

All other chains and gear in general use, once at least every 12 months.

13 Annealing Details

The annealing is to be done in suitable closed oven and not over an open fire. Wrought iron is to be annealed at a temperature of between 593°C to 649°C (1100°F to 1200°F) for a period between 30 and 60 minutes. After being annealed, the article should be allowed to cool slowly.

15 Annealing Certificate

A certificate on prescribed form (see Form CHG-6 in A1-1) is to be furnished by the firm undertaking the annealing, describing gear annealed, which is to be attached to the Register of Lifting Appliances (see Section 2-8).

**APPENDIX 1 Samples of ABS Register of Lifting Appliances,
Register of Cargo Gear and Shipboard Elevator
Certificate (1 July 2016)**

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**APPENDIX 1 Samples of ABS Register of Lifting Appliances,
Register of Cargo Gear and Shipboard Elevator
Certificate (1 July 2016)**

**SECTION 1 American Bureau of Shipping Register of Lifting
Appliances**

Section 1 of the Appendix applies to the latest editions of the “Guide for Certification of Cranes”, “Guide for Certification of Base-Mounted Manriding Winches” and the “Guide for Certification of Stern, Bow and Sideport Ramps and Moveable Platforms (Decks)” (Chapters 2 and 6 of the *ABS Guide for Certification of Lifting Appliances*, respectively), as appropriate.

AMERICAN BUREAU OF SHIPPING



REGISTER OF LIFTING APPLIANCES

SAMPLE ONLY
NOT TO BE USED

NUMBER OF REGISTER BOOK _____

DATE OF ISSUE _____

PORT OF ISSUE _____

NAME OF VESSEL OR OFFSHORE STRUCTURE _____

PORT OF REGISTRY _____

IMO/OFFICIAL NUMBER _____

OWNER _____

ADDRESS _____

This Register when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 or Subchapter I-A and 29 CFR 1918.11.

CHG-1

INSTRUCTIONS

1. **Initial Inspection and Test** – Before being taken into use all cranes, winches, hoists, derrick booms, derrick and mast bands, goose necks, eye bolts, and all other permanent attachments to the derricks, masts and decks, used in hoisting or lowering, are to be proof tested and examined by a competent person.
 - 1.1 Details of Proof Tests and Examinations are to be entered in Part I of this Register
 - 1.2 An appropriate, endorsed Certificate of Test and Examination is to be attached to Part IV of this register.
 - 1.2.1 CHG 2 is to be used for proof test and examination of Winches and Derricks
 - 1.2.2 CHG 3 is to be used for proof test and examination of Cranes or Hoists
2. **All Derricks and Permanent Attachments**, including bridle chains, to the derrick, mast and deck, used in hoisting or lowering, are to be inspected by a competent person once in every 12 months, (functional tests) and proof tested and examined by a competent person once at least in every five years. *
 - 2.1 Details of Annual Inspections and Tests are to be entered in Part II of this Register
 - 2.2 Details of Retesting and Examinations are to be entered in Part I of this Register
 - 2.3 An endorsed Certificate of Test and/or Inspection is to be attached to Part IV of this Register
 - 2.3.1 CHG 7 is to be used to document Inspections
 - 2.3.2 CHG 2 is to be used to document each retesting and examination.
3. **All Cranes, Winches, and Hoists** are to be thoroughly examined by a competent person at least once in every 12 months and proof tested and examined by a competent person at least once in every five years.*
 - 3.1 Details of Annual Inspections and Tests are to be entered in Part II of this Register
 - 3.2 Details of Retesting and Examinations are to be entered in Part I of this Register
 - 3.3 An endorsed Certificate of Test and/or Inspection is to be attached to Part IV of this Register
 - 3.3.1 CHG 7 is to be used to document Inspections
 - 3.3.2 CHG 3 is to be used to document each retesting and examination
4. **Initial Test of Loose Gear** – All chains, rings, hooks, shackles, swivels or pulley blocks used in hoisting or lowering, are to be tested and examined by a competent person before being taken into use. The test and examination is to be documented with CHG 4 and attached to Part IV of this register
5. **Initial Test of Wire Rope** – All Wire Rope is to be tested and examined before being taken into use. The test and examination is to be documented with CHG 5 and attached to Part IV of this register.
6. **Test and Re-examination of Loose Gear after Repair** – All chains, rings, hooks, shackles or swivels used in hoisting or lowering which have been lengthened, altered or repaired by welding shall, before being again taken into use, be adequately tested and re-examined by a competent person. The test and re-examination is to be documented with CHG 4 and attached to Part IV of this register.

7. **Annealing** – Cargo gear used on lifting machinery driven by power, all half-inch (12.5 mm) and smaller chains, rings, hooks, shackles and swivels in general use, if made of wrought iron, shall be annealed under the supervision of a competent person once at least in every 6 months, and all other such cargo gear once at least in every 12 months. In the case of cargo gear used solely on lifting machinery worked by hand the above periods shall be 12 months and 2 years, respectively. The particulars are to be entered in Part III of this register, and the Heat Treatment is to be documented using Form CHG 6 and attached to Part IV of this register.

If the requirement of heat treatment does not apply to chains made of malleable cast iron, and chains, rings, hooks, shackles and swivels made of steel, all such chains, etc., must be thoroughly examined by a competent person once at least in every 12 months, the particulars are to be entered in Part II of this register, and the examination is to be documented using Form CHG 7 and attached to Part IV of this document.

8. **The following classes of gear are exempt from heat treatment** subject to the provision that such gear shall be thoroughly examined by a competent person once at least in every 12 months

Plate link chains; Pitched chains; Rings, hooks, shackles and swivels permanently attached to pitched chains, pulley blocks or weighing machines; Hooks and swivels having ball bearings or other case-hardened parts; Bordeaux connections and gear constructed of steel.

The particulars are to be entered in Part II of this Register, and examination is to be documented using Form CHG 7 and attached to Part IV of this register.

- 9 The Register must be produced on demand of any person authorized for the purpose by the U.S. Department of Labor in accordance with Sec. 1918.12(a) of the Safety and Health Regulations for Longshoring (CFR 29 - Part 1918). The Register should be preserved for at least 5 years after the date of the last entry. Note: "Competent person" is defined on each certificate. On the reverse side of the certificates will be found the particulars of tests pertaining to that Certificate.

*Attention is called to the Owner that certain Administrations require the Retesting Survey at four year intervals, and ABS is prepared to do such testing and note it in the Register of Lifting Appliances.

FORMAT

This Register of Lifting Appliances is issued in compliance with ILO Article 25(2) and Chapter 2 and Chapter 6 of this Guide, and when properly executed endorses and establishes traceability for the Lifting Appliance and accessory equipment through the following documents and sections.

CHG-1 – The Register of Lifting Appliances contains four parts and:

- Provides the Register Number and vessel and owner identification.
- Establishes requirements and Standards Certification is based on.
- Identifies Special Materials with any special weld requirements

CHG 1, Part I, for the Surveyors use to document the:

- Original proof tests and examination
- Retesting proof tests and examinations.
- Examinations and tests associated with repairs

CHG 1, Part II, for the Surveyors use to document the:

- Annual Inspections of cranes and cargo gear.

CHG 1, Part III, documents the:

- Annealing records

CHG 1, Part IV, contains:

- Force Diagrams
- Cargo Gear/Crane Arrangements with applicable marking data
- Certificates of tests and inspections
- Certificates for any replacement gear
- Manufacturer's bolt and torque standards for slew ring bearings
- Approved crane capacity rating chart and corresponding wire rope reeving diagrams
- Manufacturer's procedures for proof-testing of cranes including overriding of limiting devices (where required) to achieve full proof load.

Samples of Cargo Handling Gear (CHG) Forms are as follows:

CHG-2 – Certificate of Test and Examination of winches, derricks and accessory gear; before taken into use, or retesting surveys or tests associated with repairs. *This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11*

Compatible with ILO Form No. 2

CHG-3 – Certificate of Test and Examination of cranes or hoists and their accessory gear; before taken into use, or retesting surveys or tests associated with repairs. *This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11*

Compatible with ILO Form No. 2

CHG-4 – Certificate of Test and Examination of chains, rings, hooks, shackles, swivels and pulley blocks. *This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11*

Compatible with ILO Form No. 3

CHG-5 – Certificate of examination of wire rope before being taken into use. *This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11*

Compatible with ILO Form No. 4

CHG-6 – Certificate of heat treatment of chains, rings, hooks, shackles and swivels which require such treatment. *This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11*

Compatible with ILO Form No. 6

CHG-7 – Certificate of annual through examination of gear that does not require to be periodically heat treated, and for Annual Inspection of cargo gear or cranes. *This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11*

Compatible with ILO Part II

CHG-1

- I. CERTIFICATION IS BASED ON THE FOLLOWING REQUIREMENTS (Standards).
- II. NOTES OF SPECIAL MATERIALS FOR THE PRINCIPAL STRUCTURAL PARTS WITH ANY SPECIAL INFORMATION REGARDING WELDING PROCEDURES
 1. Cargo Gear, Masts, Kingposts or other Supporting Structures:
 2. Crane A-Frame, Mast or Gantry, Swing Circle Assembly Bolts, Crane Pedestal or Tub Structure:
 3. Cargo Gear, Booms, End Fittings, Pins and Gooseneck:
 4. Crane Boom Chords, Lacing Members, End Connections and Pins:

Other Components:

Note: Special materials noted above should be verified by reference to detail drawings prior to undertaking repairs or ordering replacement materials.

NOT TO BE USED

Offshore Structure or Vessel's Name _____

THIS IS TO CERTIFY that the lifting appliances listed below have been surveyed and found in a satisfactory condition unless otherwise noted under Remarks. (If all of the lifting appliances are inspected at one time, it will suffice to so indicate below; however, if this is not the case, each article or unit inspected should be listed.)

[illegible]

[illegible]

ABS GUIDE FOR CERTIFICATION OF LIFTING APPLIANCES • 2019

Offshore Structure or Vessel's Name _____

Retesting Surveys and Examinations - Repairs

[illegible]

[illegible]

RECORD OF MONTHLY INSPECTION BY VESSEL'S PERSONNEL

[illegible]

CHG-1 GL

CHG-1

Annual Inspections

[illegible]

CHG-1

[illegible]

PART III
RECORD OF ANNEALING OF WROUGHT IRON GEAR

CHG-1

CHG-1

PART IV

CERTIFICATES of tests, examinations and inspections as follows, are to be attached behind this sheet:

- a. Certificate of Test of Loose Gear.
- b. Certificate of Test of Wire Rope.
- c. Certificate of Annealing of Wrought Iron Gear.
- d. Certificate of Proof Test to Gear as a Unit.
 - 1) For Original Test.
 - 2) For Retesting Surveys.*
 - 3) In association with repairs.
- e. Certificate of Annual Inspections.
- f. Force diagrams, gear arrangement and marking data, and replacement gear certificates.
- g. Crane capacity rating chart (see 2-2/5.19 and 2-2/9.9 of the *ABS Guide for Certification of Lifting Appliances*).

Note: The name of the offshore structure or vessel should be noted at the top of each certificate issued.

* Attention is called to the Owner that certain Administrations require the Retesting Survey at four year intervals, and ABS is prepared to do such testing and note it in the Register of Lifting Appliances.

CHG-1

Test Certificate No. _____

**CERTIFICATE OF TEST AND EXAMINATION OF WINCHES, DERRICKS AND ACCESSORY GEAR:
BEFORE BEING TAKEN INTO USE, OR RETESTING SURVEYS OR TESTS ASSOCIATED WITH REPAIRS**

This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11.

Name of ship on which machinery is fitted _____ Class Number _____

(1) Situation and description of machinery and gear with distinguishing number or mark (if any)	(2) Angle to the horizontal of derrick boom while the load was applied (degrees)	(3) Proof load applied (tons)	(4) Safe working load at design angle* (tons)
<p>SAMPLE ONLY</p> <p>NOT TO BE USED</p>			

(Delete as applicable)

- All Annual Survey requirements were dealt with in the course of the Retesting Survey.
- The above testing was carried out after repairs to the Cargo Gear listed on the certificate.

5. Name and address of association witnessing the test and making the examination:

**American Bureau of Shipping
Houston, Texas, U.S.A..**

Port of Survey _____

6. Position of signatory in association: **Surveyor to American Bureau of Shipping.**

I certify that on the _____ day of January, _____ the above machinery, together with accessory gear, was tested by a competent person in a manner set forth on the reverse side of this certificate; that a careful examination of the said machinery and gear by a competent person after the test showed that it had withstood the proof load without injury or permanent deformation; and that the safe working load of the said machinery and gear is as shown in Column 4.

(Date) _____

- Surveyor

* NOTE: When the test angle is less than the lowest angle approved in association with the design, the design angle will be stated here.

CHG-2

In substantial agreement with I.L.O. Form No. 2

INSTRUCTIONS

Every winch with the gear accessory thereto (including derricks, goosenecks, eye plates, eyebolts, or other attachments) shall be tested with a proof load that shall exceed the safe working load as follows:

Safe Working Load	Proof Load
Up to 20 tons	25 percent in excess.
20 - 50 tons.....	5 tons in excess.
Over 50 tons	10 percent in excess.

The proof load shall be lifted with the ship's normal tackle with the derrick at an angle which should not be more than 15 degrees to the horizontal, or when this is impracticable, at the lowest practicable angle. The angle at which the test was made should be stated in the certificate of test. After the proof load has been lifted, it should be swung as far as possible in both directions.

As a general rule, all tests should be carried out in this way by dead load, and no exceptions should be allowed in the case of gear on new ships. In the case of replacements or renewals, however, spring or hydraulic balances may be used where dead loads are not available. Where a spring or hydraulic balance is used it shall be accurate and the test should not be regarded as satisfactory unless the indicator remains constant for a period of at least five minutes.

After being tested as aforesaid, all lifting machinery, with the whole of the gear accessory thereto shall be examined to see whether any part has been injured or permanently deformed by the test.

The safe working load shown in Column 4 is applicable only to a swinging derrick. When using fixed derricks, such as "union purchase" rigs, the safe working load should as a general rule be reduced; in any case, it should be determined with due regard to the actual conditions of use.

In the case of heavy derricks, care should be taken that the appropriate shrouds and stays are rigged.

NOTE: The expression "ton" normally means a British Long Ton of 2240 lbs, which is equal to 1.01605 metric ton. If metric tons or pounds are used, this should be noted in Column 3 on page one (1). (1 pound = 0.4536 kg).

For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or other recognized certifying agency.

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-2

Test Certificate No. _____

**CERTIFICATE OF TEST AND EXAMINATION OF CRANES OR HOISTS AND THEIR
ACCESSORY GEAR:
BEFORE BEING TAKEN INTO USE, OR RETESTING SURVEYS OR TESTS ASSOCIATED WITH REPAIRS**

This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91, Subchapter I-A and 29 CFR 1918.11.

Name of ship on which machinery is fitted _____ Class Number _____

(1) Situation and description of the lifting appliance with distinguishing number or mark (if any)	(2) For jib cranes radius at which the proof load was applied	(3) Proof load applied (tons)	(4) Safe working load (for jib cranes at radius shown in Column 2) (tons)
SAMPLE ONLY NOT TO BE USED			

(Delete as appropriate)

- All Annual Survey requirements were dealt with in the course of the Retesting Survey.
- The above testing was carried out after repairs to the Cargo Gear listed on the certificate.
- Crane(s) was/were examined in accordance with the current Chapter 2, "Guide for Certification of Cranes" of the ABS *Guide for Certification of Lifting Appliances*.
- Crane(s) was/were examined in accordance with the Chapter 2, "Guide for Certification of Cranes" of the ABS *Guide for Certification of Lifting Appliances* and in accordance with the American Petroleum Institute (API) "Recommended Practice for operation and Maintenance of Offshore Cranes" API RP 2D First Edition (October 1972).
- Non Destructive Testing was carried out of crane hook(s) and found satisfactory.

5. Name and address of association witnessing the test and making the examination:

**American Bureau of Shipping
Houston, Texas, U.S.A.**

Port of Survey _____

6. Position of signatory in association: **Surveyor to American Bureau of Shipping.**

I certify that on the _____ day of January _____, the above lifting appliance(s), together with accessory gear, was tested by a competent person in a manner set forth on the reverse side of this certificate; that a careful examination of the said machinery and gear by a competent person after the test showed that it had withstood the proof load without injury or permanent deformation; and that the safe working load of the said machinery and gear is as shown in Column 4.

(Date) _____

- Surveyor

CHG-3

In substantial agreement with I.L.O. Form No. 2

INSTRUCTIONS

Every crane and other hoisting machine, with accessory gear, shall be tested with a proof load which shall exceed the safe working load or rated load as follows:

Shipboard, Heavy Lift, and Offshore Cranes

Safe Working Load	Proof Load
Up to 20 tons	25 percent in excess.
20 - 50 tons.....	5 tons in excess.
Over 50 tons	10 percent in excess.

The proof load shall be lifted and swung as far as possible in both directions. If the jib of the crane has a variable radius, it should be tested with a proof load, as defined above, at the maximum, minimum and intermediate radii of the jib. For testing subsequent to the original test, in the case of hydraulic cranes where, owing to the limitation of pressure, it is impossible to lift the proof load, it will be sufficient to lift the greatest possible load.

After being tested, each crane or hoist, with the whole of the gear accessory thereto, shall be examined to see whether any part has been damaged or permanently deformed by the tests.

NOTE: The expression "ton" normally means a British Long Ton of 2240 lbs, which is equal to 1.01605 metric ton. If metric tons or pounds are used, this should be noted in Column 3 on page one (1). (1 pound = 0.4536 kg).

For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or other recognized certifying agency.

SAMPLE ONLY
NOT TO BE USED

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-3

Test Certificate No. _____					
CERTIFICATE OF TEST AND EXAMINATION OF CHAINS, RINGS, HOOKS, SHACKLES, SWIVELS AND PULLEY BLOCKS					
This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 or Subchapter I-A and 29 CFR 1918.11					
(1) Distinguishing number or mark (if any)	(2) Description of gear*	(3) Number tested	(4) Date of test	(5) Proof load applied (tons)	(6) Safe working load (tons)
<div style="position: absolute; top: 50%; left: 50%; transform: translate(-50%, -50%); opacity: 0.5; font-size: 2em; font-weight: bold;"> SAMPLE ONLY NOT TO BE USED </div>					
<p>* The dimension of the gear, the type of material of which it is made (indicating the carbon content of the gear made of steel) and, where applicable, the heat treatment received in manufacture should be stated (unless Form CHG-6 is used for the purpose).</p> <p>(7) Name and address of maker or supplier _____</p> <p>_____</p> <p>(8) Name and address of public service, association, company or firm making the test and examination _____</p> <p>_____</p> <p>_____</p> <p>(9) Position of signatory in public service, association, company or firm _____</p> <p>_____</p> <p>I certify that on the ____ day of _____, the above gear, was tested and examined by a competent person in the manner set forth on the reverse side of this certificate; that the examination showed that said gear withstood the proof load without injury or deformation; and that the safe working load of the said gear is as shown in Column 6.</p> <p style="text-align: right;">(Signature) _____</p> <p>(Date) _____</p> <p>NOTE: For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or a responsible and technically qualified employee of the manufacturer of the gear certificated or of a recognized testing laboratory or company.</p> <p>CHG-4 In substantial agreement with I.L.O. Form No. 3</p>					

INSTRUCTIONS

Chains, rings, shackles and other loose gear (whether accessory to a machine or not) shall be tested with a proof load equal to that shown against the article in the following table:

<u>Article of gear</u>	<u>Proof load</u>
Chain, ring, hook or swivel	100 percent in excess of the safe working load.
Pulley blocks:	
Single-sheave block	300 percent in excess of the safe load.
Multiple -sheave block with safe working load up to and including 20 tons	100 percent in excess of the safe working load.
Multiple-sheave block with safe working load over 20 tons up to and including 40 tons	20 tons in excess of the safe working load.
Multiple-sheave block with safe working load over 40 tons	50 percent in excess of the safe working load.
Pitched chains used with hand-operated pulley blocks and rinks, hooks, shackles, or swivels permanently attached thereto	50 percent in excess of the safe working load.
Hand-operated pulley blocks used with pitched chains and rings, hooks, shackles or swivels permanently attached thereto	50 percent in excess of the safe working load.

After being tested, all the gear shall be examined, the sheaves and the pins of the pulley blocks being removed for the purpose, to see whether any part has been damaged or permanently deformed by the test.

NOTE: The expression "ton" normally means a British Long Ton of 2240 lbs, which is equal to 1.01605 metric ton. If metric tons or pounds are used, this should be noted in Column 5 on page one (1). (1 pound = 0.4536 kg)...

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-4

Test Certificate No. _____

CERTIFICATE OF EXAMINATION AND TEST OF WIRE ROPE BEFORE BEING TAKEN INTO USE

This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91, Subchapter I-A and 29 CFR 1918.11.

Name and address of maker or supplier of rope _____

Circumference / diameter* of rope _____

Length of wire _____

Number of strands _____

Number of wires per strand _____

Lay and core type _____

Quality / material / grade of wire _____

Date of test of sample of rope _____

Load at which sample broke _____

Safe working load, subject to any stated qualifying conditions such as minimum pulley diameter; direct tensile load, etc.

Name and address of public service, association, company or firm making the examination and test _____

Position of signatory in public service, association, company or firm making the examination and test _____

I certify that the above particulars are correct, and that the examination and test was carried out by a competent person.

(Signature) _____

(Date) _____

NOTE: For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or a responsible and technically qualified employee of the manufacturer of wire rope or of a recognized testing laboratory or company.

* Delete what does not apply.

CHG-5 In substantial agreement with I.L.O. Form No. 4

Appendix	1	Samples of ABS Register of Lifting Appliances, Register of Cargo Gear and Shipboard Elevator Certificate (1 July 2016)	
Section	1	American Bureau of Shipping Register of Lifting Appliances	A1-1

INSTRUCTIONS

A sample of the wire rope is to be tested to destruction. Refer to the appropriate sections of Chapter 3, "Guide for Certification of Base-Mounted Manriding Winches" and Chapter 2, "Guide for Certification of Cranes" of the *ABS Guide for Certification of Lifting Appliances*, for wire rope safety factors.

**SAMPLE ONLY
NOT TO BE USED**

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-5

Certificate No. _____						
CERTIFICATE OF HEAT TREATMENT OF CHAINS, RINGS, HOOKS, SHACKLES AND SWIVELS WHICH REQUIRE SUCH TREATMENT						
This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91, Subchapter I-A and 29 CFR 1918.11.						
(1) Distinguishing number or mark	(2) Description of gear*	(3) Number of certificate of test and examination	(4) Number heat- treated	(5) Date of heat treatment	(6) Nature of heat treatment given	(7) Defects found at inspection after heat treatment
<div style="font-size: 48px; opacity: 0.5; transform: rotate(-15deg);"> SAMPLE ONLY NOT TO BE USED </div>						
<p>* The dimension of the gear, the type of material of which it is made, and the heat treatment received in manufacture should be stated.</p> <p>(8) Name and address of public service, association, company or firm carrying out the heat treatment and inspection</p> <p>_____</p> <p>_____</p> <p>(9) Position of signatory in public service, association, company or firm _____</p> <p>_____</p> <p>I certify that on the date shown in Column 5, the gear referred to in Columns 1 to 4 was heat-treated (indicated in Column 6) under my supervision. After being heat-treated, every article was carefully inspected and no defects affecting its safe working condition was found, other than those items indicated in Column 7.</p> <p>(Date) _____ (Signature) _____</p> <p>NOTE: The person under whose supervision the work is done must be a competent person, defined as a reasonably and technically qualified employee of the manufacturer of the gear tested or of a recognized heat treating company. For requirements as to heat treatment, see reverse side.</p>						
CHG-6		In substantial agreement with I.L.O. Form No. 6				

INSTRUCTIONS

ANNEALING

Chains (other than bridle chains attached to derricks or masts), rings, hooks, shackles and swivels made of wrought iron, used in hoisting or lowering, shall be annealed at the following intervals:

	If used on lifting machinery driven by power	If used solely on lifting machinery worked by hand
Half-inch (12.5 mm) and smaller chains, rings, hooks, shackles and swivels in general use.....	6 months	12 months
All other chains, rinks, hooks, shackles and swivels in general use.....	12 months	2 years

The annealing shall be done in a suitable closed oven and not over an open fire. Wrought iron shall be annealed at a temperature of between 1100° and 1200°F for a period between thirty and sixty minutes. After being annealed, the article should be allowed to cool slowly.

SAMPLE ONLY
NOT TO BE USED

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-6

Certificate No. _____

CERTIFICATE OF ANNUAL THOROUGH EXAMINATION OF GEAR THAT DOES NOT REQUIRE TO BE PERIODICALLY HEAT-TREATED, AND FOR ANNUAL INSPECTION OF CARGO GEAR OR CRANES.

This Certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91, Subchapter I-A and 29 CFR 1918.11.

Name of unit or vessel on which lifting appliance is fitted _____

Class Number _____

(1) Distinguishing number, marks or location	(2) Description of gear*	(3) Number & Date of Certificate of Test and Examination	(4) Condition found and Repairs effected
<p>SAMPLE ONLY NOT TO BE USED</p>			
<p>(Delete as appropriate)</p> <ul style="list-style-type: none"> Crane(s) was/were examined in accordance with the current Chapter 2, "Guide for Certification of Cranes" of the <i>ABS Guide for Certification of Lifting Appliances</i>. Crane(s) was/were examined in accordance with the current Chapter 2, "Guide for Certification of Cranes" of the <i>ABS Guide for Certification of Lifting Appliances</i> and in accordance with the American Petroleum Institute (API) "Recommended Practice for operation and Maintenance of Offshore Cranes" API RP 2D First Edition (October 1972). 			

* In regard to gear not required to be periodically heat treated, the dimensions of the gear, the type of material of which it is made, and the heat treatment received in manufacture should be stated.

5. Name and address of association making the examination: American Bureau of Shipping.

Port of Survey _____

6. Position of signatory in association: Surveyor to American Bureau of Shipping.

I certify that on the _____ day of _____, the above lifting appliance(s) was/were thoroughly examined by a competent person and that no defects affecting its/their safe working condition were found other than those indicated and corrected as noted in Column 4.

(Date) _____ - Surveyor

NOTE: For list of gear not required to be treated and definition of thorough examination, see reverse side.

For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or other recognized certifying agency.

CHG-7

In substantial agreement with I.L.O. Part II

INSTRUCTIONS

Gear not required to be heat treated, but required to be thoroughly examined by a competent person once at least in every twelve months:

- Plate-link chains.
- Pitched chains.
- Rings, hooks, shackles, and swivels permanently attached to pitched chains, pulley blocks or weighing machines.
- Hooks and swivels having ball bearings or other case-hardened parts.
- Bordeaux connections.
- Gear constructed of steel.

NOTE: "Thorough examination" refers to a visual examination, supplemented (if necessary) by other means, such as a hammer test, carried out as carefully as conditions permit in order to arrive at a reliable conclusion as to the safety of the parts examined; if necessary for the purposes, parts of the machines or gear must be dismantled.

For additional ABS requirements see Chapter 2, "Guide for Certification of Cranes" of the *ABS Guide for Certification of Lifting Appliances*.

SAMPLE ONLY
NOT TO BE USED

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-6

**APPENDIX 1 Samples of ABS Register of Lifting Appliances,
Register of Cargo Gear and Shipboard Elevator
Certificate (1 July 2016)**

**SECTION 2 American Bureau of Shipping Register of Cargo
Gear (for Great Lakes Vessels)**

Section 2 of this Appendix applies to the latest edition of the “Guide for Certification of Selfunloading Cargo Gear on Great Lakes Vessels” (Chapter 4 of the *ABS Guide for Certification of Lifting Appliances*).

AMERICAN BUREAU OF SHIPPING



REGISTER OF CARGO GEAR

SAMPLE ONLY
NOT TO BE USED

NUMBER OF REGISTER BOOK _____

DATE OF ISSUE _____

PORT OF ISSUE _____

NAME OF VESSEL _____

PORT OF REGISTRY _____

IMO/OFFICIAL NUMBER _____

OWNER _____

ADDRESS _____

This Register when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 and 29 CFR 1918.11.

CHG-1 GL

REGISTER OF CARGO GEAR ON SELF-UNLOADING GREAT LAKES VESSELS

INSTRUCTIONS

1. This Register of Cargo is issued in connection with Chapter 4, "Guide for Certification of Self-Unloading Cargo Gear on Great Lakes Vessels" of the ABS *Guide for Certification of Lifting Appliances* and is to be kept available for inspection of proper authority and endorsement by the Surveyor at the time of inspections.

2. The Register is divided into three parts for the purpose of recording the following information:

PART I - The Surveyors are to fill in the required information with respect to the original load tests and examination of the vessel's cargo gear in accordance with 4-5/7, "Initial Test to the Gear as a Unit" and with respect to Annual and Special Inspections of the cargo gear on the vessel in accordance with 4-6/1.1 and 4-6/1.2.

PART II - A record shall be kept in this section of the monthly inspection of the cargo gear made by the vessel's personnel as required by 4-6/3.

PART III - In this part, there shall be inserted the following certificates of tests, examinations and inspections:

- a. Certificate of Test of Loose Gear. Form CHG-4-GL
- b. Certificate of Test of Wire Rope. Form CHG-5-GL
- c. Certificate of Initial Test and Examination, or Tests Associated with Repairs. Form CHG-3-GL
- d. Certificate of Annual Examinations and Special Inspections. Form CHG-7-GL

On the reverse side of the above mentioned certificates will be found the particulars of tests pertaining to each.

CHG-1 GL

Appendix	1	Samples of ABS Register of Lifting Appliances, Register of Cargo Gear and Shipboard Elevator Certificate (1 July 2016)	
Section	2	American Bureau of Shipping Register of Cargo Gear (for Great Lakes Vessels)	A1-2

NOTES ON SPECIAL MATERIALS FOR THE PRINCIPAL STRUCTURAL PARTS

Masts, “A”-Frames or Supporting Structures: -

Booms: -

**SAMPLE ONLY
NOT TO BE USED**

Other Structural Parts: -

CHG-1 GL

PART I
INITIAL TEST AND SUBSEQUENT ANNUAL AND SPECIAL
INSPECTION CERTIFICATES

[illegible]

216

[illegible]

[illegible]

ABS GUIDE FOR CERTIFICATION OF LIFTING APPLIANCES • 2019

[illegible]

ABS GUIDE FOR CERTIFICATION OF LIFTING APPLIANCES • 2019

[illegible]

ABS GUIDE FOR CERTIFICATION OF LIFTING APPLIANCES • 2019

Vessel's Name _____

PART II

RECORD OF MONTHLY INSPECTION BY VESSEL'S PERSONNEL

[illegible]

CHG-1 GL

RECORD OF MONTHLY INSPECTION BY VESSEL'S PERSONNEL

SAMPLE ONLY
NOT TO BE USED

222

Vessel's Name _____

PART II

RECORD OF MONTHLY INSPECTION BY VESSEL'S PERSONNEL

[illegible]

CHG-1 GL

PART II

[illegible]**ABS** GUIDE FOR CERTIFICATION OF LIFTING APPLIANCES • 2019

Appendix	1	Samples of ABS Register of Lifting Appliances, Register of Cargo Gear and Shipboard Elevator Certificate (1 July 2016)	
Section	2	American Bureau of Shipping Register of Cargo Gear (for Great Lakes Vessels)	A1-2

PART III

CERTIFICATES of tests, examinations and inspections are to be inserted behind this sheet.

**SAMPLE ONLY
NOT TO BE USED**

CHG-1 GL

Test Certificate No. _____

CERTIFICATE OF INITIAL TEST AND EXAMINATION OF SELF-UNLOADING CARGO GEAR ON GREAT LAKES VESSELS, AND TESTS ASSOCIATED WITH REPAIRS AND RETESTING SURVEY

This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91.

Name of ship on which cargo gear is fitted _____ Class Number _____

(1) Description and Location of Cargo Gear	(2) Angle to the horizontal of the boom at which the proof load was applied	(3) Test load applied	(4) Safe working load (S.W.L.)

5. Issuance for completion of Special Inspection: YES _____ NO _____

6. Issuance in association with repairs only: YES _____ NO _____

NOTE: (a) Downgrading S.W.L. in association with repair load test will require subsequent load testing of 125% prior to restoration of design S.W.L.

(b) Wash box fitted: YES _____ NO _____ S.W.L. assumes wash box empty.

7. For commencement of Special Inspection of Cargo Gear see Report No. _____ dated _____

REMARKS

This Certificate valid until: _____

8. Name and address of association witnessing the test and making the examination:

**American Bureau of Shipping
Houston, Texas, U.S.A.**

Port of Survey _____

9. Position of signatory in association: **Surveyor to American Bureau of Shipping.**

I certify that on the _____ day of January _____, the above cargo gear was tested by a competent person in a manner set forth on the reverse side of this certificate; that a careful examination of the said machinery and gear by a competent person after the test showed that it had withstood the test load without damage or deformation; and that the safe working load of said machinery and gear is as shown in Column 4.

(Date) _____

- Surveyor

CHG-3 GL

In substantial agreement with I.L.O. Form No. 2

Appendix	1	Samples of ABS Register of Lifting Appliances, Register of Cargo Gear and Shipboard Elevator Certificate (1 July 2016)	
Section	2	American Bureau of Shipping Register of Cargo Gear (for Great Lakes Vessels)	A1-2

INSTRUCTIONS

After installation or major repair and when the cargo gear is placed in service it shall be initially tested to a load equal to 125% of the working load of the assembled gear, for subsequent Special Inspections and for minor repairs it shall be tested to a load equal to 110% of the working load of the assembled gear. A general, careful examination of all accessible parts of the assembled gear is to be carried out after the load test. Where damaged or deformed condition is noted, parts are to be further examined to determine the condition of the affected parts.

NOTE: The expression "ton" means a ton of 2240 lbs unless stated otherwise. Load is to be recorded in pounds per running foot of conveyor and also in total tons.

For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or other recognized certifying agency.

For additional ABS requirements see 4-5/7, 4-6/1 and 4-6/5 of Chapter 4, "Guide for Certification of Self-unloading Cargo Gear on Great Lakes Vessels" of the *ABS Guide for Certification of Lifting Appliances*.

SAMPLE ONLY
NOT TO BE USED

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge hereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-3 GL

Test Certificate No. _____					
CERTIFICATE OF TEST AND EXAMINATION OF CHAINS, RINGS, HOOKS, SHACKLES, SWIVELS AND PULLEY BLOCKS					
This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 or Subchapter I-A and 29 CFR 1918.11.					
(1) Distinguishing number or mark (if any)	(2) Description of gear*	(3) Number tested	(4) Date of test	(5) Test load applied (tons)	(6) Safe working load (tons)
<div style="font-size: 2em; opacity: 0.5; transform: rotate(-15deg); position: absolute; top: 50%; left: 50%;"> SAMPLE ONLY NOT TO BE USED </div>					
<p>* The dimension of the gear, the type of material of which it is made (indicating the carbon content of the gear made of steel) and, where applicable, the heat treatment received in manufacture should be stated.</p> <p>(7) Name and address of maker or supplier _____</p> <p>_____</p> <p>(8) Name and address of public service, association, company or firm making the test and examination _____</p> <p>_____</p> <p>_____</p> <p>(9) Position of signatory in public service, association, company or firm _____</p> <p>_____</p> <p>I certify that on the ____ day of _____, the above gear was tested and examined by a competent person in the manner set forth on the reverse side of this certificate; that the examination showed that the said gear withstood the test load without injury or deformation; and that the safe working load of the said gear is as shown in Column 6.</p> <p style="text-align: right;">(Signature) _____</p> <p>(Date) _____</p> <p>NOTE: For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or a responsible and technically qualified employee of the manufacturer of the gear certificated or of a recognized testing laboratory or company.</p> <p>CHG-4 GL In substantial agreement with I.L.O. Form No. 3</p>					

INSTRUCTIONS

Test Load: All chains, rings, hooks, links, shackles and blocks of cargo gear are to be tested with a test load at least equal to that shown against the article in the following table:

<i>Article of Gear</i>	<i>Proof Load</i>
Chain, ring, hook, link shackle or swivel.....	100% in excess of the safe working load.
Pulley blocks:	
Single-sheave block	300% in excess of the safe working load. (See Note)
Multiple sheave block with safe working load up to and including 20 tons	100% in excess of the safe working load.
Multiple sheave block with safe working load over 20 tons up to and including 40 tons.....	20 tons in excess of the safe working load.
Multiple sheave blocks with safe working load over 40 tons	50% in excess of the safe working load.

Note: The safe working load of a single sheave block is to be the maximum load which can safely be lifted by the block when the load is attached to a rope which passes around the sheave of the block. In the case of a single-sheave block where the load is attached directly to the block instead of to a rope passing around the sheave, it is permissible to lift a load equal to twice the safe working load of the block as defined in this note.

After being tested, all the gear shall be examined, the sheaves and the pins of the pulley blocks being removed for the purpose, to see whether any part has been damaged or deformed by the test.

Note: The expression "ton" normally means a ton of 2240 lbs, unless stated otherwise.

Refer to the appropriate sections of Chapter 4, "Guide for Certification of Self-Unloading Cargo Gear on Great Lakes Vessels" of the *ABS Guide for Certification of Lifting Appliances*.

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge hereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-4 GL

Test Certificate No. _____

CERTIFICATE OF EXAMINATION AND TEST OF WIRE ROPE BEFORE BEING TAKEN INTO USE

This certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91 or Subchapter I-A and 29 CFR 1918.11.

Name and address of maker or supplier of rope _____

Circumference / diameter* of rope _____

Length of wire _____

Number of strands _____

Number of wires per strand _____

Lay and core type _____

Quality / material / grade of wire _____

Date of test of sample of rope _____

Load at which sample broke _____

Safe working load, subject to any stated qualifying conditions such as minimum pulley diameter; direct tensile load, etc.

Name and address of public service, association, company or firm making the examination and test _____

Position of signatory in public service, association, company or firm making the examination and test _____

I certify that the above particulars are correct, and that the examination and test was carried out by a competent person.

(Signature) _____

(Date) _____

NOTE: For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or a responsible and technically qualified employee of the manufacturer of wire rope or of a recognized testing laboratory or company.

* Delete what does not apply.

CHG-5 GL In substantial agreement with I.L.O. Form No. 4

Appendix	1	Samples of ABS Register of Lifting Appliances, Register of Cargo Gear and Shipboard Elevator Certificate (1 July 2016)	
Section	2	American Bureau of Shipping Register of Cargo Gear (for Great Lakes Vessels)	A1-2

INSTRUCTIONS

A sample of the wire rope is to be tested to destruction. Refer to the appropriate sections of Chapter 4, "Guide for Certification of Self-Unloading Cargo Gear on Great Lakes Vessels" of the *ABS Guide for Certification of Lifting Appliances*

**SAMPLE ONLY
NOT TO BE USED**

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge hereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-5 GL

Certificate No. _____

CERTIFICATE OF ANNUAL THOROUGH EXAMINATION OF CARGO GEAR ON SELF-UNLOADING GREAT LAKES VESSELS.

This Certificate when properly executed by a competent person is accepted by the Government of the United States of America as being in accordance with the requirements of 46 CFR Part 91.

Name of ship on which cargo gear is fitted _____

Class Number _____

Description and Location of Gear	Number and date of Certificate of last test and examination (Form CHG 3 G.L.)
<p>SAMPLE ONLY NOT TO BE USED</p>	
<p>REMARKS</p>	

Name and address of association witnessing the test and making the examination:

**American Bureau of Shipping
Houston, Texas, U.S.A.**

Port of Survey _____

Position of signatory in association: **Surveyor to American Bureau of Shipping.**

I certify that the above cargo gear was thoroughly examined by a competent person and that no defects affecting its safe working condition were found other than those indicated and corrected as noted under remarks.

(Date) _____

- Surveyor

NOTE: For the purpose of this certificate a competent person is defined as a Surveyor of a Classification Society or other recognized certifying agency.

CHG-7 GL

In substantial agreement with I.L.O. Form Part I.

Appendix	1	Samples of ABS Register of Lifting Appliances, Register of Cargo Gear and Shipboard Elevator Certificate (1 July 2016)	
Section	2	American Bureau of Shipping Register of Cargo Gear (for Great Lakes Vessels)	A1-2

INSTRUCTIONS

The following parts are to be visually examined in place at each Annual Inspection. Dismantling of the gear may be required where damaged or deformed condition is noted.

1. Boom slewing tackle blocks, shackles, padeyes, rings, tables, cable connections, etc.
2. Boom slewing and luffing cables.
3. Boom slewing and luffing winches.
4. Boom structure, "A" frame and other supporting structures to which may be attached such tackle or other device as is employed to luff, swing, or otherwise position the boom.
5. Gear for securing boom in stowed position.
6. Slewing and luffing equipment including safety devices and limit switches.
7. Valves, cocks, pipes, strainers, and cylinders

**SAMPLE ONLY
NOT TO BE USED**

NOTE: This Certificate evidences compliance with one or more of the Rules, guides, standards or other criteria of ABS and is issued solely for the use of ABS, its committees, its clients or other authorized entities. This Certificate is a representation only that the structure, item of material, equipment, machinery or any other item covered by this Certificate has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by the Rules and standards of ABS who shall remain the sole judge hereof. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

CHG-5 GL

**APPENDIX 1 Samples of ABS Register of Lifting Appliances,
Register of Cargo Gear and Shipboard Elevator
Certificate (1 July 2016)**

**SECTION 3 American Bureau of Shipping Shipboard Elevator
Certificate**

Section 3 of the Appendix applies to the latest edition of the “Guide for Certification of Shipboard Elevators” (Chapter 5 of the *ABS Guide for Certification of Lifting Appliances*).

Shipboard Elevator Certificate



Certificate No. _____

Port of _____

Builder's Hull No. _____

Date _____

Valid Until _____

Vessel: _____

Shipbuilder: _____

Description of Elevator: _____

Manufacturer: _____

Type: _____

Serial No.: _____

Size: _____

Speed: _____

Capacity (Kg. Lbs.) _____

No. of Persons: _____

Location of Elevator: _____

No. & Size of Hoisting Ropes _____

THIS IS TO CERTIFY that the elevator described above has been surveyed and tested while under construction and found in accordance with recommendations of ABS as set forth in the "Guide for the Construction of Shipboard Elevators".

Surveyor

Note: This Certificate evidences that the survey reported herein was carried out in compliance with one or more of the Rules, guides, standards or other criteria of ABS and issued solely for the use of ABS, its committees, its clients or other authorized entities. This certificate is a representation only that the vessel structure, item of material, equipment, machinery or any other item covered by this certificate has been examined for compliance with, or has met one or more of the Rules, guides, standards or other criteria of ABS. The validity, applicability and interpretation of this Certificate is governed by these Rules and standards of ABS who shall remain the sole judge thereof. Nothing contained in this Certificate or in any notation made in contemplation of this Certificate shall be deemed to relieve any designer, builder, owner, manufacturer, seller, supplier, repairer, operator or other entity of any warranty express or implied.

Form ELEV

ANNUAL SURVEY ENDORSEMENT

Annual Survey:

Place:

Date:

Signed:

(Surveyor, American Bureau of Shipping)

Annual Survey:

Place:

Date:

Signed:

(Surveyor, American Bureau of Shipping)

Annual Survey:

Place:

Date:

Signed:

(Surveyor, American Bureau of Shipping)

Annual Survey:

Place:

Date:

Signed:

(Surveyor, American Bureau of Shipping)

**SAMPLE ONLY
NOT TO BE USED**

INTERMEDIATE SURVEY ENDORSEMENT

(for hydraulic elevators only)

Intermediate Survey:

Place:

Date:

Signed:

(Surveyor, American Bureau of Shipping)