Launching appliances for work boats and tender boats
FOREWORD

DNV GL standards contain requirements, principles and acceptance criteria for objects, personnel, organisations and/or operations.

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Any comments may be sent by e-mail to rules@dnvgl.com

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CHANGES – CURRENT

This is a new document.
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SECTION 1 INTRODUCTION

1.1 Objective
This standard provides criteria and guidance for certification and verification of design, materials, fabrication, systems, safety, installation and testing, leading to the issuance of certificates for launching appliances for work boats and tender boats.

1.2 Scope

1.2.1 General
The following topics are covered:
— design approval
— materials
— production
— testing.
Requirements for operational procedures and training are not part of the scope.

1.2.2 Davit types
The standard covers the following types as related to the operation of the davits. The appropriate type shall be agreed with DNV GL prior to commencing design.

*Work boat davit*
Davit permanently installed on board a vessel designed for routine handling of a manned craft not intended to be used for passenger transport, characterized by:
— expected daily load cycles during established life
— capable of being launched while vessel is making headway
— to be handled by trained crew
— to handle a craft intended for a predefined working application(s).

*Tender boat davits*
Davit permanently installed on board a passenger vessel designed for routine handling of a manned craft intended to be used for passenger transport, characterized by:
— expected daily load cycles during established life
— to be launched while passenger vessel is stationary
— to be handled by trained crew
— to launch and recover a craft without passengers.
On a case by case each of the above-mentioned davit types may also combine the described functions with life-saving purpose. In these cases the design shall be examined in accordance with international maritime safety conventions and national and governmental regulations and with the applicable requirements in this standard, these shall be agreed prior to commencing design.

1.2.3 Equipment associated with davits
This standard also covers the following equipment associated with davits:
— winches
— release mechanisms
— painter arrangements
— launching cradles.

### 1.3 Application

This standard is applicable to all launching appliances for work boats and tender boats permanently installed on a vessel.

This standard is written for worldwide application. National and governmental regulations may include requirements in excess of the provisions given by this standard.

Whenever a launching appliance is a dual duty equipment, international maritime safety conventions and national and governmental regulations applies in addition to the requirements in this standard. The provisions described hereinafter are not to be considered acceptable means to deviate from statutory regulations.

Requirements presented herein are minimum requirements to be satisfied. Alternatives may be accepted when the overall safety and reliability level is found to be equivalent or better.

The requirements in this standard may be supplemented with additional requirements in the case where service experience and/or theoretical findings show that unacceptable risks may exist.

### 1.4 Structure

This document is structured as follows:

This section – General principles and common requirements

Sec.2 – Documentation and certification

Sec.3 – Materials and fabrication

Sec.4 – Structural design and strength

Sec.5 – Systems

Sec.6 – Safety and safety equipment

Sec.7 – Davits

Sec.8 – Winches

Sec.9 – Release mechanisms, painter arrangements and launching cradles

Appendices – Recommended worksheets, tests procedures and test forms.

### 1.5 References

Latest edition of the following referenced standards shall be used:

<table>
<thead>
<tr>
<th>Reference</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNVGL-RP-C205</td>
<td>Environmental conditions and environmental loads</td>
</tr>
<tr>
<td>DNVGL-ST-E273</td>
<td>2.7-3 Portable offshore units</td>
</tr>
<tr>
<td>DNVGL-ST-0378</td>
<td>Standard for offshore and platform lifting appliances</td>
</tr>
<tr>
<td>DNVGL-CG-0194</td>
<td>Hydraulic cylinders</td>
</tr>
<tr>
<td>DNVGL-OS-A101</td>
<td>Safety principles and arrangements</td>
</tr>
<tr>
<td>DNVGL-OS-A201</td>
<td>Winterization for cold climate operations</td>
</tr>
<tr>
<td>DNVGL-OS-B101</td>
<td>Metallic materials</td>
</tr>
</tbody>
</table>
1.6 Definitions, abbreviations, symbols and reference

1.6.1 Abbreviations

Table 1-2 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CoG</td>
<td>Center of gravity</td>
</tr>
<tr>
<td>DF</td>
<td>Dynamic factor</td>
</tr>
<tr>
<td>DFF</td>
<td>Design fatigue factor</td>
</tr>
<tr>
<td>HPU</td>
<td>Hydraulic power unit</td>
</tr>
<tr>
<td>IACS</td>
<td>International Association of Classification Societies</td>
</tr>
<tr>
<td>LL</td>
<td>Live load; for marking purposes, it shall represent MWL</td>
</tr>
<tr>
<td>MHL</td>
<td>Maximum hoisting load</td>
</tr>
</tbody>
</table>
### 1.6.2 Definitions

**Table 1-3 Definitions**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal configuration</td>
<td>Davit configuration that may result from system single failure or davit mishandling.</td>
</tr>
<tr>
<td>Automatic tensioning system</td>
<td>System keeping the tension of the hoisting wire to a given set point value.</td>
</tr>
<tr>
<td>Back-up control systems</td>
<td>Comprise all equipment necessary to maintain control of essential functions required for the davit operation when the main control system have failed or malfunctioned (HSC Code 11.1.2).</td>
</tr>
<tr>
<td>Control and monitoring system</td>
<td>System designed to control components, with some degree of automation that receives inputs from sensors or components and detect malfunctions and failures in pre-established procedures.</td>
</tr>
<tr>
<td>Control system</td>
<td>Comprise all equipment necessary to control davit operation, i.e., main control systems and back-up control systems.</td>
</tr>
<tr>
<td>Craft</td>
<td>Work boat or tender boat.</td>
</tr>
<tr>
<td>Crew</td>
<td>People who serve or operate a vessel.</td>
</tr>
<tr>
<td>Customer</td>
<td>Any person and/or company which has requested the Society’s service and/or has entered into a contract for services directly with the Society.</td>
</tr>
<tr>
<td>Davit</td>
<td>Main structure of the launching appliance and its fittings, including loose gears, hanging-off pendants, lashings, etc (ISO 15516:2006(E)).</td>
</tr>
<tr>
<td>Davit essential functions</td>
<td>Braking, lowering and hoisting. Slewing/telescoping if needed to bring the craft to position were people can be evacuated to a safe zone see [7.1.1].</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>Davit mishandling</td>
<td>Event in which the crew fail to observe one single step from the pre-established procedures of launching or recovering.</td>
</tr>
<tr>
<td>Design assessment for type approval</td>
<td>Examination and acceptance of a design for type approval. The type approval will be assigned first after a prototype test also has been successfully carried out.</td>
</tr>
<tr>
<td>Design verification report</td>
<td>Written confirmation of a design approval.</td>
</tr>
<tr>
<td>Designer</td>
<td>A party who created or developed Documentation which is submitted to the Society for approval or information.</td>
</tr>
<tr>
<td>Dual duty equipment</td>
<td>Equipment serving work boats or tender boats in day-to-day activities and in emergency situation as lifesaving.</td>
</tr>
<tr>
<td>Fully loaded craft</td>
<td>Craft fully equipped and loaded with a full complement of persons.</td>
</tr>
<tr>
<td>HAZOP</td>
<td>Hazard and operability study.</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organization.</td>
</tr>
<tr>
<td>Light-loaded craft</td>
<td>Work boat or tender boat fully equipped and loaded by crew.</td>
</tr>
<tr>
<td>Loose gear</td>
<td>Parts and assemblies withstanding loads during hoisting the craft (ISO 15516:2006(E)). E.g.: falls, blocks, suspension chains, links, padeyes, shackles, hooks, swivel, fastenings and other fittings that bears loads during launching and recovery.</td>
</tr>
<tr>
<td>Maximum hoisting load (MHL)</td>
<td>Load transmitted to the launching appliance when recovering the maximum weight of fully loaded craft.</td>
</tr>
<tr>
<td>Maximum working load (MWL)</td>
<td>Maximum load held by the falls at the winch drum.</td>
</tr>
<tr>
<td>Non-loaded craft</td>
<td>Work boat or tender boat fully equipped without persons.</td>
</tr>
<tr>
<td>Overload</td>
<td>Load that results from exceeding the maximum working load (MWL).</td>
</tr>
<tr>
<td>Painter arrangement</td>
<td>Equipment associated with towing a craft during launch and recovery.</td>
</tr>
<tr>
<td>Painter hook</td>
<td>Connection between the vessels painter line and the craft that is being launched or recovered.</td>
</tr>
<tr>
<td>Passenger</td>
<td>People that may board the craft and that does not serve or operate a vessel.</td>
</tr>
<tr>
<td>Person</td>
<td>Crew or passenger.</td>
</tr>
</tbody>
</table>
| Product certificate (the Society's) | A compliance document validated and signed by the issuing organization:  
  — identifying the product that the certificate applies to  
  — confirming compliance with referred requirements.  
  It is required that:  
  — the tests and inspections have been performed on the certified product itself, or, on samples taken from the certified product itself  
  — the tests were witnessed by a qualified representative of the organization issuing the certificate and the Society’s representative, or, in accordance with special agreements. |
<p>| Purchaser | Company or person who orders the lifting equipment from a manufacturer. This standard does not necessarily require that the purchaser will need to have any direct relationship to or communication with the Society. |</p>
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Redundancy</td>
<td>Ability of a system to maintain its function when one failure has occurred. Redundancy can be achieved by two mutually independent systems that can maintain a function.</td>
</tr>
<tr>
<td>Redundancy design intent</td>
<td>Refers to redundant component groups which constitutes the overall system design for a given system operational mode and technical system configuration.</td>
</tr>
<tr>
<td>Release mechanisms</td>
<td>Arrangement that comprise hook, hydrostatic interlock, operating cables and release controls.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Ability of a component or system to perform its required function under given conditions for a given time interval.</td>
</tr>
<tr>
<td>Restricted state of operation</td>
<td>Pre-established procedures to safely abort a launching sequence or recovery sequence (i.e. required procedures to bring back the launching appliance into a normal configuration, or alternatively procedures needed to bring the craft into a position were all persons can be safely evacuated, and in case of radio remote control loss of signal, procedures needed to hand over the control of the davit to the back up control system operator).</td>
</tr>
<tr>
<td>Robustness</td>
<td>Ability of a structure to withstand events like system single failures or the consequences of human erroneous actions, without being damaged to an extent disproportionate to the original cause - see also definition in EN 1991-1-7 Accidental actions eurocode. Robustness of a structure is needed when consequences are unacceptable relative to the triggering event. In order to minimize the likelihood of failures, designer shall base it's design assessment in FMEA and HAZOP or similar methods.</td>
</tr>
<tr>
<td>Ship type notation</td>
<td>Code used by the classification societies to define a type of vessel related to its most typical service (tanker for oil, passenger ship and crane vessel are typical examples).</td>
</tr>
<tr>
<td>Single failure criteria</td>
<td>Applied in systems design and analysis to promote reliability of systems that may have impact on safety and to mitigate consequences of accidents. The assessment of a potential single failure involves identifying the critical components of a complex system, which in case of malfunction, would cause the equipment to fail in its intended function. Safe systems should not be dependent of individual components.</td>
</tr>
<tr>
<td>Subsystem</td>
<td>E.g., lashing system, braking system, hydraulic system, electric system, pneumatic system, release and retrieval system, etc.</td>
</tr>
<tr>
<td>Tender boat</td>
<td>Craft used to transport more than 12 passengers from a stationary passenger ship to shore and back (IMO Circular MSC.1/Circ.1417 as amended).</td>
</tr>
<tr>
<td>The Society</td>
<td>The Society signifies DNV GL.</td>
</tr>
<tr>
<td>Type approval</td>
<td>Approval of conformity with specified requirements based on systematic examination of one or more specimens of a product representative of the production.</td>
</tr>
<tr>
<td>Type approval certificate</td>
<td>A document issued by the Society confirming compliance with the rules is named DNV GL Type approval certificate (TA).</td>
</tr>
<tr>
<td>Verification</td>
<td>A service that confirms through the provision of objective evidence (analysis, observation, measurement, test, records or other evidence) that specified requirements have been met. (See DNVGL-RU-SHIP Pt.1 Ch.1 Sec.1)</td>
</tr>
<tr>
<td>Vessel</td>
<td>Any object designed for transportation or special operations on water.</td>
</tr>
<tr>
<td>Winch</td>
<td>Winch used for launching and recovering the craft. (ISO 15516:2006(E))</td>
</tr>
<tr>
<td>Work boat</td>
<td>Includes but not limited to, daughter craft, crew transfer boat, patrol boat, professional boat, general purpose craft, tug boat, etc., see [1.4.2].</td>
</tr>
</tbody>
</table>
### Term

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works certificate</td>
<td>See DNVGL-RU-SHIP Pt.1 Ch.3 Sec.5 [2.5]. A document signed by the manufacturer stating:</td>
</tr>
<tr>
<td></td>
<td>— conformity with rule requirements</td>
</tr>
<tr>
<td></td>
<td>— that tests are carried out on the certified product itself</td>
</tr>
<tr>
<td></td>
<td>— that tests are made on samples taken from the certified product itself</td>
</tr>
<tr>
<td></td>
<td>— that tests are witnessed and signed by a qualified department of the manufacturers.</td>
</tr>
<tr>
<td>Worst case failure design intent</td>
<td>Refer to the minimum remaining capacity after any relevant single failure or common cause (for a given operational mode).</td>
</tr>
</tbody>
</table>

### 1.7 Verbal forms

#### Table 1-4 Verbal forms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>shall</td>
<td>verbal form used to indicate requirements strictly to be followed in order to conform to the document</td>
</tr>
<tr>
<td>should</td>
<td>verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required</td>
</tr>
<tr>
<td>may</td>
<td>verbal form used to indicate a course of action permissible within the limits of the document</td>
</tr>
</tbody>
</table>
SECTION 2 DOCUMENTATION AND CERTIFICATION

2.1 Documentation

2.1.1 Overview

Documentation shall be submitted as required by Table 2-1.

Table 2-1 Documentation requirements

<table>
<thead>
<tr>
<th>Object</th>
<th>Document type</th>
<th>Additional description</th>
<th>Info code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davit structure</td>
<td>C010 - Design criteria</td>
<td>Operational limitations (principal loads, max operational list and trim, exceptional loads, safe state, etc).</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>C020 - Assembly or arrangement drawing</td>
<td>A drawing showing how the parts of a mechanical assembly is arranged together.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>C030 - Detailed drawing</td>
<td>Davit structure and components for slewing, telescoping. Winches with gears and brakes.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>C040 - Design analysis</td>
<td>See [2.1.2].</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>C050 - Non-destructive testing (NDT) plan</td>
<td>A document describing the methods, extent and criteria for the non-destructive testing that shall be performed.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z051 - Design basis</td>
<td>A document describing: — regulatory basis for the design, i.e. applicable rules, regulations and standards — design principles applied — technical specification — davit operational philosophy.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z060 - Functional description</td>
<td>A document describing: — all functions incorporated in the system and their technical realization — all interfaces towards other systems, including their technical realization.</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z161 - Operation manual</td>
<td>See [2.1.3].</td>
<td>FI</td>
</tr>
<tr>
<td>Testing</td>
<td>Z252 - Test procedure at manufacturer</td>
<td>A document describing the test configuration and test methods for testing at the manufacturer's works, specifying for each test: — initial condition — how to perform the test, what to observe during the test and acceptance criteria for each test — the tests shall cover normal modes and failure modes.</td>
<td>AP</td>
</tr>
<tr>
<td>Object</td>
<td>Document type</td>
<td>Additional description</td>
<td>Info code</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Power supply</td>
<td>Z030 - Arrangement plan</td>
<td>A drawing showing the arrangement of a specified system. All major equipment shown on the drawing shall be identified by tag number and name. Type and maker of prime mover or specification of other main and emergency power supply, including mechanical components.</td>
<td>FI</td>
</tr>
<tr>
<td>Electric power system</td>
<td>E170 - Electrical schematic drawing</td>
<td>A schematic drawing showing the configuration of the electrical circuits. Information on protection, synchronization, interlocks, under voltage trips, remote control circuits, cable list, etc. shall be included if relevant.</td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>Z090 - Equipment list</td>
<td></td>
<td>FI</td>
</tr>
</tbody>
</table>
| Hydraulic power system | S011 – Piping and instrumentation diagram (P&ID) | A diagrammatic drawing including the following:  
- components including reference identification (tag numbers)  
- size of pressure equipment and piping  
- piping with line numbers  
- pump type and capacity  
- type of valves and connections  
- type of expansion elements  
- location of shutdown and isolation valves  
- failure mode of control and shutdown and isolation valves  
- hydrostatic test pressure after installation on board, where required  
- instrumentation, including safety devices, control and monitoring equipment  
- signal lines, sufficient to describe the function  
- maximum flow through pumps and compressors  
- set points for all shutdown and isolation valves and rupture disks  
- design and operational data for the components  
- input and output signals from safety systems. | AP        |
<p>|                        | S042 - Hydraulic control diagram           | A schematic diagram showing hydraulic control lines and associated components as actuators, valves and similar. The operational mode that is shown, e.g. normal operation with pressure applied, shall be stated. The failure mode of the components, e.g. close on loss of power, shall be stated. | FI        |
|                        | Z060 - Functional description              | As above.                                                                                                                                                                                                            | FI        |
|                        | Z090 - Equipment list                      |                                                                                                                                                                                                                      | FI        |
| Control and monitoring | I200 - Control and monitoring system documentation | A documentation package providing information corresponding to the following set of documentation types, as relevant. Functional description of safety system and the safety equipment to be included. | FI        |</p>
<table>
<thead>
<tr>
<th>Object</th>
<th>Document type</th>
<th>Additional description</th>
<th>Info code</th>
</tr>
</thead>
<tbody>
<tr>
<td>I020 – Control system functional description</td>
<td>A textual description with necessary supporting drawings, diagrams and figures to cover: 1) system configuration and arrangement (overview of the entire system) 2) failure mode effect analysis addressing the generic risk contributors listed in [6.5] 3) description of the safety principles and equipment listed in Sec.6 4) system functionality covering control, monitoring, alarm and safety functions (allocation of functions to different system items) 5) redundancy principles and switching mechanisms 6) self-diagnostics and alarming functionalities 7) safe states for each function implemented.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>1030 – System block diagram (topology)</td>
<td>A schematic drawing showing: 1) arrangement of all main components 2) networks and connections between main components 3) interfaces with other systems 4) redundancy.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>I040 – User interface documentation</td>
<td>A description of: 1) user interface functionality 2) allocation of functions between work stations, operator stations and user interfaces 3) command transfer functionality.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>I050 - Power supply arrangement</td>
<td></td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>1110 – List of controlled and monitored points</td>
<td>A list or index identifying all input and output signals to the system containing at least: 1) tag number 2) service description 3) type of signal (e.g. analogue/ digital/...and input/output) 4) system allocation to hardware units for all signals (control, safety, alarm, indication).</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>I320 – Software change handling procedure</td>
<td>A procedure describing how software changes to the system are proposed, evaluated and implemented using a standardized, systematic approach that ensures traceability, consistency and quality; and that proposed changes are evaluated in terms of their anticipated impact on the entire vessel system.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Object</td>
<td>Document type</td>
<td>Additional description</td>
<td>Info code</td>
</tr>
<tr>
<td>--------</td>
<td>---------------</td>
<td>------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>Z252 – Test procedure at manufacturer</td>
<td>A document describing the test configuration and test methods for testing at the manufacturer’s works, specifying for each test: 1) initial condition 2) how to perform the test 3) what to observe during the test and acceptance criteria for each test. The tests shall cover normal modes and failure modes.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>I140 – Software quality plan</td>
<td>The software life cycle activities shall minimum contain procedures for: 1) software and hardware requirements specification 2) software and hardware design and development plans 3) software verification plans 4) software module testing 5) software integration testing 6) software validation, both functionality and failure modes. Items 3-6 may also be handled during manufacturing survey as part of a HIL testing scope.</td>
<td>FI</td>
<td></td>
</tr>
<tr>
<td>Z070 - Failure mode description</td>
<td>Required for davits that are controlled by wireless remote control system and/or by electrical components and circuits which constitute the only mean to control the essential functions. A document describing the effects due to failures in the systems, not failures in the equipment supported by the systems. The following aspects shall be covered: — list of failures which are subject to assessment, with references to the system documentation — description of the system response to each of the above failures, including a list of davit safe positions — comments to the consequence of each of these failures.</td>
<td>AP</td>
<td></td>
</tr>
<tr>
<td>Failure mode and effect analysis (FMEA) and hazard and operability study (HAZOP)</td>
<td>Z071 - Failure mode and effect analysis (FMEA) and hazard and operability study (HAZOP)</td>
<td>Required for davits, see also [5.7]. A document where the davit system response to failures are identified and analysed. The FMEA applies for the davit as a unit, not limited to only a subsystem. See DNV-RP-D102 (Failure mode and effect analysis (FMEA) of redundant systems) for recommended practice when providing objective evidence of required redundancy and fault tolerance.</td>
<td>FI</td>
</tr>
</tbody>
</table>
2.1.2 Design analysis

For structural parts and components, the drawings shall be supplemented with calculations demonstrating that the structural strength complies with the requirements. The documentation shall contain information regarding objectives, premises, assumptions and conclusions. A complete listing of structural components and parts subjected to strength calculations shall be submitted. The list shall include information of:

— permissible stress (WSD)
— types of failures considered (SF to tensile, buckling, fatigue, yielding)
— elastic or plastic analysis performed.

See also Sec.3 Materials and fabrication.

2.1.3 Operation manual

A manual shall be prepared, containing information regarding operation modes procedures that shall include, but not be limited to:

— the operational limitations, such as maximum working load, max. operation vessel angle, max. operation vessel speed, user interface description, user interface description, failure detection and identification, restoration of functions, etc.
— normal use of the davit with information of:
  — launching/recovery procedures
  — preparation procedure prior to personnel boarding, preparation procedure for stowing etc.
— restricted state of operation mode procedure with information of:
— fixed procedures as how the davit shall be operated and available functions and minimum available operational time, hazard identification
— resumed check list with step by step information for normal procedures and restricted state of operation procedures.

Guidance note:
IMO MSC.1/Circ.1205 from 26 May 2006 summarizes the basic contents of an operational manual nevertheless it shall be enhanced with additional information that may accrue from complying with this standard.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.1.4 Service manual
A manual shall be prepared, containing information regarding periodical inspection and maintenance procedures that shall include, as minimum:
— checklists and list of key items that shall be submitted to inspection
— maintenance routines and instructions for standard repairs
— information on lubrication and recommended lubricants
— lists of replaceable parts with recommended wearing limit of parts
— log or records for inspections and maintenance
— pre/post-test inspection procedures as well as load test procedures
— list of components requiring particular attention during inspections, as well as the inspection procedures for these components.

Guidance note:
Records of the routine inspection and maintenance of onboard lifting appliances and winches should be maintained on board.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

2.2 Certification

2.2.1 General
Product certificates are in general issued based on material certification, design approval, prototype or production testing.
Pedestal flange shall be approved according to DNVGL-ST-0378 [4.4.4].

Table 2-2 Certificate requirements for davits

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard</th>
<th>Additional description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slewing rings</td>
<td>PC</td>
<td>DNV GL</td>
<td>DNVG-ST-0378</td>
<td></td>
</tr>
<tr>
<td>Hydraulic cylinders</td>
<td>PC</td>
<td>DNV GL</td>
<td>DNVGL-CG-0194</td>
<td></td>
</tr>
<tr>
<td>Winches</td>
<td>PC</td>
<td>DNV GL</td>
<td>DNVG-ST-0378</td>
<td>For luffing and telescoping winches.</td>
</tr>
<tr>
<td>Sheaves</td>
<td>PC</td>
<td>DNV GL/Manufacturer</td>
<td>DNVG-ST-0378</td>
<td>Product certificate (PC) or work certificate (W) issued by manufacturer will be satisfactory for un-welded sheaves.</td>
</tr>
</tbody>
</table>
### Object
- **Wire ropes**
  - Certificate type: CG4
  - Issued by: DNV GL
  - Certification standard: DNVG-ST-0378
  - Additional description: Certificate of test and thorough examination of wire rope. Alternatively ILO form No.4 issued by other competent person according to IL 152.
- **Fiber ropes**
  - Certificate type: PC
  - Issued by: DNV GL
  - Certification standard: DNVGL-ST-0378
  - Additional description: The Society’s product certificate in accordance with DNVGL-OS-E303.
- **Transmission gears and brakes**
  - Certificate type: PC
  - Issued by: DNV GL/Manufacturer
  - Certification standard: DNVG-ST-0378
  - Additional description: When issued by the manufacturer shall state compliance of the design with the approved drawings.
- **Slewing gear**
  - Certificate type: PC
  - Issued by: Manufacturer
  - Certification standard: DNVG-ST-0378
  - Additional description: Also other transmission gears for non-critical applications, see [4.4.5.4]. When issued by the manufacturer shall state compliance of the design with the approved drawings.
- **Hydraulic components**
  - Certificate type: TR
  - Issued by: Manufacturer
  - Certification standard: N/A
- **Control system**
  - Certificate type: PC or TA
  - Issued by: DNV GL
  - Certification standard: DNVG-ST-0498
  - Additional description: Product certificate, valid type approval (TA) issued by DNV GL.

*PC = Product Certificate, MC = Material Certificate, TR = Test Report, TA = Type Approval*

### 2.2.2 Certification procedure

#### 2.2.2.1 General
The following activities are covered by this standard:
- design approval
- survey during fabrication
- witness of testing and marking.

#### 2.2.2.2 Design examination
Load-carrying and other important components of a davit are subject to design examination with respect to strength and suitability for its purpose. A design approval is granted when the design examination has been concluded without detection of non-compliance towards this standard.

Structural strength examination of components related to power supply and safety equipment is not part of the scope of this certification.

The design approval may be obtained either on a case-by-case basis or as a type approval.

**Guidance note:**
Type approval means that the design as approved can be applied for identical units to be fabricated, i.e. requested documents need not to be submitted for each unit.
Type approval is based on certain conditions and its validity period is limited see DNVGL-CP-0338.
Each davit is given a separate product certificate.
2.2.2.3 Survey during fabrication and installation
A survey during manufacture of each separate davit shall be carried out by DNV GL's surveyor in order to ascertain compliance with the approved drawings and other requirements from this certification standard as well as general good workmanship.

As an alternative to survey during manufacture of each separate davit, modified survey procedures and survey arrangements may be accepted provided the manufacturer operates a quality-assurance system approved and certified by DNV GL.

Before being put into service for the first time, the davit shall be tested according to the approved "Factory overload test and functional test" by a competent person and in case of DNV GL class vessel shall be witness by DNV GL surveyor.

2.2.2.4 Testing and marking
Testing and marking shall be performed as per App.C.

2.2.2.5 Extension of scope of work
Upon request from the customer, the scope of work may be extended beyond the subjects and aspects covered in this certification standard.

Extensions shall be agreed in writing, DNV GL may if found necessary, require for the customer to present reference documents for the extended scope of work, such as authority regulations, norms and standards.

In case of disputes regarding interpretations of requirements on which the extended work is based, the customer shall contact the publisher/owner of the requirements and obtain their written interpretation. If the publisher/owner is not willing to interpret the disputed requirement, or for other reason an interpretation cannot be acquired, DNV GL interpretation will prevail.

2.2.2.6 Limited scope of work
Upon request from and agreed with the customer, parts of the scope of work, components, systems or specific aspects or requirements may be excluded from the scope of work specified in this certification standard. This will be annotated in the documentary evidence of the completed assignment (DVR).

DNV GL will not agree to limit the scope of work or parts of the suggested services if it is of the opinion that it may lead to hazards or unacceptable lowering of the safety standard.

A limited scope of work is not applicable when a DNV GL product certificate is required.

2.2.2.7 Safe means of access and personnel safety devices
Personnel safety protection devices such as guard rails, shielding, safety of ladders, etc. are not covered by this standard scope of work.

2.2.3 Certificate
As a minimum the certificate shall contain:
— design parameters/limitations
— list of certified sub-components
— reference to valid type approval certificates/approval letters for the certified sub-components
— reference to a signed prototype test report and functional tests report as applicable
— list of tests to be carried out after certification (factory overload test and installation test).

Guidance note:
The product certificate is issued based on the approved factory overload test and installation test.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

DNV GL's formal documentation of the certification to the customer will be the product certificate issued upon completion of the project.
2.2.4 Services

Figure 2-1 describes the services offered and the associated documents issued by the society to prove compliance with technical and procedural requirements of this standard.

![Diagram]

Figure 2-1

* in case of agreed limited scope of work.

The manufacturing survey report shall clearly state that:

— only the davit structure is covered
— the DNV GL product certificate for the davit shall be issued following certification of the system and control and monitoring system and successful functional test.

2.3 In operation follow-up

It is recommended to have a regular inspection during operational use according to an established plan, either from manufacturer and/or as defined by regulatory bodies.

Such periodic inspection may be required to be carried out by DNV GL as part of classification’s scope annual survey. As an alternative the original manufacturer/authorized representative (recognised by flag/state authorities) shall carry out such inspections.

Notwithstanding the above, major repairs or modifications which may affect the validity of the certificate shall be approved by DNV GL.
SECTION 3 MATERIALS AND FABRICATION

3.1 General
This section describes the structural categorization, selection of materials and inspection principles to be applied in design and construction of davits.

The below requirements for structural member’s materials and equipment are applicable for davits with design temperature TD down to -30°C. Materials for davits with design temperature below -30°C shall be especially considered. Design temperature is defined in [3.2].

Materials with properties deviating from the requirements in this section shall be accepted on case by case and shall be proposed to DNV GL prior commencing design.

As an alternative, materials that comply with national or proprietary specifications may be accepted provided such specifications show reasonable equivalence to the requirements in DNVGL-OS-B101 or are especially approved by DNV GL.

3.2 Design temperature
Design temperature is a reference temperature used as criteria for the selection of material grades.

The design temperature TD for davits is defined as the lowest acceptable service temperature.

For davits installed on vessels or mobile offshore units classified by DNV GL, the design temperatures of the davit and the supporting vessel/unit are recommended to be compatible.

If not otherwise specified, the design temperature shall be -20°C.

3.3 Structural category
The following categorization is defined for structural members:

— Special: Highly stressed areas where no redundancy for total collapse exists.
— Primary: Structures carrying main load as well as components with highly stressed areas.
— Secondary: Structures other than primary and special members.

Slewing bearings with flanges shall normally be categorized as special, other structure, including hinges, connection to the deck and pedestal, transmitting principle loads shall normally be categorized as primary.

The categories shall be agreed with DNV GL in each case.

Bolt connections shall be categorized according to DNVGL-ST-0378 [3.4.4.1].

Guidance note:
Highly stressed areas are areas were the stress level is more than 85% of allowable stress when considering 4.5 safety factor to material ultimate strength.

3.4 Material manufacture survey, certification and testing procedures
Certificates covering specification of the chemical composition and mechanical properties shall be presented for all materials for all load-carrying structures and mechanical components. The test values shall show conformity with the approved specification. Test specimens shall be taken from the products delivered.

For testing/retesting procedures and requirements, see DNVGL-OS-B101, as applicable.

Guidance note:
DNV GL approved material manufacturer is not required.
For slewing rings, DNV GL inspection certificate 3.2 is required unless otherwise agreed. The materials shall be adequately marked for identification. The marking shall at least comprise name or trade mark of the manufacturer, material grade, heat number, and for 3.2 certificates, either the stamp of the purchaser's authorized inspection representative or the inspector of a flag/state recognized body. Marking and identification of smaller items, e.g. bolts and nuts, shall be especially agreed upon between manufacturer and DNV GL, but shall at least comply with a fastener product standard. Materials without proper identification shall be rejected unless renewed testing verifies compliance with approved specifications. The number and type of tests will be decided by DNV GL in each case.

### 3.5 Structural materials

#### 3.5.1 Rolled structural steel for welding

##### 3.5.1.1 General
Certificates covering specification of the chemical composition and mechanical properties shall be presented for all materials for all load-carrying structures and mechanical components. The requirements to chemical composition, mechanical properties, etc. are given in DNVGL-OS-B101. As an alternative, materials that comply with national or proprietary specifications may be accepted provided such specifications show reasonable equivalence to the requirements in DNVGL-OS-B101 or are especially approved. The grade of steel to be used shall in general be related to the service temperature and thickness for the applicable structural category, see DNVGL-OS-C101 Table 3-5.

##### 3.5.1.2 Impact test
Required impact test temperatures are dependent on design temperature TD and the material thickness. Impact test temperatures are given in Table 3-1 for structural steel for special, primary and secondary applications. For definition of design temperature, see [3.2].

For structural members subjected to compressive and/or low tensile stresses, modified requirements may be considered, i.e. greater material thicknesses for the test temperatures specified. Impact test temperature for flanges for slewing bearings shall be as for primary members given in Table 3-1 based on actual thickness. When welding a thinner plate to a thicker plate, e.g. connecting a flange to the supporting structure for the flange, inserted reinforcement rings etc., the following shall apply, provided that the thicker plate does not contain butt welds:

The impact test temperature shall be the lower of the temperatures according to Table 3-1, based on t1 or 0.25 x t2 where:

\[
t_1 = \text{thickness of the thinner supporting plate}
\]

\[
t_2 = \text{thickness of the flange.}
\]

However, the impact test temperature for the flange (thicker plate) shall not be higher than the required test temperature, based on t2 according to Table 3-1, plus 30°C.

**Table 3-1 Impact test temperatures for welded structural steel**

<table>
<thead>
<tr>
<th>Material thickness ( t ) in mm</th>
<th>Impact test temperature in ( ^\circ \text{C} )</th>
<th>Structural steel for special and primary members ( 2) )</th>
<th>Structural steel for secondary members ( 2) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( 6 \leq t \leq 12 ) ( 3) )</td>
<td>( T_D + 10 )</td>
<td>Test not required</td>
<td>Test not required</td>
</tr>
<tr>
<td>( 12 &lt; t \leq 25 )</td>
<td>( T_D )</td>
<td>Test not required</td>
<td>Test not required</td>
</tr>
</tbody>
</table>
### 3.5.2 Rolled structural steel not for welding

#### 3.5.2.1 General
Rolled steel for special and primary components other than those mentioned in [3.5.2.2] (e.g. mechanisms) shall be specified with reference to a recognized standard. The material shall be delivered in the following conditions:

- carbon and carbon/manganese steel in normalized condition
- alloy steel in quenched and tempered condition
- as rolled (AR) condition, when subjected to special consideration.

For all materials, impact toughness shall be documented by Charpy V-notch impact tests. Test temperatures shall be as specified in Table 3-1 but, in the case of low calculated stresses, e.g. not exceeding 50 N/mm², a test temperature of 20°C will be accepted. Required minimum impact energy shall be as required for welded parts, see [3.5.1.2].

### Table 3-2 Impact testing for rolled steel not for welding

<table>
<thead>
<tr>
<th>Material thickness t in mm</th>
<th>Impact test temperature in °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>t ≤ 10</td>
<td>Impact test not required</td>
</tr>
<tr>
<td>10 &lt; t ≤ 50</td>
<td>TD - 20</td>
</tr>
<tr>
<td>50 &lt; t ≤ 100</td>
<td>TD - 10</td>
</tr>
<tr>
<td>t &gt; 100</td>
<td>TD</td>
</tr>
</tbody>
</table>

#### 3.5.2.2 Bolts and nuts
Materials for bolts and nuts shall comply with the requirements in [3.5.4] for bolts and nuts. This includes requirements for chemical composition and mechanical properties.

#### 3.5.2.3 Rolled rings
Rolled rings for important components such as slewing rings, toothed wheel rims etc. shall comply with the requirements for steel forgings, see [3.5.3].

### 3.5.3 Steel forgings

#### 3.5.3.1 Steel forgings
Steel forgings shall comply with the requirements in DNVGL-OS-B101.

As an alternative, materials that comply with national or proprietary specifications may be accepted provided such specifications show reasonable equivalence to the requirements in DNVGL-OS-B101 or are especially...
approved. As a minimum the following particulars shall be specified: manufacturing process, chemical composition, heat treatment, mechanical properties and non-destructive testing. For machinery components, see DNVGL-RU-SHIP Pt.4 Ch.2 Sec.3.

Impact testing requirements shall not be less than given in Table 3-3.

**Table 3-3 Impact testing for steel forgings**

<table>
<thead>
<tr>
<th>Design temperature $T_D$</th>
<th>Test temperature</th>
<th>Minimum Charpy value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_D \geq -20^\circ C$</td>
<td>0°C</td>
<td>27 J</td>
</tr>
<tr>
<td>$-20^\circ C &gt; T_D &gt; -30^\circ C$</td>
<td>-20°C or (0°C)</td>
<td>27 J (48 J)</td>
</tr>
</tbody>
</table>

### 3.5.3.2 Forged rings for slewing bearings

Specifications of slewing rings essential for the structural and operational safety of the davit are subject to individual approval by DNV GL. All relevant details shall be specified such as chemical composition, mechanical properties, heat treatment, depth and hardness of surface hardened layer and surface finish of fillets. Position of test specimens shall be indicated. Method and extent of non-destructive testing shall be specified and the testing procedures shall be stated. Detailed information about method of manufacture shall be submitted.

For each new material of which the manufacturer has no previous experience and for any change in heat treatment of a material previously used, a principal material examination shall be carried out. This means that DNV GL may impose additional requirements not specified in this standard. The results shall be submitted to DNV GL for consideration. The programme for such examination shall be agreed with DNV GL. All test results shall comply with the approved specifications.

Steel for slewing rings shall satisfy the requirements of Table 3-4.

**Table 3-4 Slewing materials**

<table>
<thead>
<tr>
<th>Heat treatment</th>
<th>According to approved specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charpy V-notch test temperature</td>
<td>$T_D$</td>
</tr>
<tr>
<td>Charpy V-notch value</td>
<td>Average 42 J</td>
</tr>
<tr>
<td></td>
<td>Single min. value 27 J</td>
</tr>
<tr>
<td>Elongation A5</td>
<td>14%</td>
</tr>
<tr>
<td>Fatigue properties</td>
<td>Documentation may be required by type tests on specimen of ring section</td>
</tr>
<tr>
<td>Fracture toughness</td>
<td>Documentation may be required by type tests on specimen of ring section in question</td>
</tr>
</tbody>
</table>

### 3.5.4 Bolts and nuts

Bolt connections are normally considered to be in the following groups:

— Special – where it is part of a slewing ring connection.
— Primary – where the bolts or nuts are transferring principle loads
— Secondary – where the bolts or nuts are transferring load, not belonging in the category special or primary. Examples are bolt connections in driver’s cabin, platforms, stairs and ladders.

Bolts and nuts for use in connections categorized as special or primary shall conform with and be tested in accordance with a recognized standard, e.g. pertinent parts of ISO 898 or other recognized standard. Additional requirements to testing and inspection of slewing ring bolts are given in Table 3-5.
### Table 3-5 Testing and inspection of slewing ring bolts

<table>
<thead>
<tr>
<th>Strength Class, ISO 898, or equivalent</th>
<th>Diameter d in mm</th>
<th>Ultimate strength N/mm²</th>
<th>Yield strength. Minimum N/mm²</th>
<th>Elongation A5</th>
<th>Required Charpy V energy 1) at test temp. as required for rings Table 3-4</th>
<th>Fracture mechanics testing (CTOD)</th>
<th>Surface inspection 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.8</td>
<td>d &lt; 25</td>
<td>800 - 1000</td>
<td>640</td>
<td>14</td>
<td>--</td>
<td>42 J</td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>d ≥ 25</td>
<td>1000 - 1200</td>
<td>900</td>
<td>12</td>
<td></td>
<td>42 J</td>
<td>Visual and magnetic particle (MPI)</td>
</tr>
<tr>
<td>10.9 3)</td>
<td>d &lt; 25</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td>42 J</td>
<td>Visual</td>
</tr>
<tr>
<td></td>
<td>d ≥ 25</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
<td>--</td>
<td>Visual and magnetic particle (MPI)</td>
</tr>
</tbody>
</table>

1) Average value. Single value accepted to be 30% lower.
2) For all the bolts (100%), magnetic particle testing shall be carried out at least 48 hours after completion of quenching and tempering for bolts with yield strength above 355 N/mm². Inspection shall be in accordance with ASTM E 709. Depth of longitudinal discontinuities shall not exceed 0.03 of the nominal diameter. Transverse cracks will not be acceptable irrespective of crack depth and location. Other surface irregularities will be considered in each case.
3) Bolt material having minimum specified yield strength higher than 1100 N/mm² will normally not be accepted.

Bolt connections considered as secondary shall be made from suitable materials.
Nuts may be accepted to be in one strength class lower than the bolts of bolt/nut assemblies.
Bolts and nuts shall be delivered with the following certificates as per EN10204, verifying compliance with the material requirements and other test requirements:
DNV GL inspection certificate type 3.2 for slewing ring bolts and nuts.
2.1 test report for bolts and nuts in primary and secondary connections.
Slewing ring bolts shall have rolled threads, and the rolling shall be performed after final quenching and tempering of the bolts. 12.9 bolts are not accepted as slewing ring bolts.
Fasteners (bolts, nuts and washers) in marine environment shall normally be hot-dipped galvanized or sherardised with coating thickness min. 50 micrometre. If special thread profiles or narrow tolerances prohibit such coating thickness, bolts and nuts may be supplied electro-plated or black provided properly coated/painted after installation. Pickling and electro-plating operations shall be followed by immediate hydrogen-relief (degassing) treatment to eliminate the risk of hydrogen embrittlement.
Galvanizing of bolts and nuts may be acceptable provided additional loss of bolt load (pretension) of at least 4% is compensated for.

#### 3.5.5 Steel castings

Steel castings shall comply with the requirements in DNVGL-OS-B101.

#### 3.5.6 Steel pipes, tubes and fittings

Steel pipes, tubes and fittings shall comply with the requirements in DNVGL-OS-B101.
3.5.7 Aluminium alloys
Aluminium alloys shall comply with the requirements in DNVGL-OS-B101.

3.5.8 Steel wire ropes
Steel wire ropes shall comply with the requirements in DNVGL-ST-0378 [3.10].

3.5.9 Fiber ropes
Fiber ropes shall comply with the requirements in DNVGL-ST-0378 [5.2.6].

3.6 Fabrication and testing

3.6.1 General
The manufacturer shall have a system for quality control involving competent personnel with defined responsibilities that shall cover all aspects of quality control. For qualification of welders, see DNVGL-OS-C401. The materials shall be identifiable during all stages of manufacturing and construction. Manufacturing and construction shall be in accordance with the approved drawings and specifications. The specification shall refer to recognized codes, standards or rules relevant for the structure in question. Supplementary requirements amending the reference documents may be stipulated. Dimensional tolerances specified in the design analysis of the davit structures shall be complied with during manufacturing and construction. All defects and deficiencies shall be corrected before the structural parts and equipment are painted, coated or made inaccessible. Alternative methods of making joints may be considered and shall be subject for approval by DNV GL on each case.

3.6.2 Forming of materials
Cold forming shall comply with the requirements in DNVGL-OS-C401 Ch.2 Sec.2. Alternatively other relevant internationally recognized code or standards applicable may be acceptable if it is proposed by designer and accepted by DNV GL prior to commencing design.

3.6.3 Welding
All aspects relating to welding (i.e. welding procedures, consumables, welding preparations, welding performance, repairs, heat-treatment, production, inspection, NDT and acceptance criteria) shall comply with the requirements in DNVGL-OS-C401.

3.6.4 Non-destructive testing acceptance criteria for components machined after forged/cast
Acceptance criteria from the following documents can be used for NDT of machined components, unless otherwise specified in the approved manufacturer's specification:
For forged components:
— IACS Recommendation no.68, Inspection zone 1.
For cast components:
— IACS Recommendation no.69, Quality level 1.

NDT testing shall be focused on critical areas. Extent to be specified by the manufacturer and shall be according to recognized standards.

Guidance note:
The objective and scope of quality control for materials, material testing and documentation thereof is to verify that the relevant properties as specified by the designer and accepted by DNV GL are obtained.

---end---of---guidance---note---

3.6.5 Material protection against corrosion

3.6.5.1 Steel
Steel surfaces exposed to marine atmospheric conditions shall be protected by a suitable coating system. Steel surfaces to which application of coating is not possible and which are exposed to internal corrosive conditions shall be protected by other protective systems such as oil, grease, grouting etc. Bolts, nuts and associated elements shall be protected by hot-dip galvanizing according to relevant standards, e.g. BS 729 or ASTM A 153-82. Alternatively they may be fully encapsulated and the open space be filled with inhibited oil, grease etc.
Other protection methods may be accepted by DNV GL provided they are in line with DNVGL-CG-0288.

3.6.5.2 Aluminium
Corrosion protection for aluminium alloys shall comply with the requirements in DNVGL-RU-HSLC Pt.3 Ch.3 Sec.2.
Other protection methods may be accepted upon special consideration by DNV GL.

3.6.5.3 Steel and aluminium connections
In areas exposed to green sea/sea spray, a non-hygroscopic material shall be applied between steel and aluminium in order to prevent galvanic corrosion. Bolts with nuts and washers shall be of stainless steel, quality A4-316 or equivalent.
Horizontal inertia forces in bolted connections may be required to be taken up by metal to metal stoppers with insulation tape in the gap.
Aluminium superstructures that are provided with insulating material between aluminium and steel shall be earthed to the hull see DNVGL-RU-SHIP Pt.4 Ch.8 Sec.2.
SECTION 4 STRUCTURAL DESIGN AND STRENGTH

4.1 General considerations and safety factors
Permissible stresses for davit structural members shall be verified taking in consideration a safety factor of 4.5 against buckling and ultimate strength of the material used.
Hoisting hooks falls and other structural members and fittings used in the launching equipment shall have a safety factor of 6 against ultimate strength of the material used.

4.2 Design loads

4.2.1 General
The loads to be considered in the analysis of structures are divided into:
— principal loads see [4.2.2]
— exceptional loads due to davit mishandling or system single failure see [4.3.3]
— loads due to climatic effects see [4.2.4].
The determination of the loads specified by the designer shall be documented with enclosed calculations, referenced to standards, or other justification.
Other relevant loads shall be considered if applicable.

4.2.2 Principal loads
The following loads shall be considered principal loads:
— loads due to dead weight of the components: self-weight of the structure and all installed equipment
— loads due to live load (MWL).

4.2.3 Exceptional loads
Loads that may result from system single failures or davit mishandling shall be considered during davit design assessment, i.e., davit structure shall include robustness to withstand these without consequences to davit essential functions or risks to personnel see [5.1.1.2].
The following loads shall be considered exceptional loads:
— loads that result from system single failures or
— loads that result from system mishandling.

Guidance note:
Unless sound reason recommends, each exceptional load case may be considered independent from each other, i.e., they are not actuating simultaneously and rather each shall be part of an independent load combination.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

4.2.4 Loads due to climatic effects
The following loads shall be considered loads due to climatic effects:
— loads due to green sea forces and wind affecting WB/TB at stowage position
— ice and snow load.
**Guidance note:**

Sea pressure loads (green sea loads) vary according to vessel type and the actual location of the davit on vessel; in general environmental loads on MOUs will be less than those on ships. Sea pressure loads should be calculated according to DNVGL-RU-SHIP Pt.3 Ch.4 Sec.5 and DNVGL-CG-0156.

Ice accretion from sea spray, snow should be considered, where relevant.

Other environmental conditions may be applied upon request from the customer. Compliance/non-compliance with the above requirements may be mentioned in the certificate.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

### 4.3 Load combinations

#### 4.3.1 General

Listed below are the generic load combinations to be considered. Applicability of each load combination, as well as any additional load combination shall be evaluated and agreed with DNV GL on a case-by-case.

— normal working condition, the davit in operation mode (lowering or hoisting WB/TB with its full complement of people see [4.3.2])
— slewing/swivelling condition see [4.3.3]
— exceptional load condition see [4.3.4]
— parked position/transit (environmental conditions when applicable see [4.3.5]).

It is recommended that a sensitivity analysis is performed in order to identify all operational configurations and loads acting on the davit for each load combination. Based on this, the davit structure shall be dimensioned for the most unfavourable conditions.

#### 4.3.2 Normal working condition

The following loads shall be included in normal working load combination:

— principal loads: self-weights and live loads.

Other relevant conditions shall be agreed with DNV GL on a case-by-case basis.

#### 4.3.3 Slewing/swivelling condition

The following loads shall be include in slewing/swivelling load combination:

— principal loads: self-weights and live loads if applicable.

**Guidance note:**

Live loads shall be considered if boarding is possible from stowage position. Other relevant conditions shall be agreed with DNV GL on a case by case basis.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

Other relevant conditions shall be agreed with DNV GL on a case by case basis.

#### 4.3.4 Exceptional load condition

The following loads shall be included in exceptional load combination:

— principal loads: self-weights and live loads
— loads impose to the structure due to a specific system single failure or davit mishandling.

Loads that may arise to the structure due to davit mishandling or system single failure shall only be considered if no mitigating measures are implemented see also [5.1.1.3]. Other relevant conditions shall be agreed with DNV GL on a case-by-case basis.
4.3.5 Parked position/transit

The davit is parked when completely pulled-in and WB/TB resting in a cradle or similar:
— principal loads: self-weights in light load condition
— loads due to green sea forces and wind affecting WB/TB at stowage position
— ice and snow load.

4.4 Strength calculations

4.4.1 General

It shall be demonstrated that structures and components have the required safety against the following types of failure:
— all structural members, 4.5 safety factor against buckling and material ultimate strength
— falls, suspension chains, links and blocks used in the launching equipment, 6 safety factor against material ultimate strength
— yielding and buckling as per [4.4.2] and [4.4.3] when verifying exceptional load condition [4.3.4]
— fatigue fracture.

The safety shall be evaluated for all applicable load combinations defined in [4.3]. For each of these cases and for each member or cross section to be checked, the most unfavourable position and direction of the forces shall be considered.

The strength calculations shall be based on accepted principles of structural strength and strength of materials. When applicable, plastic analysis may be used if elastic methods are not suitable to verify safety.

The verification of safety shall be based on the permissible stresses method **DNVGL-OS-C201 - WSD** with the safety factors given in this standard.

For aluminium structures, the capacity checks shall normally be based on **EN 1999-1** or equivalent internationally recognized standards with the safety factors given in this standard. In the case of welded connections, the respective mechanical properties in the welded condition shall be assumed. If these values are not available, the corresponding values in the soft condition shall be assumed.

For structures with nonlinear behaviour, limit state method should be used, and the safety factor, load factor and material factors shall be agreed with DNV GL on a case-by-case basis.

4.4.2 Excessive yielding verification for exceptional load condition

4.4.2.1 With reference to method of analysis and method of verification of safety given in Table 4-1, $\sigma_y$ is the guaranteed minimum yield strength (or 0.2% proof stress). If $\sigma_y$ is higher than 0.8 times the ultimate strength $\sigma_u$, it shall be used 0.8 x $\sigma_u$ instead of $\sigma_y$.

4.4.2.2 When using elastic analysis for cases of combined stresses, the permissible stresses (or the required safety factors) given in Table 4-1 refer to the equivalent stress according to von Mises. Local peak stresses in areas with pronounced geometrical changes may be accepted on a case by case evaluation.

4.4.2.3 Joints shall not be weaker than the minimum required strength of the members to be connected. For riveted joints, bolted joints, friction-grip joints, and welded joints the design shall be based on an internationally recognized standard.
4.4.3 Buckling verification for exceptional load condition

4.4.3.1 The guiding principle is that the safety against buckling shall be the same as the required safety against the yield limit load being exceeded. This principle indicates that the factors given in the second line of Table 4-1 should represent the normal requirement. However, other values may be required or allowed, for instance due to uncertainty in the determination of the critical stresses (or load) or due to the post-buckling behaviour. Required factors are given for various types of buckling in Table 4-2.

4.4.3.2 The safety factors given in Table 4.2 are based on the assumption that the critical stresses (or loads) are determined by recognized methods, taking possible effects of geometrical imperfections and initial stresses into account. Elastic buckling in Table 4.2 means that elastic buckling stress does not exceed the yield strength.

Alternatively other relevant internationally recognized code or standards applicable may be acceptable if it is proposed and agreed by DNV GL prior to commencing design.

Table 4-1 Criteria for the checking with respect to excessive yielding

<table>
<thead>
<tr>
<th>Method of verification</th>
<th>Exceptional load condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor</td>
<td></td>
</tr>
<tr>
<td>Elastic analysis</td>
<td>1.50</td>
</tr>
<tr>
<td>Plastic (ult. str.) analysis</td>
<td>1.69</td>
</tr>
<tr>
<td>Permissible stresses</td>
<td></td>
</tr>
<tr>
<td>Elastic analysis</td>
<td>$\sigma_y / 1.50$</td>
</tr>
</tbody>
</table>

For aluminium structures, the safety factors in Table 4-1 shall be multiplied with an additional safety factor, $SF_{AL} = 1.05$.

Table 4-2 Safety factors for the checking with respect to buckling

<table>
<thead>
<tr>
<th>Type of buckling</th>
<th>Safety factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic buckling</td>
<td>1.86</td>
</tr>
<tr>
<td>Elastic-plastic buckling</td>
<td>1.69</td>
</tr>
</tbody>
</table>

4.4.4 Checking with respect to fatigue

Checking with respect to fatigue shall be based on an internationally recognized standard applicable for structures intended to be used offshore (e.g. DNVGL-ST-0377, F.E.M. 1.001, etc.).

The fatigue assessment shall be performed on the davit and winch structure considering the cumulative damage effects of both the operational (including slewing) and transit/parked cases and shall consider, but not limit to, the following davit specifics:

— Operation time: not less than 20 years.
— Deployment/retrieval cycles per day.
— Translation and/or rotation cycles in the directions/around X, Y and Z axis (e.g. telescoping, slewing, etc.).
— Loads due to motion of the vessel on which the davit is mounted.
— Wind load and green sea forces may usually be excluded.
— The design fatigue factor (DFF) shall be in accordance with DNVGL-OS-C101.
— Stress acceptance levels according to the fatigue standard used.
4.4.5 Design and strength of particular components

4.4.5.1 General
The design and strength of particular components, such as slewing bearings, flanges, pedestals and pedestal adapters shall be based on DNVGL-ST-0378 [4.4] requirements.

4.4.5.2 Wheel rolling on rail/structure
Calculation of stress shall be done according to EN 13001-3-1 Annex C.4.
EN 1993-6 part 5 or other applicable internationally recognized standards shall be used if the wheel and runway beam design is not covered in EN 13001-3-1 Annex C.4. These standards shall be agreed with DNV GL.
Alternatively calculations can be made by means of FE calculations provided accepted by DNV GL.

4.4.5.3 Hydraulic Cylinders
Load carrying hydraulic cylinders shall fulfil the requirements in DNVGL-CG-0194 Hydraulic cylinders.
The design calculations for hydraulic cylinders shall be based on the design pressure or on load chart 'stroke-vs-force'.
Hydraulic cylinders are considered structural components and shall comply with requirements in [4.4.1].
Cylinder tube thickness safety factor shall be verified as defined in DNVGL-CG-0194, i.e., min (ReH/1.7; Rm/2.7).

4.4.5.4 Drive components
Drive components (e.g. gears transmitting braking forces) shall be designed according with DNVGL-ST-0378 requirements considering the specific use of the davit and consequences in case of failure and taking in consideration the WSD safety factor mentioned in this standard.

4.4.5.5 Wire rope end termination
Wire rope shall have their breaking strength affected by the type of end terminations. Maximum allowable reduced strength in accordance with shall be documented with ILO form 4.
SECTION 5 SYSTEMS

5.1 General

5.1.1 Design principles

5.1.1.1 Systems and their lay-out shall be designed in accordance with a relevant internationally recognized codes or standards and shall as far as relevant or applicable, comply with pertinent rules of DNV GL.

5.1.1.2 Davit systems design shall take into consideration the interaction between all davit sub-systems and in which a davit mishandling or system single failure shall not result in hazards to persons and equipment essential functions (fail safe concept).

5.1.1.3 In cases where a specific failure mode is not mitigated by system redundancy or implementation of a control and monitoring system, the acceptance shall be achieved by structural verification based on a load combination(s) that includes the effects of an abnormal configuration(s) and it is documented that the davit is able to resist these exceptional loads without consequences to the essential functions or risk to personnel see also [4.3.4].

Guidance note:
Davit design should be based on a systematic HAZOP and FMEA see [5.7] in order to identify all possible davit configurations that result from davit mishandling or system single failure and implemented measures to prevent hazards (when applicable). In cases where such mitigating measure is not accounting for a specific abnormal configuration then it shall be documented if davit is provided with proper robustness to resist this unusual circumstance.

5.1.2 Basic Requirements

5.1.2.1 Davit systems shall have defined fail-safe state in which they will return in case of failure detection or emergency. This means that all outputs return to default open/closed output in case of an emergency stop situation, loss of signal, loss of power or other defined failure modes. Diagrams and test-reports for defined safe state configuration including inputs/outputs should be delivered.

5.1.2.2 In general it can be assumed that safe state is immediate stop of all davit movements. Alternatively the safe state may not be a complete stop if it is demonstrated that unacceptable consequences for the personnel or for the equipment may accrue due to a complete system stop-situation.

5.1.2.3 Davits equipped with control and monitoring systems should engage into a safe state whenever an abnormal configuration is detected or in case of loss of signal for davits equipped with radio remote control system. Crew shall be warned by means of visual and acoustic signal, and the davit shall be kept in this state until the operator deliberately engage the davit into restricted state of operation. Maximum safety to personnel shall be the prime consideration and damage to equipment minimized.

5.1.2.4 Restricted state of operation shall be kept engaged while the launching appliance is brought into a normal configuration, or alternatively into a position where all persons can be safely evacuated, or in case of loss of signal, until the operator hand over the control of the davit to the back up control system operator. Restricted state of operation shall be accompanied by a visual and acoustic signal.
5.2 Electrical installations, equipment and systems

5.2.1 Requirements

5.2.1.1 Electrical installation shall comply with relevant recognized codes or standards pertinent to the location of the davit.

5.2.1.2 Electrical installations of DNV GL certified davits shall be designed based on the generic principles specified in DNVGL-RU-SHIP Pt.4 Ch.8, with the documentation and certification requirements listed in Table 2-1.

5.2.1.3 Davits electrical/electronic component(s) that constitute the single mean to attain control of davit essential functions shall be designed based on DNVGL-RU-SHIP Pt.4 Ch.8 and be defined as 'essential', see also [5.7.2].

5.2.1.4 All electrical equipment part of the control and/or safety system shall be type approved by an internationally recognized certification body, documenting suitability for the intended application in a marine environment.

Guidance note:
The requirement normally applies to the following components:
— switchboards
— motor starters and frequency converters, electric motors
— slip rings
— generators and transformers
— cables, termination accessories
— other components that may be essential for the electrical system functionality.

5.2.1.5 For davits on-board mobile offshore units (semi submersibles, jack-ups, etc.), additional requirements as specified by the governing DNV GL rules for classification: Offshore (OU) shall be applied.

Guidance note:
Relevance of the additional requirements may be agreed with DNV GL on a case-by-case basis.

5.2.1.6 Batteries shall not be located in a battery box at open deck exposed to sun and frost. Ventilation shall be arranged for all battery rooms, lockers and boxes to avoid accumulation of flammable gas. The air intake shall be in the lower part and air outlet shall be arranged in the upper part so that gas pockets cannot accumulate. Other information about batteries installation are covered by DNVGL-OS-D201 Sec.2 [9.4].

Guidance note:
Installation of battery types which may not produce explosive gasses but which may require other safety precautions will be evaluated on a case-by-case basis. Installation and ventilation recommendations from the manufacturer should always be followed.

An alarm shall be given at a manned control station if the charging of a battery fails, alternatively an alarm shall be given if the battery is being discharged.
5.3 Hydraulic systems

5.3.1 General

5.3.1.1 Hydraulic systems and their lay-out shall be designed and executed in accordance with a relevant internationally recognized code or standards and shall as far as relevant or applicable, comply with pertinent rules of DNV GL.

5.3.1.2 When designing hydraulic circuits, all aspects of possible single failure scenarios (including supply failure) shall be considered. In each case, components shall be selected, applied, mounted and adjusted so that in the event of a failure, maximum safety to personnel shall be the prime consideration, and damage to equipment minimized.

5.3.1.3 All parts of the system shall be designed or otherwise protected against pressures exceeding the maximum working pressure of a system or any part of the system or the rated pressure of any specific component.

5.3.1.4 Systems shall be designed, constructed and adjusted to minimize surge pressures and intensification pressures. Surge pressure and intensified pressure shall cause no hazards.

5.3.1.5 Loss of pressure or critical drops in pressure as well as missing hydraulic refilling shall not cause a hazard.

5.3.1.6 Leakage (internal or external) shall create no hazard.

5.3.1.7 Whatever type of control or power supply used (e.g., electrical, hydraulic, etc.), the following actions or occurrences (unexpected or by intention) shall create no hazard:
— switching the supply on or off
— supply reduction
— supply cut-off or re-establishment.

5.3.1.8 Hydraulic systems and other machinery in connection with the hydraulic system shall be designed to protect personnel from surface temperatures that exceed touchable limits by either insulating or guarding.

5.3.1.9 To facilitate maintenance, means shall be provided or components shall be so fitted that their removal from the system:
— shall minimize the loss of fluid
— shall not require draining of the reservoir
— shall not necessitate extensive disassembly of adjacent parts.

The fluid reservoir shall be designed with respect to:
— dissipation of heat from the oil
— separation of air
— settling of contamination in the oil
— maintenance work.

5.3.1.10 Indicators showing the fluid level shall be permanently marked with system “high” and “low” levels.

5.3.1.11 Air breathers on vented reservoirs shall be provided with means to filter air entering the reservoir to a cleanliness level compatible with the system requirements and taking into consideration the environmental conditions in which the system shall be installed.
5.3.1.12 Effective means for filtration and cooling of the fluid shall be incorporated in the system.

5.3.1.13 Means of obtaining a representative fluid sample shall be provided to allow for checking fluid cleanliness condition.

5.3.1.14 Valves for fluid sampling shall be provided with sealing and with warning signs marked "system under pressure".

5.3.1.15 The hydraulic fluid shall fit the operational temperature range which it may be subjected when in service.

5.3.2 Flexible hoses
Flexible hoses and couplings shall be delivered with 3.1 level documentation (type approval certificate issued by DNV GL is recommended).
Flexible hoses shall only be used:
— between moving elements
— to facilitate the interchange of alternative equipment
— to reduce mechanical vibration and/or noise.
Flexible hoses shall be located or protected to minimize abrasive rubbing of the hose cover.

5.3.3 Accumulators
Accumulators shall be delivered with 3.1 level documentation (type approval certificate issued by DNV GL is recommended).

5.3.4 Hydraulic cylinders
Cylinders shall be delivered with 3.1 level documentation (type approval certificate issued by DNV GL is recommended).

5.3.5 Testing
Each component shall be pressure tested to 1.5 times the design pressure, except for mountings which shall be tested at two (2) times the design pressure. The test pressure needs not to exceed the design pressure by more than 70 bar.
Hydraulic testing of the assembly shall be performed in the presence of a surveyor, unless otherwise agreed. The pressure from the overload testing is deemed sufficient and shall be maintained for a time sufficient for check of leakage. The assembly shall exhibit no sign of defects or leakage.

5.4 Pneumatic systems

5.4.1 General
Air intakes for compressors shall be so located as to minimize the intake of oil- or water-contaminated air.
When designing pneumatic circuits, all aspects of possible single failure modes (including supply failure) shall be considered. In each case, components shall be selected, applied, mounted and adjusted so that in the event of a failure, maximum safety to personnel shall be the prime consideration, and damage to equipment minimized.
5.4.2 Requirements

5.4.2.1 Loss of pressure or critical drops in pressure shall cause no hazard.

5.4.2.2 Leakage (internal or external) shall create no hazard.

5.4.2.3 Whatever type of control or power supply used, the following actions or occurrences (unexpected or by intention) shall not create a hazard:
— switching the supply on or off
— supply reduction
— supply cut-off or re-establishment.

5.4.2.4 Indicators showing the fluid level shall be permanently marked with system "high" and "low" levels.

5.4.2.5 Air supply to instrumentation equipment shall be free from oil, moisture and other contaminants. The dew point shall be below 5°C for air in pipes located in davit engine room. In pipes outside the engine room the air shall have a dew point below \((T_D-5)°C\).

5.4.2.6 Components requiring extremely clean air shall not be used.

5.4.2.7 Main pipes shall be inclined relative to the horizontal, and drainage shall be arranged.

5.4.2.8 Piping and pressure equipment’s shall comply with general principles of DNVGL-RU-SHIP Pt.4 Ch.6 Piping Systems or other relevant internationally recognized codes and standards.

5.5 Control and monitoring systems

5.5.1 General

5.5.1.1 Control and monitoring system design and components shall be selected, applied, mounted and adjusted so that in the event of a failure, personnel safety shall be the prime consideration and damage to equipment minimized. Control and monitoring systems supporting the davit essential functions, shall be designed with due consideration for robustness and availability.

5.5.1.2 Control system shall be designed based on the generic principles specified in DNVGL-RU-SHIP Pt.4 Ch.9 Control and monitoring systems the functional requirements in this section, safety requirements in Sec.6, and documentation and certification are given in Table 2-1. Independence of control and monitoring system is not mandatory.

5.5.1.3 Control and monitoring systems components and installation shall be designed to monitor abnormal configurations.

5.5.1.4 Control and monitoring systems shall be designed in a way were in case of need they can be override and shut down without consequences to equipment essential functions.

5.5.1.5 Control and monitoring system shall in case of loss of main power be feed by alternative power source.

5.5.1.6 It shall be possible to delay alarms to prevent false alarms due to normal transient conditions, unless otherwise agreed, the delay shall not be by more than 1.5 s.
5.5.1.7 When attested by FEMA, fixed arm cantilevered davits or davits designs where the craft is boarded from a position where the vertical motion is the remain step from the launching sequence, are exempted of being equipped with control and monitoring systems. Davits which the craft is suspended at vessel board in a way were it is not required to move the craft from stowed to boarding position, are only exempted if have as mandatory procedure to lower and hoist the craft for an height no smaller than 2 m before any person is allowed to embark.

5.5.1.8 Control and monitoring systems. Documentation and certification requirements are given in Table 2-1. The certification procedure shall consist of:
   — plan approval (assessment of manufacturer documentation, see Table 2-1)
   — manufacturing survey covering:
     — visual inspection
     — verification/witness test of performance (normal and degraded operation, e.g., restrict operation) according to functional requirements based on approved test programs
     — verification/witness test of failure mode behaviour
     — verification of implementation software quality plan covering life cycle activities, if applicable
   — issuance of certificate Form 86.70a.

5.5.1.9 The testing program shall verify the control system performance with regards to the davit functionality and safety.

5.5.1.10 The failure modes associated with the above functions identified and addressed in the failure mode description document and/or FEMA shall also be included in the testing program. Typical failures, but not limited to, are listed below:
   1) sensors or input devices failure modes (dropout, noise, calibration errors, drift, bias, signal freeze, wild point, etc.)
   2) failure mode of actuators, drives, power system components or other electro-mechanical components
   3) feedback from sensors on actuator failure modes
   4) failure modes in computer networks
   5) failure modes related to overload of networks (when applicable)
   6) failures affecting weighting and voting mechanisms
   7) failures affecting protective safety functions
   8) failures affecting alarms, monitoring, and analysis functions
   9) failures causing and/or otherwise affecting switch-over in redundant systems
   10) common mode failures affecting several components and/or signals
   11) other relevant failures.

Guidance note:
Full scale functional and physical failure mode testing of the integrated control and monitoring system may not always be practical/possible to perform during FAT/SAT. Consequently, the test scope may be split as follows:
   — Failure mode testing of software by means of physical or simulator based testing during manufacturing survey.
   — Factory testing of physical system (parts or complete) – functional, failure mode (reduced scope).
   — Site acceptance testing of physical system (complete).
Traceability shall be ensured by documenting actions performed during each stage of the testing process.

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5.5.1.11 For davits on-board mobile offshore units (semi submersibles, jack-ups, etc.), additional requirements as specified by the governing DNVGL-RU-OU shall be applied.
5.6 Wireless remote control systems

5.6.1 Requirements

5.6.1.1 The principles for wireless remote control shall be:
— A safe state for the wireless remote control system shall be defined. Wireless systems shall have a defined fail-safe mode in case of an emergency stop situation, loss of signal, loss of power or other defined failure modes. Wiring diagram and test-reports for all inputs/outputs should be delivered with the system.
— The system shall stop operation if the operator is not constantly actuating the wireless remote control, "hold to run" type.
— The data sent to/from the remote control unit shall be subjected to error detection and/or error correction.
— Transmitting of radio data shall be made possible by "handshaking".

5.6.1.2 The wireless communication with the davit shall not be disturbed by any other external communication signals, and it shall be designed in accordance with accepted standards for emission. Radio solutions shall be tested in accordance to ETSI EN 301 489 Electromagnetic compatibility and radio spectrum matters (ERM); Electromagnetic compatibility (EMC) standard for radio equipment and services.

5.6.1.3 If it cannot be proven that the frequencies allocated for the wireless communication for a specific davit are unique in all areas where the davit will be operated, and that such communication will never be interrupted by external communication signals, some kind of unique encryption or ID of the wireless communication or similar is mandatory.
The main concern is that such arrangements shall prevent other signals to controlling the davit movements.

5.6.1.4 Loss of communication with the remote control shall cause the davit engage into a safe state as outlined above.
Furthermore:
— By starting of the remote control unit a self-check shall be conducted in order to prevent movements.
— The davit shall also be provided with emergency stop easily accessible.
— The remote control unit shall be provided with a key-switch for closing when not in use.
— The remote control unit should also be provided with a "dead man button".
— The planned operation shall be subjected to an analysis where special hazards and risks are identified. Consequences of single failures shall be documented in the form of a failure mode and effect analysis.

5.7 System redundancy

5.7.1 General
Redundancy of components such as hydraulic cylinders, winches, gears, flexible hoses, hydraulic circuit, etc., is not required provided they are designed, tested and installed in accordance with a relevant internationally recognized code or standards or with pertinent DNV GL rule, and the components are protected from mechanical damage (e.g. overloading and abrasive rubbing, etc.) and subject to a regular inspection and maintenance programme.
5.7.2 Wireless remote controls and electrical components

When a wireless remote control system or an electrical/electronic component constitute the single mean to attain control of davit essential functions in the conditions prescribed in [7.1.2.8], (i.e. the operator is able to observe the craft during whole launching and recovery process), the design level of redundancy employed in the arrangement shall be to the extent that the davit maintains the ability to safely handle the work boat/tender boat after a single failure on the remote control system or electrical/electronic component for sufficient time, restrict operation, to bring the craft into a position were all persons can be evacuated, and alert personnel that the davit is no longer safe to be used. In these cases the wireless remote control and electric system design philosophy shall describe the main features of the design and identify the redundancy intent.
SECTION 6 SAFETY AND SAFETY EQUIPMENT

6.1 General

6.1.1 Safety functions
All davits shall be provided with safety functions, reducing the risk connected to davit operation. Safety functions shall be established using a risk based approach. It is up to the customer to select the technological platform for the safety functions. In principle, all alternatives providing safe operation will be accepted.
A series of components or systems to prevent the use of the davit outside operation limitation (e.g. automatic/manual protection systems, emergency stop function) shall be implemented as a safety system.

6.2 Safety system requirements

6.2.1 Provisions shall be taken so that the davit essential functions can still be made available after a failure from main power feeding system by means of incorporating alternative power source such as batteries, super-capacitors, connection to vessel emergency power generator, etc., with enough capacity to safely operate during established restricted state of operational time see also [6.2.1.4] item 2.

6.2.2 Provisions shall be taken so that the davit essential functions can still be made available after a failure from main power system (hydraulic or pneumatic) by means of incorporating alternative power source such as hydraulic pump, etc., with enough capacity to safely operate during established restricted state of operational time see also [6.2.1.4] item 2.

6.2.3 Provisions shall be taken so that the davit essential functions can still be made available after a failure from main control system by means of incorporating alternative control system, with enough capacity to safely operate during established 'restricted state of operation' time see also [6.2.1.4] item 2.

6.2.4 No single failure shall affect the availability to operate davit essential functions.

1) From the main power source, up to the actuators, elements or components that have the sole function as carrier of signals or power are not considered to be critical for safety system. These components may be part of the normal davit system as well as part of the safety system.

2) Where single failures do not compromise the functionality of the main power source, main power system or main control system (i.e. these systems are redundant), an alternative power source, emergency power system or safety control system are not deemed required.

3) For mutually independent safety control systems, elements or components of the main control system that have the function to transform or generate signals or power should be considered failed when designing the safety system.

6.2.5 The safety system shall constitute an alternative mean to bring the davit to a safe position and/or state in the following cases:
— failure/interruption of the main power supply
— failure in the main power unit
— failure in the control system.

A graphical representation of a basic safety system is presented in Figure 6-1:

![Figure 6-1](image-url)

**6.3 Stowage and precautions**

Means to safely secure the craft in stowage condition shall be provided. Whenever applicable the effect of green sea forces and wind and wind gusts in addition to vessel motions shall be considered.

**6.4 Bowsing, tricing and precautions**

Crafts that are not boarded in it’s stowed position, shall be fitted with means to be held against vessel's side for safe embarkation. This may be achieved by incorporating bowsing and tricing gear, or other equivalent equipment, to pull the craft it into the vessel side and secure to the structure. These components shall be so design so that they may also be released from within the craft and in case they are secured to the davit structure it should be demonstrated that under no circumstances the entire weigh of the craft may be taken by one bowsing pennant and overload a davit arm.

**6.5 Protection and precautions against fire**

Fire and fire ignition may arise from the davit itself or from the vessel/installation, and thereby lead to hazards. Necessary protection and precautions against fires and explosions shall be considered in each case, and shall be based on the hazardous area classification in which the davit or parts of the davit will operate:

1) Risk contributor: fire can arise from the davit itself (e.g. from warm surfaces, at davit connection with vessel power system, etc.) risk control measure:
   - Fire prevention measures mitigating the risk of fire outbreak shall be determined on a case by case basis and may include:
     — passive: heat shields, special coatings, etc.
     — active: fire extinguishing devices smoke/gas detectors and alarm system(s)
     — air pipes from fuel tanks shall be led to open air
     — drip trays shall be arranged at fuel filling pipe
     — all batteries cabinets shall have air pipes led to open air.

2) Risk contributor: fire can arise from an external source:
   - For davits operated on board offshore units/installations with hydrocarbon contact (production and drilling units) DNVGL-OS-A101 Sec.4 [2.1.4] Safety principles and arrangements, Emergency shutdown (ESD), applies. The davit manufacturer shall ensure proper fire safety accordingly.
   - It shall be possible to shut down the davit from a davit place external place.
See DNVGL-RU-SHIP Pt.4 Ch.3 Sec.1 for fire protection of diesel engines and other combustion engines.

**6.6 Generic risk contributors**

Davit operation outside normal configuration may lead to stress beyond davit structural strength and to personal hazards. All davits shall be kept within safe operational limitations, either by means of limit devices/alarms or physical layout.

Limit devices shall be positively activated and be of failsafe type, i.e. the davit go to a defined safe condition in case of failure (power failure, etc.).

The following are identified as generic risk contributors for davits:

— davit abnormal configurations
— lack of visibility
— lack of communication
— failure in safety components/system
— loss of power
— false activation of safety functions
— hazards due to activation of safety functions
— fire/fire ignition.

**6.7 Operator in control**

The operator shall have the possibility to manually override any of the davit’s automatic safety systems in case of an emergency.

*Guidance note:*

FMEA assessment shall determine which safety functions are allowed to be manually override. Proper procedures shall be established to avoid unintentional override.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

**6.8 Automatic protection system**

When the davit is fitted with a control system that detects a pre-defined fault configuration or overloading or operational outside equipment limitations, etc., it shall automatically provide warning by audible and visual means.

**6.9 Emergency stop function**

A manually operated emergency stop function, leading to shut-down and stop of the davit movements, shall be fitted, in such case brakes shall be engaged in a progressive and safe manner. The emergency stop shall retain its function regardless of any malfunction in the davit’s control system. Emergency stop actuators shall be located at convenient locations.

The emergency stop shall be so designed that deciding to actuate the emergency stop actuator shall not require the operator to consider the resultant effects (deceleration rate, etc.).

Measures against inadvertent operation shall not impair the accessibility of the emergency stop actuator. The emergency stop actuator shall be coloured red. The background shall be coloured yellow, as far as practicable. If the emergency stop actuator is not located directly on the machine, labels shall be provided addressing the actuator to the machine. A warning/alarm and an indication in the davit or on the operator control shall inform that the emergency stop has been activated.
6.10 Failure in control system

Failure in the davit’s control system may result in unintentional davit response and movements. Control system design and components shall be selected, applied, mounted and adjusted so that in the event of a failure, personnel safety shall be the prime consideration (fail-safe concept). All aspects of possible methods of failure – including power supply failure - shall be considered. If any failure occurs, the control system shall always return to the predefined safe condition. Special consideration shall be paid to the below points if subjected to failure in the control system:

— unintended start of machinery shall not be possible
— safety devices or devices with safety related functions shall be impaired to a minimum degree.

An alarm or an indicator revealing any detectable failure in the control system affecting the operation shall be installed.

6.11 Failure in safety components/system

Failure in safety components and the safety system may result in hazardous situations due to override of safety limits. The safety components/system shall therefore be so designed that all aspects of failure – including power supply failure shall lead to indication and alarm or alternatively safeguarded by redundancy design.

6.12 Loss of power

Blackout/shutdown may lead to davit stopping in an unfavourable and unsafe position. A loss of electric power shall not lead to the davit becoming inoperable. In the event of loss of main/normal and alternative electrical power source shall be available.

The davit shall be connected to an alternative power source, rated to handle the davit at full LL, i.e. essential functions under all conditions. The alternative power source may be a redundant main power supply, or a stand-alone alternative power supply.

6.13 Unintended activation of safety functions

Unintended activation of safety functions may lead to davit response giving unintentional hazards/risks. Handling devices for safety functions shall be protected against inadvertent use and positioned away from ordinary operating handles. Interlock devices, preventing inadvertent activation shall be fitted when possible.

6.14 Hazards due to activation of safety functions

Activation of safety functions may lead to secondary effects that may be harmful to the davit and/or the persons operating/crossing it. Design of safety systems and components shall be done with consideration to dangerous secondary effects.

6.15 Ranking of the safety functions

The manual overload protection (MOPS) and the emergency stop function shall be the preferred safety functions and have equal priority, before other safety devices/limiters.
SECTION 7 DAVITS

7.1 General dispositions for davits

7.1.1 Davit functions
Typical davit functions, but not limited to, are listed below:

— essential functions (e.g. braking, lowering, hoisting. Slewing/telescoping if needed to bring the davit to position were people can be evacuated to a safe zone)
— secondary functions (e.g. automatic tension system, active dampened system, automatic lashing systems and any other not mentioned above)
— safety functions (e.g. overload protection, movement limitations, alarm systems, etc.)
— emergency functions (e.g. manual and/or automatic protection systems, emergency stop, etc.)
— other relevant functions.

7.1.2 Common requirements

7.1.2.1 Unless established by the administration WBD and TBD shall be operational throughout the air temperature range -15°C to +40°C and not be damaged in stowage throughout the air temperature range -30°C to +65°C.

7.1.2.2 The WB TB embarkation and launching appliances shall be such that it should be able to be boarded and launched in a manner providing utmost safety for people and operators.

7.1.2.3 The launching appliance shall be provided with means to prevent an accidental release of the craft in its unattended stowed position, if the provided means cannot be released from inside the craft they shall be arranged in a way were the crew shall be worn by means of a visual and acoustic signal if attempts to launch the craft without releasing them.

The warning signal shall be distinctly different from other signals on the installation.

7.1.2.4 Crafts in their stowed position shall be protected from damage by heavy seas. Whenever this is not possible, the provided lashing to keep the craft in its stowed position shall also be designed to withstand with green sea forces and wind if applicable.

7.1.2.5 The nominal size of the components used for the lashing shall possess a safety of 6 against the minimum breaking load based on the proportionate launching weight and environmental conditions when applicable.

7.1.2.6 Crafts that lower down at vessel side shall be launched from a mid ship or aft, and in addition as far forward of the propeller as possible.

7.1.2.7 Each launching appliance shall be so constituted that the fully equipped craft it serves can be safely lowered and recovered fully occupied or without anyone on board, at a minimum trim of 2° and a list of 5° either way.

7.1.2.8 The control mechanism for the launching appliances with falls shall be so arranged that it should be operated by one person, from a position on deck and from within the craft. The operator on deck shall be able to observe the craft during the whole launching/recovery process.

In other words, the control device(s) for the launching appliance shall be arranged in a way that the control of the launching and recovery can be carried out from the vessel deck and from within the craft, but it is not required for this to be possible simultaneously from the two (2) mentioned positions.
7.1.2.9 Each launching appliance shall as far as possible be designed and constructed in a way were only limited maintenance is required. All parts requiring regular maintenance by the vessel crew shall be readily accessible and easily maintainable.

7.1.2.10 The launching appliance and its attachments except for the winch brakes shall be design to withstand a static test of 2.2 times the maximum load.

7.1.2.11 The maximum lowering speed shall be established in line with [8.1.2.6] and having regard to the design of the craft, the protection of its occupants from excessive forces and the strength of the launching appliance taking into account the dynamic forces arising during an emergency stop. Means shall be embodied in the launching appliance to ensure that this speed is not exceeded.

7.1.2.12 Where davit arm(s) are recovered by winch power, limit devices shall be fitted which automatically cut off the winch power in order to avoid overstressing the falls or davit structure, unless the motor is designed to prevent such overstressing.

7.1.2.13 When davit design is establish so that arms are structurally independent from each other, limit device's shall be installed on each davit arm, and shall be arranged so that the opening of one device will disconnect the winch power.

7.1.2.14 When recovering the craft by winch power limit devices used to detect that the craft reached utmost position shall be incorporated with due consideration to single failures or alternately with redundancy.

7.1.2.15 In the case of a pair of davit arms, the load on one davit arm shall be taken as the maximum value obtained from a distribution of the weight of the boat between the arms.

7.1.2.16 When giving type approval to a launching appliance with falls and winch, the distribution of the weight on the two hoisting hooks shall be established. If distribution of the load is not known, each davit arm shall be dimensioned for a load of at least 0.6 MWL.

7.1.2.17 For determining the pull in the boat fall under the hoisting and/or recovery weight, if sheave friction is not known then a friction coefficient of 5% shall be considered for slide bearings, or 2% for roller bearings.

7.1.2.18 The work boat and tender boat launching appliance shall be able to recover the craft with its full complement of passengers and crew.

7.1.2.19 All sheaves and blocks shall be so arranged that the wire rope cannot run off the sheave.

7.1.2.20 Sheaves shall either be castings, forgings, welded or be gas cut and machined from steel plate. However, sheaves made from nylon castings or other composite material may be accepted after special considerations, provided thorough documentation of the applied design criteria as well as material properties (confirmed by independent testing).

7.1.2.21 Castings and plates for sheaves shall comply with Sec.3. However, for non-welded sheaves the required impact testing of the material will be waived.

7.1.2.22 Sheaves shall comply with a recognised code or standard. Normally, the sheave diameter for steel wire ropes shall at least correspond to a ratio Dp/d = 18, where Dp is the pitch diameter of the sheave and d is the wire rope diameter. Further, the sheave groove shall comply with the corresponding guidance for grooves in drums as specified in DNVGL-ST-0578 [5.2.7.1]. Sheaves for fibre ropes shall comply with specified in DNVGL-ST-0578 [5.2.7.2].

7.1.2.23 The sheave diameter for steel wire ropes intended to work in heave compensation mode or automatic tension system shall at least correspond to a ratio Dp/d = 20.
7.2 Tender boat davits

7.2.1 General

The provisions include on these sub paragraphs are intended for tender boat launch and recovery systems. Tender boats have been growing in passenger capacity and dimension and the davits that serve these equipment’s have been evolved to be integrated in the cruise concept with more compact design saving valuable space in the vessel board. Although a type approval program do not need to be carried in the meantime as the alternative design analysis (when this is deemed performed), it is designer responsibility to verify if the FMEA/HAZOP is embodied with the applicable scenarios include in ADA and if relevant, update the type approval accordingly.

7.2.2 Tender boat davit requirements

7.2.2.1 Tender boat davits shall be designed in accordance with the requirements stated in [7.1] and the provisions described below.

7.2.2.2 TB davits shall incorporate a control systems that can detect abnormal configurations and warn the crew that is under such condition. These requirements need not to be fulfilled if davit is designed in accordance with exceptions in [5.5.1.6] or it is documented that all abnormal configurations will not constitute risks to personnel or davit essential functions and when applicable, during structural strength assessment, it is proven that the davit is able to resist the exceptional load(s) that may accrue from such condition(s).

Guidance note:

Abnormal configurations should be understood as a configuration that may result from system single failure or davit mishandling, i.e., it shall be systematically investigated any possible configuration that the davit can engage if crew fail to observe one of each possible single step from the launching or recovering sequence or from a system single failure. Each possible configuration and consequences shall be documented in a FMEA and submitted to the Society.

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7.2.2.3 It is davit designer responsibility propose which abnormal configuration the tender boat davit can detected, and describe them in the submitted technical specifications.

7.3 Work boat davits

7.3.1 General

WB launching systems differs from multi fall systems to single-fall systems to stern ramps, launching cradles, etc.

This standard does not intend to set technical requirements for all variations but rather indicate ways to develop fail safe oriented solutions for the most common systems. A WB launching system may deviate from the prescriptive requirements set out in this standard, provide an equivalent level of safety to the requirements in this standard is achieved. For such cases, engineering analysis, evaluation and approval of the design shall be carried out based on a case-by-case agreement with DNV GL.

7.3.2 Work boat davit requirements

7.3.2.1 WBD are designed for routine handling of a craft not intended for passenger transport and shall comply with the requirements in [7.1] and the provisions described below:
7.3.2.2 WB davits shall incorporate a control systems that can detect abnormal configurations and engage the davit in a safe state and warn the crew that is under such condition. These requirements need not to be fulfilled if davit is designed in accordance with exceptions in [5.5.1.6] or it is documented that all abnormal configurations will not constitute risks to personnel or davit essential functions and when applicable, during structural strength assessment, it is proven that the davit is able to resist the exceptional load(s) that may accrue from such condition(s).

7.3.2.3 Work boats shall be capable of being launched, utilizing painters, with the vessel making headway at speeds up to 5 knots in calm water.

7.3.2.4 Recovery of the work boat should be possible at calm weather within no more than five (5) minutes when loaded with its full complement of persons and equipment.

7.3.2.5 For the purpose of limiting the dynamic effect due to interaction with the waves, work boats davits should be fitted with an efficient shock absorber to dampen the forces when the work boat is being launched or recovered.

7.3.2.6 Interaction between shock absorber and winch gradual braking stop shall be such that will protect its occupants from excessive forces arising from emergency braking including maximum pre-established motion of the vessel.

7.3.2.7 Shock absorber used to limit the dynamic forces shall be designed and adjusted to work in the actual load range and efficiency documented in accordance with an international recognized standard, pertinent rules developed for this specific verification such as Norsok R-002.

7.3.2.8 It shall be documented by means of calculations or testing that the dynamic force induced in the wire due to an emergency stop plus motion of the vessel will not exceed 0.5 times the working load of the launching appliance.

Guidance note: Dynamic effects can be documented according to NORSOK R-002 A1.5.

7.3.2.9 Whenever in presence of a patrol boat davit or whenever it is deemed needed, WB davits shall also be designed taking in consideration a horizontal force corresponding to part of the total value that results from the sum of a dragging force and most unfavourable wind force for operational condition.

7.3.2.10 Work boat davits should incorporate systems that can prevent or warn the crew that it is being used outside its operational limitations (e.g. overload systems and operation outside predefined working angles, etc.).

7.3.3 Work boat davits that may operate under sea state condition 4 or above

7.3.3.1 WBD designed for routine operation under WMO sea state conditions 4 or above shall be evaluated on a case by case and comply with the requirements in [7.3] and the recommendations below.

7.3.3.2 The launching appliance shall be fitted with anti-pendulation system, e.g. docking head or boat guiding system, capable of improving craft stability during launching and recovery.

7.3.3.3 The lifting arrangement hanging from the davit shall be as lightweight as possible. Lifting hook(s) should be installed onboard the craft and lifting ring on the fall.

7.3.3.4 WB fitted with offload release mechanisms shall be fitted with an interlock system that ensures simultaneous release of the lifting mechanism.
7.3.3.5 Winch hoisting and lowering speed shall be adequate to limit the re-entry on next wave and deal with the expected vessels motions when making headway up to 5 knots.

**Guidance note:**
The appropriate speed should be agreed prior commencing the design. The below formula should be used as basis for discussion for other than nordic sea.

\[ V_H = 0.13 \cdot (H_{\text{sign}} + 1) \]

where:
- \( H_{\text{sign}} \) = significant wave height (m)
- \( V_H \) = maximum attainable hoisting and lowering speed in (m/s) for maximum MWL and weight of lightest craft respectively.

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7.3.3.6 Winch speed between stop-max. speed-stop shall be gradual and efficient, preferably adjustable by the operator.

7.3.3.7 The launching appliance shall be fitted with a device that can prevent improper spooling on winch drum.

7.3.3.8 The constant tension system shall be able to deliver a speed of at least double the hoisting speed.

7.3.3.9 Dual fall davits with two independent winches shall be fitted with a redundant synchronization system. This system shall be part of the FMEA and designer shall submit testing program for evaluation.
SECTION 8 WINCHES

8.1 Dispositions for winches

8.1.1 Base requirements
Winches for WBD and TBD shall be designed and executed in accordance with DNVGL-ST-0378 [5.2] and DNVGL-ST-0378 [11.5.1] and taking in consideration the referenced safety factor for all structural parts stated in this standard see [4.4.1] and the disposition below. Alternatively, other relevant internationally recognized code or standards applicable for winch design might be acceptable provided it is proposed and agreed by DNV GL prior to commencing design.

8.1.2 Additional requirements

8.1.2.1 Winches shall be dimensioned up to the maximum rope tension under spooling.

8.1.2.2 In the cases were davit arms are turn in/out by winch power, the load shall be determined on the basis of the hoisting weight and dead weight of davit arms and attachments and rope friction shall be considered.

8.1.2.3 Each launching appliance shall be led by one winch, in case of multiple drum winch it shall be arranged so that falls are always kept separated and be fitted with a device that wind the wire fall at the same rate. Winch falls shall be led so that there is no danger to operating personnel, when necessary guard plates shall be provided. This need not to be fulfilled in case of winches as defined in [7.3.3.5].

8.1.2.4 All moving parts of the winches (except the rope drum) and the powered drive shall have suitable guards to protect against contact.

8.1.2.5 No specific hoisting speed is stipulated for power-driven winches when they are able to be manually operated. When determining the turning moment of the winch for hoisting the craft by hand, 160 N per person shall be considered maximum value. Provided there is sufficient space, any number of men up to four may operate the winch together.

8.1.2.6 Every WBD or TBD shall be equipped with a power-driven winch capable of hoisting the craft when fully loaded. The minimum hoisting and loweringspeed shall be:
— 0.3 m/s for WBD
— 0.1 m/s for TBD
— Other agreed speeds for WBD in accordance with [7.3.3].

8.1.2.7 Every launching appliance shall be equipped with brakes capable of stopping the lowering of the craft and holding it securely when loaded with its full complement of persons and equipment. In case of failure of driving power the winch shall be able to safely lower the boat.

8.1.2.8 The braking devices shall be so constructed that they remain always applied unless the operator, or a component activated by him holds the braking device in a release position. Brake pads shall, where necessary, be protected from water and oil.

8.1.2.9 The lowering speed of the boat shall be controlled to remain constant by means of a regulating brake (e.g. centrifugal brake, hydraulic lowering brake valve, frequency converter).

8.1.2.10 A mechanical regulating brake (e.g. centrifugal brake) shall be connected directly to the transmission.
8.1.2.11 A hydraulic regulating brake (e.g. lowering brake valve) is permissible only for permanently installed hydraulic drives and shall be connected directly to the drive.

8.1.2.12 When calculating the speeds, the frictional losses due to blocks, rope sheaves and winch shall be taken into account.

8.1.2.13 Brakes shall be design with due consideration for overheating, thus all brakes shall have the demonstrated capacity to cope with heat may accrue from a mechanical maladjustment or equipment mishandling.
SECTION 9 RELEASE MECHANISMS, PAINTER ARRANGEMENTS AND LAUNCHING CRADLES

9.1 Release mechanisms

9.1.1 General

9.1.1.1 Unless otherwise agreed with DNV GL, every WB/TB launched by fall(s) shall be fitted with onboard release mechanism(s) certified in accordance to IMO SOLAS and LSA Code as amended, alternatively, work boats may be launched by mean of a launching cradle certified by DNV GL in accordance with [9.3] or in case of launching appliances as defined in [7.3.3] with release mechanisms only with off-load release capability in accordance to IMO SOLAS and LSA Code as amended.

9.1.1.2 Unless otherwise agreed with DNV GL, every WB/TB release mechanisms with on-load release capability shall be fitted with an alarm to warn the crew by means of acoustic signal whenever:
   — crew removes or bypasses the safety interlocks, or
   — crew destroy the protection glass or translucent cover used to avoid inadvertent override of the hydrostatic interlock.

This shall be feed by battery and provided with clear instructions suitably worded with pictograms and/or symbols, noticing about dangerous consequences when improperly used.

9.2 Painter arrangements

9.2.1 General

9.2.1.1 Every work-boat shall be fitted with a device to secure a painter near its bow. The device shall be such that the work boat does not exhibit unsafe or unstable characteristics when being towed by the vessel making headway at speeds up to 5 knots in calm water.

9.2.1.2 The painter securing device shall include a release mechanism to enable the painter to be released from inside the work-boat. The mechanism should be remote-operated with a push/pull cable-solution with a dedicated remote release handle, electrical actuator or hydraulic cylinder.

9.2.1.3 Unless the painter operator have direct visual contact with the lifting release system, the painter mechanism shall be fitted with a visual signal that portrays the lifting mechanism status, or preferably a built-in sequential release system that prevents the operator to release the painter line before the lifting mechanism is released.

9.2.1.4 When painter hooks are released with an electrical actuator or hydraulic cylinder they shall be fitted with manual override to be used in case of power failure.

9.2.2 Load conditions

The painter SWL shall be estimated as 35% of the full weight of the WB, including fuel, equipment and personnel.

The designer shall ensure that the real sustained load is not higher than the estimated SWL for painter hooks that will operate under the conditions defined in [7.3.3].
9.2.3 Painter hooks

9.2.3.1 The hook structural components shall be designed with a factor of safety of 6 compared to the material ultimate strength with the SWL as described in [9.2.2] and angles defined in [9.2.3.2].

9.2.3.2 The painter hooks shall be able to release within the angles listed below.

— 50% of the SWL in the athwartships direction at an angle of ±45 from the longitudinal center line
— 25% of the SWL in the athwartships direction at an angle of ±90 from the longitudinal center line
— 100% of the SWL in the lengthwise direction of the boat at an angle of ±15deg to the neutral (resting) angle
— 75% of the SWL in the lengthwise direction of the boat at an angle of ±30deg to the neutral (resting) angle.

Figure 9-1

9.2.3.3 The components of the hook shall be of material corrosion resistant in a marine environment in accordance with IMO MSC.1/Circ.1529.

9.2.4 Painter booms

9.2.4.1 Painter booms shall be used to safely guide the WB in line with the mother vessel.

9.2.4.2 The structural parts of the booms shall be designed to a safety-factor of 6 compared to the material UTS and shall be based on the SWL as calculated in [9.1.2].

9.2.5 Painter lines

9.2.5.1 Painter lines shall be designed with a safety-factor of 6 compared to the painter arrangement SWL calculated in [9.2.2].

9.2.5.2 Painter lines shall include a dedicated metal ring to ensure safe release and precise connection with the painter hook.

9.2.6 Prototype testing

Painter hook arrangements shall be subject to testing at prototype stage, fabrication, and installation.

9.2.6.1 The hook component shall be mounted on a tensile testing device and tested to six (6) times the calculated SWL in [9.1.2] Load conditions. The connecting part shall not have released when the test is completed.
9.2.6.2 It should be demonstrated that the painter release mechanism can release the painter on a fully equipped and loaded boat that is being towed at a speed of not less than 5 knots in calm water. There should be no damage to the boat or its equipment as a result of this test.

9.2.6.3 The painter release mechanism should be tested in several distinct directions of the upper hemisphere not obstructed by the canopy or other constructions in the WB.

9.2.7 Factory acceptance testing
Each painter hook shall be factory tested to an overload equal to 2.2x the SWL.

9.2.8 Installation testing
Painter arrangements (painter hook, boom and line) shall be tested upon installation.
It should be demonstrated that the painter release mechanism can release the painter on a fully loaded craft that is being towed at a speed of not less than 5 knots in calm water. There should be no damage to the boat or its equipment as a result of this test.

9.3 Launching cradles

9.3.1 General

9.3.1.1 Launching cradles are devices designed with the purpose to launch and recover a WB, furthermore they may also be used as stowage cradles provided they are fitted with a lashing system to secure the craft to the vessel deck and are able to cope with all loads that may arise during transit and survival condition.

9.3.1.2 Launching cradles lashing systems shall be designed with a minimum safety-factor of 6 when compared to the material UTS.

9.3.1.3 Launching cradles shall be fitted with mechanically secured device to secure the craft to the cradle before the WB is lifted out of water. This devise shall b design with a minimum safety-factor of 6 when compared to the material UTS.

9.3.2 Load conditions

9.3.2.1 Cradles shall be designed for vertical lifting operations when crafts shall be launched from the vessel in stationary condition. Alternatively the cradle may be designed to launch a craft from the vessel at a speed not higher than 5 knots in calm water if it is connected to a painter arrangement that is designed to withstands with the additionally forces that result from launching in such condition.

— Structure shall be design considering a dynamic factor of 3.4.
  — Acceptance criteria as defined in DNVGL-ST-0378 Sec.4 Table 4-2 load case II, i.e., safety factor to yield 1.33 and 1.66 to buckling.
  — Lifting points, padeyes and fastening points shall be designed with a safety factor of 6 compared to the material ultimate strength.
  — When used as stowage cradle the structure shall also be verified for vessel transit and survival conditions. Typical acceleration values in DNVGL-ST-0378 Sec.4, C.1.3, and applicable wind loads and green sea forces shall be include. Acceptance criteria as defined in DNVGL-ST-0378 Sec.4 Table 4-2, load case II for vessel transit and load case III for survival.
— Painter line connection shall be designed with a safety factor of 6 compared to the material ultimate strength when considering SWL as calculated in [9.2.2], forces that result from adding the cradle shall be include.

The designer is responsible to ensure that under normal in-service conditions the real load will never be higher than the calculated designed load.

9.3.2.2 Painter arrangements to be used together with launching cradles shall be designed according to [9.2.2], forces that result from adding the cradle shall be include.

9.3.3 Materials
Cradles shall be built with material suitable for marine environment and when not coated with corrosion protection they shall be built with corrosion-resistant material in accordance with IMO MSC.1/Circ.1529.

9.3.4 Prototype testing
9.3.4.1 Cradle arrangements shall be subject to testing at prototype stage, fabrication, and installation.

9.3.4.2 Cradle shall be subjected to a static proof load of 2.2 x the maximum working load. There should be no evidence of significant deformation or other damage as a result of this test. The test shall also be carried for painter line connection point.

9.3.4.3 Cradle shall be loaded with a mass equal to 1.1 times the maximum working load and suspended from the lifting points with the launching appliance in the upright position and should be lowered at maximum lowering speed through a distance of at least 3 m and stopped by applying the winch brake sharply. There should be no evidence of significant deformation or other damage as a result of the tests.

9.3.5 Factory acceptance testing
Each launching cradle shall be factory tested to an overload equal to 2.2 x SWL. This test shall also be carried for the painter line connection point. There should be no evidence of significant deformation or other damage as a result of the tests.

9.3.6 Installation testing
It should be demonstrated that the launching cradle does not exhibit unsafe or unstable characteristics when lowering a loaded craft and when applicable also when being towed by the vessel making headway at speeds up to 5 knots in calm water. There should be no damage to the boat or its equipment as a result of this test.
APPENDIX A - FMEA HAZOP

A.1 Failure mode effects analysis (FMEA), hazard and operability study (HAZOP)

A.1.1 General

FMEA and HAZOP are essential parts of a WBD/TBD certification scheme and should be initiated as soon as possible, even as early as concept stage. When performed early in the development cycle, and integrated concurrently with all other design activities, it's a cost-effective iterative process that identifies deficiencies and improve the design and ensures the product operation is safe and reliable during the useful life of the equipment.

A.1.2 FMEA

Consequences of system single failures in accordance with rule requirements shall be documented in the form of a failure mode and effect analysis (FMEA).

The main purpose of the FMEA is to demonstrate that systems are not degraded beyond acceptable performance criteria after a single failure and that no hazards arise to personnel or consequences for equipment essential functions. The FMEA shall normally consist of the following parts:

1) general system information
2) specification of acceptance criteria
3) specification of the overall boundary of the system/unit subject to the FMEA
   — redundancy design intent (when applicable), worst case failure design intent, time requirements, and davit operational modes
   — specification of all redundant components and single component groups included within the overall system boundary. The relevant system names, main units and main functions shall be presented and supported with a descriptive text
   — specification of all assumptions related to systems interfaces and dependencies of external systems
   — single failure and common cause analysis at unit and subsystem levels, including consequence for the function and eventual manual/automatic corrective actions assumed
   — summary and conclusions
   — a redundancy and failure mode test program specifying tests to verify assumptions and conclusions
   — a compliance statement referring to the overall system boundary, operational modes, tests, and acceptance criterion including time requirements shall be stated for the FMEA.

The requirements to FMEAs for redundant systems differ from traditional bottom up FMEAs in the following:

— requirement to state the redundancy design intent
— requirements to specification of acceptance criterion to be complied with
— requirements to refer to full scale testing to support analysis
— requirements to state compliance with the acceptance criterion. The FMEA documentation shall be self-contained and provide sufficient information to get the necessary overview of the system.

A.1.3 FMEA basic scenarios

The below listed operational scenarios should form the basis for a WBD or TBD FMEA. Appropriate alternative scenarios can be considered if previous commencing the design it is agreed and accepted by DNVG and all interested parties.
Each of the above scenarios shall be decomposed in all applicable sub-scenarios, e.g.:

— A1 Preparation: visual inspection, disconnect charging cable, hook release system status, release of craft lashing, enable system, failure detection and system checking, pretension of the wire fall, painter connection, etc.
— A2 Embarkation: boarding of crew, confirmation of 'in command station', etc.
— A3 Launching: final order to launch, winch operator release winch brake, lowering, etc.
— A4 Disconnect: Confirm craft is waterborne, release mechanism and painter disengagement, etc.

Each of the above scenarios/sub-scenarios are merely indicative and not compiled in a mandatory order, it is davit designer responsibility propose appropriate scenarios in accordance with design.

Similar process should be followed for the recovery sequence.

Below can be found the simplified flowchart that can be followed to record consequences of system components failures and equipment mishandling.

---

**Figure A-1**

**Figure A-2**
Guidance note:
It is understood that not all failure modes are possible to simulate. For such failure modes, the acceptance will be based on the theoretical FMEA, and hence the documentation analysis of these failure modes should be highlighted in the FMEA worksheet.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

A.1.4 HAZOP

Consequences of davit mishandling in accordance with rule requirements shall be documented in the form of a hazard and operability study (HAZOP).

The main purpose of HAZOP of procedures is to demonstrate that a davit mishandling will not constitute an hazard to personnel and will not have consequences for equipment essential functions. The HAZOP shall normally focus on the following parts:

1) initial state
2) final state
3) identify which omitted single step from launching procedure can constitute an hazard to personnel or result in consequences for equipment essential functions.
   — summary and conclusions
   — is the equipment fail safe designed and provided with the adequate robustness
   — is the control and monitoring system providing adequate warning signals when detecting abnormal configuration/deviation from procedure
   — acceptance criterion including time requirements shall be stated in the HAZOP.
APPENDIX B LAUNCHING APPLIANCES TEST PROCEDURES AND TEST FORMS

B.1 Test procedures

This part provides requirements for design and testing of painter arrangements.

B.1.1

For WB/TB davits and launching appliances, except the winch brakes, shall be subjected to a static proof load of 2.2 times their maximum working load. With the load at the full outboard position, the load shall be swung through an arc equals the design trim angle to each side of vertical in the intended fore and aft plane. The test shall be done first in the upright position, followed by tests simulating a shipboard condition of design list angle both inboard and outboard. There shall be no evidence of significant deformation or other damage as a result of this test.

B.1.2

A mass equal to 1.1 times the maximum working load shall be suspended from the lifting points with the launching appliance in the upright position. The load shall be moved from the full inboard to the full outboard position using the means of operation that is used on the vessel. The test shall be repeated with the launching appliance positioned to simulate a combined design list angle at inboard position and design trim angle. All the tests shall be repeated with a mass equal to that of a fully equipped work boat, without persons, or the lightest craft intended for use with the davit to ensure the satisfactory functioning of the davit under very light load conditions. The appliance shall successfully lower the load under all conditions, and there shall be no evidence of significant deformation or other damage as a result of the tests.

B.1.3

A mass equal to 1.1 times the maximum working load shall be suspended from the lifting points with the launching appliance in the upright position. The load shall be moved from the full inboard to the full outboard position using the means of operation that is used on the vessel. The appliance shall successfully move the maximum designed hoisting load from the outboard to the inboard position without causing permanent deformation or other damage.

B.1.4

Winch drums shall be wound to the maximum number of turns permitted and a static test load of 1.5 times the maximum working load shall be applied and held by the brake. This load shall then be lowered for at least one complete revolution of the barrel shaft. A test load of 1.1 times the maximum working load shall then be lowered at maximum lowering speed through a distance of at least 3 m and stopped by applying the hand brake sharply. The test load shall drop not more than 1 m when the brake is applied. This test shall be repeated several times. If the winch design incorporates an exposed brake, one of these tests shall be carried out with the brake wetted, but in this case the stopping distance may be exceeded. The various tests shall achieve a cumulative lowering distance of at least 150 m. Operation of the winch with a load of a mass equal to that of a fully equipped work boat, without persons, or the lightest work boat intended for use with the winch, shall also be demonstrated.

B.1.5

It shall be demonstrated that a winch intended for use with a WB/TB can recover the craft with the number of persons for which it shall be approved and its equipment or an equivalent mass.
B.1.6
Following completion of the tests the winch shall be stripped for inspection.

B.2 Production test

B.2.1
Each launching appliance, except the winch, shall be tested with a static load of 2.2 times the working load with the appliance in the full outboard position. The appliance shall not be deformed or damaged. Winches with the brakes applied shall be tested by applying a static load of 1.5 times the maximum working load. Any cast components of the frame and arm shall be hammer-tested to determine that they are sound and without flaw.

B.3 Prototype test

B.3.1 Load test
The craft loaded with its normal equipment or an equivalent mass and a distributed mass equivalent to that of the number of persons, each weighing 82.5 kg, as applicable, it is permitted to accommodate, shall be released by operation of the launching control on deck.

B.3.2 Light loaded test
The craft loaded with its normal equipment or an equivalent mass shall be released by operation of the launching control on deck to demonstrate that the craft's mass is sufficient to overcome the frictional resistance of the winch, falls, blocks and associated gear. A person shall then board the craft and perform a test of the launching operation from within the boat.

B.3.3 Loaded lowering test (brake test only)
The craft loaded with its normal equipment or an equivalent mass and a distributed mass equal to that of the number of persons, each weighing 82.5 kg, as applicable, it is permitted to accommodate + 10% of the working load, shall be released by the operation of the launching controls on deck. When the WB/TB has reached its maximum lowering speed, the brake shall be abruptly applied to demonstrate that the attachments of the davits and winches to the vessel structure are satisfactory.

B.3.4
If lowering of the craft is controlled from within the WB/TB by means of a control wire paid off from an auxiliary drum on the winch, the following additional points shall receive particular consideration after installation of the davits and winches:

1) the mass on the control wire shall be sufficient to overcome the friction of the various pulleys on the control wire, when turning out the craft from the stowed to the embarkation position
2) it shall be possible to operate the winch brake from within the craft
3) the winch brake shall not be affected by the mass of the fully extended control wire
4) there shall be sufficient length of control wire available at the craft, during all stages of lowering, and
5) means shall be provided to retain the free end of the control wire in the craft until the work boat is detached from the launching appliance by the operator.
B.3.5
If the winch brake is exposed to the weather, the lowering test shall be repeated with the braking surface wetted.

B.3.6 Recovery test
Where davits are recovered, it shall be demonstrated that the power is automatically cut off before the davit arms come against the stops.

B.3.7
Either an alternative power source or connection with emergency generator shall be demonstrated.
B.4 Test forms

B.4.1

CERTIFICATION OF LAUNCHING APPLIANCES
Evaluation and prototype test reports for WB/TB launching appliances

<table>
<thead>
<tr>
<th>Customer</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name/Type designation</td>
<td>DNVGL station</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>WBD - Work boat davit using fall(s)</td>
<td>TBD - Tender boat davit using fall(s)</td>
</tr>
<tr>
<td>WWB - Winches for work boat</td>
<td>WTB - Winches for tender boat</td>
</tr>
<tr>
<td>PHWB - Painter hooks for work boat</td>
<td>PBWB - Painter booms for work boat</td>
</tr>
<tr>
<td>LCWB - Launching cradle for WB</td>
<td></td>
</tr>
</tbody>
</table>

| Serial number (s) |  |
| Maximum Working Load |  |

During prototype testing, the items listed below shall be checked OK or Not Applicable, to ensure that the requirements where fulfilled.

<table>
<thead>
<tr>
<th>Type</th>
<th>Subject to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBD/TBD; WWB/WTB, PHWB/PBWB; LCWB</td>
<td>Submitted drawings, reports and documents; Quality Assurance; Visual inspection; Static proof load test; Operation test;</td>
</tr>
<tr>
<td>WBD/TBD</td>
<td>Turning in test</td>
</tr>
<tr>
<td>WWB/WTB</td>
<td>Winch brake test; Recovery test</td>
</tr>
<tr>
<td>WBD/TBD</td>
<td>Control and monitoring failure mode test</td>
</tr>
</tbody>
</table>

Control and monitoring, radio remote control prototype test program and test of redundant systems incorporated in the launching appliance are to be submitted by designer and accepted by the society before testing and shall be attached to this forms.

Comments/Observations:

Signatures and date by responsible surveyor

| Date/ Sign |  |

If needed extra sheet can be submit with notes and comments.
<table>
<thead>
<tr>
<th>Drawing No.</th>
<th>Revision No. &amp; date</th>
<th>Title of drawing</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Report/Docume</th>
<th>Revision &amp; No. Date</th>
<th>Title of report / document</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Maintenance Manual -</td>
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<tr>
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<td>Operations Manual -</td>
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</tbody>
</table>
DNVGL attending surveyor shall make random inspection of manufacturers to ensure that the
quality of launching appliances and the
materials used comply with the specification of
the approved prototype launching appliance.

Manufacturers shall be required to institute a
quality control procedure to ensure that
launching appliances are produced to the same
standard as the prototype launching appliance
approved by DNVGL and to keep records of any
production tests carried out.

If Type Approval is requested, DNVGL form no.
90.02a shall be followed up and filled in.

Quality Assurance System acceptable Yes/No

Comments/Observations:
### Visual inspection

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm that installation has been manufactured to</td>
<td>Parts which require maintenance shall be easily accessible and easily maintained.</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td>approved drawings.</td>
<td></td>
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</tr>
<tr>
<td>Visually inspect the appliance.</td>
<td>The control mechanism shall be so arranged that it may be actuated by one person</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td>Conduct measurements and verify clearances as required.</td>
<td>from a position within the craft or from vessel deck. Not needed to be available in</td>
<td></td>
</tr>
<tr>
<td>Remote control</td>
<td>both positions simultaneously.</td>
<td></td>
</tr>
<tr>
<td>Limit switches</td>
<td>Brakes shall be so arranged that the brake is always applied, unless the operator</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td></td>
<td>or a mechanism activated by the operator holds the brake control in the ‘off’</td>
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</tr>
<tr>
<td></td>
<td>position.</td>
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<tr>
<td>Provisions for hanging off pendants</td>
<td>Safety devices for recovery which will automatically cut off the power to prevent</td>
<td></td>
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<tr>
<td></td>
<td>over-stressing the are falls or davits fitted with proper redundancy, otherwise is</td>
<td></td>
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<tr>
<td></td>
<td>the motor designed to prevent such over-stressing.</td>
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<tr>
<td></td>
<td>There shall be provisions for hanging-off the craft to free the release gear for</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td></td>
<td>maintenance</td>
<td></td>
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<td></td>
<td>Structural members and blocks, falls, padeyes, links, fastenings and all other</td>
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<td></td>
<td>fittings used in connection with launching equipment installed are provide with not</td>
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<td></td>
<td>less than minimum factor of safety of 4.5 for davit and winch structural members,</td>
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<tr>
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<td>and a minimum factor of safety of 6 for members applied on falls, on the basis of</td>
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<tr>
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<td>the maximum working load assigned and the ultimate strength of the material used for</td>
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</tr>
<tr>
<td></td>
<td>construction.</td>
<td></td>
</tr>
</tbody>
</table>
##Static proof load test

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>The launching appliance except the winch brakes, shall be subjected to a static proof load of 2.2 times their maximum working load.</td>
<td>The launching appliance and its attachments other than winch brakes shall be of sufficient strength to withstand a static proof load on test of not less than 2.2 times the maximum working load.</td>
<td>MWL: ............... kN</td>
</tr>
<tr>
<td>With the load at the full outboard position, the load shall be swung through an arc of approximately the design trim angle to each side of vertical in the intended fore and aft plane.</td>
<td>There shall be no evidence of significant deformation or other damage as a result of this test.</td>
<td>Test load (2.2xMWL): ............... kN</td>
</tr>
<tr>
<td>The test shall be done first in the upright position, followed by tests simulating a shipboard condition of the design list angle both inboard and outboard.</td>
<td></td>
<td>Design list angle:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Design trim angle:</td>
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<tr>
<td></td>
<td></td>
<td>There shall be no evidence of significant deformation or other damage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Passed/Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>upright Passed/Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>inboard list Passed/Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>outboard list Passed/Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Comments/Observations</td>
</tr>
</tbody>
</table>
### Operation test

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>A mass equal to 1.1 times the maximum working load shall be suspended from the fall with the launching appliance in the upright position.</td>
<td>The appliance shall successfully lower the load under all of the conditions, and there shall be no evidence of significant deformation or other damage as a result of the tests. Each launching appliance together with all its lowering and recovery gear shall be so arranged that the fully equipped craft it serves can be safely lowered against a trim up to and list up to an angle either way:</td>
<td>Weight of the lightest craft** intended for use: LWL: .................. kN MWL: .................. kN Test load (1.1xMWL): .................. kN Clear of davit horn*** Passed/Failed Does the appliance successfully lower the load under these conditions without evidence of deformation or damage? Passed/Failed upright (1.1x MWL) Passed/Failed inboard list+trim (1.1xMWL) Passed/Failed inboard list +trim (LWL) Passed/Failed ** if applicable Comments/Observations</td>
</tr>
<tr>
<td>The load shall be moved from the full inboard to the full outboard position using the means of operation that is used on the ship.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The test shall be repeated with the launching appliance positioned to simulate a combined design trim and list angle.</td>
<td></td>
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</tr>
<tr>
<td>All the tests shall be repeated with a mass equal to that of a fully equipped craft, without persons, or the lightest craft intended for the use with the davit to ensure the satisfactory functioning of the davit under very light load conditions.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Turning in test

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>With the appliance in the full upright position the maximum design hoisting load shall be moved from the full outboard to the full inboard position using the means of operation that is used on the ship.</td>
<td>The appliance shall successfully move the maximum designed hoisting load from the outboard to the inboard position without causing permanent deformation or other damage.</td>
<td>maximum designed hoisting load:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>........................................ kN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does the launching appliance successfully move the load from outboard to inboard?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Passed/Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does the launching appliance show any evidence of significant deformation or other damage as result of this test?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Passed/Failed</td>
</tr>
</tbody>
</table>

Comments/Observations
Winch brake test

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
</table>
| Winch drums shall be wound to the maximum number of turns permitted and a static test load of 1.5 times the maximum working load shall be applied and held by the brake. This load shall then be lowered for at least one complete revolution of the barrel shaft. A test load of 1.1 times the maximum working load shall then be lowered at maximum lowering speed through a distance of at least 3 m and stopped by applying the hand brake sharply. This test shall be repeated a number of times. If the winch design incorporates an exposed brake, one of these tests shall be carried out with the brake wetted. The various tests shall achieve a cumulative lowering distance of at least 150 m. Operation of the winch with a load of a mass equal to that of a fully equipped craft, without persons, or the lightest craft intended for use with the winch shall also be demonstrated. After completion of the above, the winch shall be stripped and inspect. | The test load shall drop no more than 1 m when the brake is applied (except that the stopping distance may be exceeded if an exposed brake is wetted). The launching appliance shall successfully lower a mass equal to that of a fully equipped craft, without persons, or the lightest craft intended for use with the winch. Inspection of the stripped winch shall reveal no significant damage or undue wear. | weight of the lightest craft*: ...................... kN
MWL: ...................... kN
Test 1:
Static test load (1.5 x MWL):
.............................. kN
Does the brake test hold the test load (1.5x MWL)?
Passed/Failed
MWM: kNm
Drum diam. mm
Wire diam. mm
Number of turns
Test 2
Dynamic Test load (1,1 x MWL): kN
brake test carried out after > 3m with max lowering speed Stop within 1 meter? Passed/Failed
*delete as appropriate continued
Winch brake test

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st stop &gt; 3m;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd stop: m;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd stop: m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th stop: m;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5th stop: m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total lowering distance &gt;150 m</td>
<td>Passed/Failed</td>
<td></td>
</tr>
<tr>
<td>Test 3 (if applicable)</td>
<td>Winch design incorporates an exposed brake? Yes/No</td>
<td></td>
</tr>
<tr>
<td>Wet stopping distance m</td>
<td>Passed/Failed</td>
<td></td>
</tr>
<tr>
<td>Test 4</td>
<td>Test load (LWL) kN</td>
<td></td>
</tr>
<tr>
<td>Lowering test with LWL satisfactory? Passed/Failed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the inspection of the stripped winch reveal any significant damage or undue wear? Passed/Failed</td>
<td></td>
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</tr>
<tr>
<td>Remarks:</td>
<td></td>
<td></td>
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</tbody>
</table>
### Recovery test

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>It shall be demonstrated that a winch intended for use with the craft is</td>
<td>Each craft launching appliance shall be fitted with a powered winch motor capable of raising the craft from the water with its full craft complement of persons and equipment.</td>
<td>Hoisting load:</td>
</tr>
<tr>
<td>capable of recovering the craft with the number of persons for which it is</td>
<td></td>
<td>Test 1:</td>
</tr>
<tr>
<td>to be approved and its equipment or an equivalent mass.</td>
<td></td>
<td>Test load (1 x hoisting load): winch can be operated satisfactorily? Passed/Failed</td>
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<tr>
<td></td>
<td></td>
<td>Arrangement provided for protection against moving parts and rotating handles? Passed/Failed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Comments/Observations</td>
</tr>
</tbody>
</table>
CERTIFICATION OF LAUNCHING APPLIANCES
Evaluation and prototype test reports for release mechanism for WB/TB

<table>
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<tr>
<th>Manufacturer</th>
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<tr>
<td>Name/Type designation</td>
<td>DNVGL station</td>
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<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>RMWB - Release mechanism for WBD</td>
</tr>
<tr>
<td></td>
<td>RMTB - Release mechanism for TBD</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Serial number(s)</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Hook Maximum Working Load</td>
<td></td>
</tr>
<tr>
<td>Hang-off arrangement, Maximum Safe Work Load</td>
<td></td>
</tr>
<tr>
<td>Hydrostatic locking device, Type/Name</td>
<td></td>
</tr>
<tr>
<td>Release handle device, Type/Name</td>
<td></td>
</tr>
</tbody>
</table>

During prototype testing, the items listed below shall be checked OK or Not Applicable, to ensure that the requirements where fulfilled.

<table>
<thead>
<tr>
<th>Type</th>
<th>Subject to:</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMWB/RMTB</td>
<td>Submitted drawings, reports and documents; Quality Assurance; Visual inspection; Towing release test; First release mechanism; Second release mechanism.</td>
</tr>
</tbody>
</table>

Comments/Observations:

Signatures and date by responsible surveyor

<table>
<thead>
<tr>
<th>Date/ Sign</th>
<th></th>
</tr>
</thead>
</table>

If needed extra sheet can be submit with notes and comments.
<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
<th>Release mechanism for WB DNVGL-ST-0498</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Manufacturer:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Model:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lot/Serial Number:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Submitted drawings and documents</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Submitted drawings and documents</td>
<td></td>
</tr>
<tr>
<td>Title of drawing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Submitted reports and documents</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report/Document</td>
<td></td>
</tr>
<tr>
<td>Revision &amp; No.</td>
<td></td>
</tr>
<tr>
<td>Title of report / document</td>
<td></td>
</tr>
</tbody>
</table>

- Maintenance Manual -
- Operations Manual -
## Quality Assurance

DNVGL attending surveyor shall make random inspection of manufacturers to ensure that the quality of launching appliances and the materials used comply with the specification of the approved prototype launching appliance.

Manufacturers shall be required to institute a quality control procedure to ensure that launching appliances are produced to the same standard as the prototype launching appliance approved by DNVGL and to keep records of any production tests carried out.

If Type Approval is requested, DNVGL form no. 90.02a shall be followed up and filled in.

<table>
<thead>
<tr>
<th>Quality Assurance</th>
<th>Standard Used:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality Assurance Procedure:</td>
<td></td>
</tr>
<tr>
<td>Quality Assurance Manual:</td>
<td></td>
</tr>
<tr>
<td>Description of System:</td>
<td></td>
</tr>
</tbody>
</table>

**Quality Assurance System acceptable**

Yes/No

**Comments/Observations:**
### 8.1.1.3 Visual inspection

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirm that installation has been manufactured to approved drawings.</td>
<td>Parts which require maintenance shall be easily accessible and easily maintained.</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td>Visually inspect the appliance. Conduct measurements and verify clearances as required.</td>
<td>Parts which require maintenance shall be easily accessible and easily maintained.</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td>6.9.1 The craft with its engine fitted shall be suspended from the release mechanism just clear of the ground or the water. The craft shall be loaded so that the total mass equals 1.1 times the mass of the craft, all its equipment and the number of persons for which the craft is to be approved.</td>
<td>6.9.1 The craft shall be released simultaneously from each fall to which it is connected without binding or damage to any part of the craft or the release mechanism.</td>
<td>Passed/Failed</td>
</tr>
<tr>
<td>6.9.2.</td>
<td>6.9.2 It shall be confirmed that the craft will simultaneously release from each fall to which it is connected when fully waterborne in the light condition and in a 10% overload condition</td>
<td>Observations</td>
</tr>
</tbody>
</table>
### 8.1.4 Towing release test

**Test Procedure**

- **6.9.3** With the operating mechanism disconnected it shall be demonstrated when the craft is loaded with its full complement of persons and equipment and towed at speeds of 5 knots that the moveable hook component stays closed. Furthermore, with the operating mechanism connected, it shall be demonstrated that the craft when loaded with its full complement of persons and equipment when towed at speeds of 5 knots can be released. Both above shall be demonstrated as follows as follows:

  *(see acceptance criteria)*

<table>
<thead>
<tr>
<th><strong>Acceptance Criteria</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9.3.1 A force equal to 25% of the safe working load of the hook shall be applied to the hook in the lengthwise direction of the craft at an angle of 45° to the vertical. This test shall be conducted in the afterward as well as the forward direction;</td>
</tr>
<tr>
<td>6.9.3.2 A force equal to the safe working load of the hook shall be applied to the hook in an athwartships direction at an angle of 20° to the vertical. This test shall be conducted on both sides; and</td>
</tr>
<tr>
<td>6.9.3.3 A force equal to the safe working load of the hook shall be applied to the hook in a direction halfway between the positions of tests 1 and 2 (i.e. 45° to the longitudinal axis of the craft in plan view) at an angle of 33° to the vertical. This test shall be conducted in four positions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Significant Test Data</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Passed/ Failed</td>
</tr>
<tr>
<td>Passed/ Failed</td>
</tr>
<tr>
<td>Passed/ Failed</td>
</tr>
<tr>
<td>Comments/Observations</td>
</tr>
</tbody>
</table>

There shall be no damage as a result of these tests.
### 8.1.1.5 First release mechanism

**Test Procedure** | **Acceptance Criteria** | **Significant Test Data**
--- | --- | ---
6.9.4 A release mechanism shall be conditioned and tested as follows:

6.9.4.1 The release and retrieval system and the longest used connection cable/linkage associated with the system shall be mounted and adjusted according to instructions from the original equipment manufacturer and then loaded to 100% of its safe working load and released. Load and release shall be repeated 50 times, the system shall be released simultaneously from each fall to which it is connected without any binding or damage to any part.

6.9.4.2 The craft release and retrieval system shall be disassembled, examined and wear recorded. The release and retrieval system shall then be reassembled;

6.9.4.1 The system shall be considered as "failed" if any failure during the conditioning or unintended release occurs when load is applied but the system has not yet been operated;

6.9.4.2. (…) the parts examined and wear recorded.

Passed/ Failed

Passed/ Failed

*Wear recorded in separate attachment*
### 8.1.1.5 First release mechanism

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9.4.3 The hook assembly, whilst disconnected from the operating mechanism, shall be tested 10 times with cyclic loading from zero load to 1.1 SWL, 10 seconds per cycle; unless it has been specifically designed to operate as off-load hook with on-load capability, in this case the cyclic load shall be 1% to 1.1 SWL. For cam-type designs, the initial test shall use cam rotation 0° (reset position), and repeated at 45° in either way, or 45° in one direction if restricted by design.</td>
<td>6.9.4.3 The specimen shall remain closed during the test. The system shall be considered as &quot;failed&quot; if any failure during this test or any unintended release or opening occurs; and The actuation force shall be no less than 100 N and no more than 300 N (...) The demonstration shall verify that any interlocks, indicators and handles are still functioning and are correctly positioned in accordance with the operation and safety instruction from the original equipment manufacturer. The release mechanism is deemed to have passed the testing under paragraph 6.9.4 when the tests have been conducted successfully. The system shall be considered as &quot;failed&quot; if any failure during this test or any unintended release or opening occurs.</td>
<td>Passed/ Failed Recorded actuation force: Test 1 : ................. kN Test 2 : ................. kN Test 3 : ................. kN Actuation force test: Passed/Failed Cable length used: ....... m + ....... m Passed/ Failed</td>
</tr>
</tbody>
</table>

---

**Regulations:** LSA Code 4.4.7.6 / MSC.80(70) Pt 1/6.9
### 8.1.1.6 Second release mechanism

<table>
<thead>
<tr>
<th>Test Procedure</th>
<th>Acceptance Criteria</th>
<th>Significant Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.9.5 A second release mechanism shall be tested as follows:</td>
<td>6.9.5.1 The actuation force shall be no less than 100 N and no more than 300 N. (...) 6.9.5.2(...) The load shall be increased to at least six times the working load of the release mechanism without failure of the release mechanism.</td>
<td>Passed/ Failed</td>
</tr>
<tr>
<td>1 the actuation force of the release mechanism shall be measured loaded with 100% of its safe working load.</td>
<td></td>
<td>Passed/ Failed</td>
</tr>
<tr>
<td>2 the release mechanism shall be mounted on a tensile strength testing device. (...)</td>
<td></td>
<td>Comments/Observations</td>
</tr>
<tr>
<td>6.9.6 N/A for Lifeboat Release Mechanism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.9.7 Test is repeated from 6.9.5.2.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C INSTALLATION TESTS

CERTIFICATION OF LAUNCHING APPLIANCES
Initial installation testing of launching appliances and release gear for WB/TB

<table>
<thead>
<tr>
<th>Customer</th>
<th>DNV station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name/Type designation</td>
<td>DNV station</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBD</td>
<td>Work boat davit using fall(s)</td>
</tr>
<tr>
<td>TBD</td>
<td>Tender boat davit using fall(s)</td>
</tr>
<tr>
<td>WWB</td>
<td>Winches for work boat</td>
</tr>
<tr>
<td>WTB</td>
<td>Winches for tender boat</td>
</tr>
<tr>
<td>PHWB</td>
<td>Painter hooks for work boat</td>
</tr>
<tr>
<td>PBWB</td>
<td>Painter booms for work boat</td>
</tr>
<tr>
<td>LCWB</td>
<td>Launching cradle for WB</td>
</tr>
<tr>
<td>RMTB</td>
<td>Release mechanism for WBD</td>
</tr>
</tbody>
</table>

| Serial number(s) | |
| Maximum Working Load | |
| Name of the ship | |

Initial installation and testing of launching appliances carried out in accordance with DNV GL ST-0498 on board the above-mentioned vessel.

Certificates shall preferably be submitted together with reports of tests carried out at makers. Reports used to verify if some of the mandatory prototype and production tests were not carried out at maker are be added to the tests after installation on board.

Control and monitoring, radio remote control test program and test of redundant systems incorporated in the launching appliance are to be submitted by designer and accepted by the society and shall be attached to this forms.

Comments/Observations:

Signatures and date by responsible surveyor

| Date/Sign | |

If needed extra sheet can be submit with notes and comments.
### Part A Davit-launched craft

<table>
<thead>
<tr>
<th>Weight of craft (incl. normal equipment)</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of full complement of persons</td>
<td>kg</td>
</tr>
<tr>
<td>(max. no of persons x 82.5 kg)</td>
<td></td>
</tr>
<tr>
<td>Total weight</td>
<td>kg x 1.1</td>
</tr>
<tr>
<td></td>
<td>Overload test</td>
</tr>
</tbody>
</table>

### Davit

<table>
<thead>
<tr>
<th>Maker and type of davit(s):</th>
<th>SWL</th>
</tr>
</thead>
</table>

### Winch

<table>
<thead>
<tr>
<th>Maker and type of winch:</th>
<th>SWL</th>
</tr>
</thead>
</table>

### Falls

<table>
<thead>
<tr>
<th>Fall(s) certificate(s) have been examined with respect to:</th>
<th>Length</th>
<th>m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size</td>
<td>mm</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Breaking load</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fall(s) found to be rotation and corrosion resistant.</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
</table>

*LSA Code Ch. 6.1.2.3*

<table>
<thead>
<tr>
<th>Falls of sufficient length for craft to reach water under unfavorable trim of up to 5 degrees and list of up to 2 degrees</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
</table>

### Launching

<table>
<thead>
<tr>
<th>Fully waterborne release with 10% overload.</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tested that craft can be launched when vessel is making headway of not less than 5 knots</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>Verified that a painter release system is provided.</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Part A Davit-launched craft

| Tested that the painter can be released from the inside of the craft |  ☐  ☐  ☐ |
|---|---|---|
| Launching mechanism arranged so that it may be actuated by one person from a position on the ship’s deck and from a position within the craft. When launched by a person on deck the craft is visible to that person. | ☐  ☐  ☐ |
| If the winch brake exposed to the weather. The lowering test repeated with braking surface wetted. | ☐  ☐  ☐ |
| Craft with normal equipment and full complement of persons (or equivalent mass), shall be launched by control on deck. The lowering speed shall be not less than that obtained from the formula: \( S = 0.4 + (0.02H) \), where \( S \) = speed and \( H \) = height from davit head to waterline at lightest seagoing condition. | Lowering speed | m/s |
| Corresponding min speed \( S \)= Maximum speed established by the Administration shall not be exceeded. | ☐  ☐  ☐ |
| Mass of craft loaded with its normal equipment (or equivalent mass), but without persons on board sufficient to overcome any resistance of the winch, falls, blocks and associated gear. Speed not to be less than 70% of \( S \) above | Lowering speed | m/s |
| Person operating the launching appliance have a clear view of the craft at all times during the launching / recovery. | ☐  ☐  ☐ |
| Craft with normal equipment and full complement of persons (or equivalent mass) plus 10%, is to be released by the launching controls. When maximum lowering speed is reached, the brake shall be abruptly applied. | ☐  ☐  ☐ |
| Release wire | ☐  ☐  ☐ |
| If lowering of the craft is controlled from within the craft by means of a control wire paid off from an auxiliary drum on the winch, the following additional points shall receive consideration after installation of the davits and winches; operation, weight, wire length and functionality. | ☐  ☐  ☐ |
**Part A  Davit-launched craft**

**Release mechanism**

<table>
<thead>
<tr>
<th>On load release mechanism, capable of releasing with a load of 1.1 x fully loaded craft (normal equipment and maximum number of persons).</th>
<th>☐ ☐ ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off load release mechanism capable of releasing with a load of 1.1 x fully loaded craft (normal equipment and maximum number of persons) when fully waterborne.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>Off load release mechanism capable of releasing with empty craft when fully waterborne.</td>
<td>☐ ☐ ☐</td>
</tr>
</tbody>
</table>

**Recovery**

<table>
<thead>
<tr>
<th>Craft including 3 crew recovered to its stowage position by use of alternative power and safely and properly secured.</th>
<th>☐ ☐ ☐</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power davits fitted with auto stops / limit switches and auto stop / limit switch function tested.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>Hanging-off arrangement provided.</td>
<td>☐ ☐ ☐</td>
</tr>
<tr>
<td>Blocks, shackles and chain duly stamped.</td>
<td>☐ ☐ ☐</td>
</tr>
</tbody>
</table>

**Remarks:**
CHANGES — HISTORIC

There are currently no historical changes for this document.
About DNV GL
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping our customers make the world safer, smarter and greener.

SAFER, SMARTER, GREENER