FOREWORD

DNV GL rules for classification contain procedural and technical requirements related to obtaining and retaining a class certificate. The rules represent all requirements adopted by the Society as basis for classification.

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CURRENT – CHANGES

This is a new document.
The rules enter into force 1 July 2016.
CONTENTS

Current – changes ................................................................................................................. 3

Section 1 General .................................................................................................................. 5
  1 Introduction ..................................................................................................................... 5
  2 Documentation, certification and testing requirements .............................................. 6

Section 2 Design principles ................................................................................................. 10
  1 General ......................................................................................................................... 10
  2 Mechanical requirements .......................................................................................... 10
  3 Electrical requirements ............................................................................................ 12
  4 Coil-up/coil-off mechanism for umbilicals ............................................................... 14
  5 Jettisoning of the umbilical ....................................................................................... 15
SECTION 1 GENERAL

1 Introduction

1.1 Scope

1.1.1 This chapter provides technical requirements and requirements for testing of umbilicals including connecting elements and shut-off devices at the ends and the load transfer points. The load transfer points of the support vessel/element are not covered by this chapter.

Further this chapter provides requirements for cables and hose assemblies which may be subjected to external overpressure and integrated lifting cables.

1.1.2 The penetration into the pressure hull or a vessel under pressure are covered by these requirements.

Basic requirements for the coil-up/coil-off mechanism are defined.

1.1.3 The supply systems for substances, data and energies transferred by the umbilical are part of the support vessel/element and are not treated in this chapter.

1.2 Application

1.2.1 The umbilical is regarded as the connecting link between support unit and an element under water, which may include:

— hose assemblies for liquid and gas transport and monitoring
— communication
— data transfer
— energy supply cables
— lifting cable.

This bundled or integrated supply line may also be used between elements under water.

Under water elements in the sense of these rules are:

— diving bells
— diving chambers
— non-autonomous (manned) and remotely controlled (unmanned) submersibles
— launchers
— underwater working machines
— other diving equipment.

1.2.2 The lifting cable might be independent or integrated in the umbilical. The purpose of the lifting cable is to launch and recover, lift and lower an object under water and for absorption of tensional stresses during operation. The lifting cable may also be designed as bearing element, e.g. as netting within the sheathing of the umbilical.

1.3 Relation to other codes and standards

Umbilicals following other codes and standards and deviating from this Chapter in their type, structure, some detailed requirements may be accepted by the Society, provided that they are found to be equivalent to the principle requirements defined in this chapter.
## 2 Documentation, certification and testing requirements

### 2.1 Documentation requirements

Documentation shall be submitted as required by Table 1.

**Table 1 Documentation requirements for umbilicals**

<table>
<thead>
<tr>
<th>Object</th>
<th>Documentation type</th>
<th>Additional description</th>
<th>Info</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q010 - Quality manual</td>
<td>Document about the quality system (e.g. ISO 9001) which covers at least design,</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>manufacturing, testing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z050 - Design philosophy</td>
<td>General description of concept of operation</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z060 - Functional description</td>
<td>Description of the structure and the applied materials of the single components</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z110 - Data sheet</td>
<td>- Definition of main parameters</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Including the description of marking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z265 - Calculation report</td>
<td>Where lifting is needed and expected a calculation report shall be provided</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z030 - Arrangement plan</td>
<td>Drawing of the cross section</td>
<td>AP</td>
</tr>
<tr>
<td>Umbilical</td>
<td>S030 - Capacity analysis</td>
<td>Data concerning pressure and flow conditions and capacity for gas and liquid transport</td>
<td>FI</td>
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<tr>
<td></td>
<td>E120 - Electrical data sheet,</td>
<td>Data concerning the energy, communication and data transfer, e.g. voltage, amperage,</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>general</td>
<td>transfer rates</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Specification of impedance, capacity and resistance value</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z283 – Type certificate</td>
<td>Applicable for hose assemblies and cables</td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z162 - Installation manual</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z161 - Operation manual</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>Z252 - Test procedure at</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z262 - Report from test at</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z253 - Test procedure for quay</td>
<td></td>
<td>AP</td>
</tr>
<tr>
<td></td>
<td>and sea trial</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Z263 - Report from quay and</td>
<td></td>
<td>FI</td>
</tr>
<tr>
<td></td>
<td>sea trial</td>
<td></td>
<td></td>
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</tbody>
</table>

**AP** = For approval; **FI** = For information
2.2 Certification requirements
Certification shall be required by Table 2:

Table 2 Certification requirements for umbilicals

<table>
<thead>
<tr>
<th>Object</th>
<th>Certificate type</th>
<th>Issued by</th>
<th>Certification standard*</th>
<th>Additional description</th>
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<tbody>
<tr>
<td>Cable</td>
<td>TA</td>
<td>Society</td>
<td>IEC 60092-350</td>
<td></td>
</tr>
<tr>
<td>Hose line</td>
<td>TA</td>
<td>Society</td>
<td>Type Approval for hose assemblies</td>
<td></td>
</tr>
<tr>
<td>Hose line</td>
<td>TR</td>
<td>Manufacturer</td>
<td>Test report based on a Type Approval</td>
<td></td>
</tr>
<tr>
<td>Lifting element of umbilical</td>
<td>VL</td>
<td>Society</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength element of umbilical</td>
<td>TR</td>
<td>Manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength element of umbilical</td>
<td>WC</td>
<td>Manufacturer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Umbilical</td>
<td>PC</td>
<td>issuing organization</td>
<td>EN 15333-1</td>
<td>Only diver umbilical</td>
</tr>
<tr>
<td>Umbilical</td>
<td>VL</td>
<td>Society</td>
<td>Finished umbilical</td>
<td></td>
</tr>
</tbody>
</table>

*Unless otherwise specified the certification standard is the rules.

2.3 Initial testing requirements

2.3.1 General

a) The required tests are divided into a type test for a prototype and a routine test for the umbilical determined for use..
b) A trial and test program shall be established by the manufacturer of the umbilical according to the specification of the requirements profile defined by the end client (element producer or operator) and to be submitted to the Society for approval. Generally this program shall contain at least the test steps defined in the following.
c) The Society will decide in each case the scope for tests and trials that will be witnessed by a surveyor.

2.3.2 Type test

2.3.2.1 Mechanical requirements
The type test contains the following test steps:

— visual check
— check of dimensions, structure and markings
— weight evaluation:
  — the effective weight for missions of the umbilical [t/1000 m] shall be determined in air and water (if not specified otherwise: seawater with 1028 kg/m³) empty and filled and under defined dynamic load (with friction in water) with the aim to determine the safe working load (SWL) at the upper end of the umbilical
— test of tensile strength:
— the rated tensile strength of the elements provided for the tension load of the umbilical shall be confirmed

— fatigue test:
— the umbilical shall cycle 5000 times under design load with the defined bending radius in one direction and the hose lines pressurised. The number of cycles for launch and recovery with complex sheeving will be considered case by case. Subsequently insulation and resistance measurement of the single conductors shall be performed. Fiber optics shall be checked for functionality

— torsion test:
— where torsion is expected, a part of at least 1 m length shall be loaded vertically with 0.3 SWL and to be twisted by 90° for 5 minutes. After the test no remarkable lengthening or twist shall be noticeable. Subsequently electrical lines shall be subjected to a resistance measurement and hose lines to a tightness test under working pressure. Fiber optics shall be checked for functionality

— stretch loading test:
— a part of at least 1.5 m length shall be fixed at the ends and a pretension in longitudinal direction shall be brought up. The size of the pretension shall be agreed with the Society. For 5 cycles, the size of the pretension shall be increased by 5 times and lowered again. Subsequently electrical lines are subjected to a resistance measurement and hose lines to a tightness test under working pressure. Fiber optics shall be checked for functionality

— external pressure test (not applicable for diving systems):
— in general the umbilical shall be subjected to a cyclic hydraulic pressure test with 2 times the nominal pressure of the umbilical PN. For high water depths the test pressure shall be agreed with the Society

— attention shall be paid to the fact that for hose assemblies the internal pressure is not below the working pressure

— tightness test of the complete umbilical type:
— all hose assemblies shall be simultaneously subjected to the maximum allowable working pressure and an eventual loss of pressure because of leakage shall be checked. A maximum allowable leakage rate of 1% pressure loss within 24 hours is acceptable for the different hose lines. NB: Build-up of gas inside the umbilical sheathing is not permitted in the event of a small leakage from a hose.

— if gases with a content by volume greater 25% oxygen shall be transported, all materials coming into contact with oxygen shall be checked for their oxygen suitability (e.g. according to EN 559, see also Ch.6 Sec.2 [5]). For allowable working pressures of more than 25 bar an oxygen pressure surge test shall be performed (e.g. according to EN 15333-1).

In an actual case of application, depending on mission duty and operational conditions it will be decided by the Society if all defined tests shall be performed.

If required, the specified liquid and gas volume which can be put through shall be checked (if necessary, extrapolate results based on the actual length of the umbilical).

2.3.2.2 Electrical/electronic requirements
Principally the electric and electronic characteristics specified for the project shall be proven e.g. by a type test according to IEC 60092-350.

The type test contains the following steps:
— each single cable has to meet the requirements according to Sec.2 [3.2].
— the cross watertightness of the umbilical shall be proven within the external pressure
— test according to [2.3.2.1]
— the measurements of the insulation according to Sec.2 [3.2] shall be performed before or after the test of cross watertightness.
— impedance and/or capacity tests shall be performed depending on voltage and duty of mission in agreement with the Society.
— evaluation of voltage insulation strength according to Table 1 Sec.2
— check of compliance with the specifications for insulation, capacity and eventually impedance
— check of transfer of the specified data volume/time unit (If data cables are tracked together with cables for voltage supply within the umbilical, the check of data transfer shall be done with active nominal voltage. Voltage peaks by e.g. switching actions shall be considered.)

2.3.3 Routine test

2.3.3.1 Mechanical requirements
Within the series production the routine test contains the following test steps:
— visual check
— check of dimensions
— external pressure test:
  In general the umbilical shall be subjected to a hydraulic pressure test with 1.5 times the nominal pressure of the umbilical $P_N$ (cyclic according to the Ch.8 Sec.3 [3]). Attention shall be paid to the fact, that for hose assemblies the internal pressure is not below the working pressure.
— pressure test of the complete finally assembled hoses including end fittings:
  All hose lines shall be subjected to 1.5 times (metallic hose lines) resp. 2 times (nonmetallic hose lines) the maximum allowable working pressure.
— tightness test of the complete finally assembled umbilical including end fittings:
  All hose assemblies shall be subjected at the same time to the maximum allowable working pressure using the original media (as far as possible) and an eventual pressure decrease because of leakage shall be checked. A maximum allowable leakage rate of 1% pressure loss within 24 hours is acceptable for the different hose lines. NB: Build-up of gas inside the umbilical sheathing is not permitted in the event of a small leakage from a hose.
  During the tightness test the specified properties shall be verified by insulation tests for electrical conductors as well as impedance measurements for signal cables.
— the cleanliness of the hose lines shall be checked.

2.3.3.2 Electric/electronic requirements
Within the series production the routine test contains the following test steps:
— each single cable has to meet the requirements according to Sec.2 [3.3] covering failure test, if applicable.
— measurements of the insulation according to Sec.2 [3.3] shall be performed before and after the test of cross water tightness within the external pressure test according to [2.3.3.1].
— evaluation of voltage insulation strength according to Table 3 in agreement with the Society
— check of faultless transfer of the specified data volume/time unit by the data cables.

2.4 Marking
The marking of the umbilical shall be provided according to Pt.4 Ch.1 Sec.2.
SECTION 2 DESIGN PRINCIPLES

1 General

1.1
The requirements defined in the following are minimum requirements for the majority of the prospective applications. For special use the selection of the requirements shall be agreed with the Society.

1.2 Scope
Generally the following requirements shall be considered for the design:
— environmental influences, see Pt.3 Ch.3 Sec.2.
— influence of weight (deadweight, empty, full)
— buoyancy behaviour (positive and negative buoyancy, neutral buoyancy)
— dynamic influences because of ship movements and increasing and lowering the pressure inside
— thermal influences on expansion and shrinking because of possible temperature changes inside and outside
— thermal influences because of power cables partly on drum
— pressure differences in hoses between upper and lower end of umbilical
— chemical and electrochemical influences
— tensile loads.

1.3
The control of the coil-up/coil-off mechanism for the umbilical and the monitoring of the supply through the umbilical including the production of materials to be supplied shall be concentrated at a control stand. For manned, non-autonomous submersibles the control and monitoring shall be integrated into the control stand which maintains the connection with the submersible. For unmanned, remotely controlled submersibles and other elements these shall be integrated into the control station.

1.4
Umbilicals shall be produced in one piece for the complete required length and shall not be divided into different parts.

1.5
Requirements and tests of umbilicals for hose supplied diving equipment shall be taken from standard EN 15333-1 or similar.

2 Mechanical requirements

2.1 Materials

2.1.1 Only materials according to recognized standards shall be used and their application shall be clearly recorded and traced.
2.1.2 The materials shall be suitable for the use in salt water. If a mission in other media than water is planned, these shall be adequately considered. The material of hose assemblies shall be suitable for the media to be transported. The materials shall be suitable for permanent and varying bending stress.

2.1.3 If hoses are used for breathing gases their suitability shall be proven (e.g. off-gas testing).

2.1.4 Umbilicals, hose assemblies and cables shall be protected against abrasion and damages.

2.1.5 The protection layers of umbilicals shall be designed that no internal pressure can be built up if small leakages occur in an internal hose.

2.2 Tensile load

2.2.1 For umbilicals with integrated lifting cable the mechanical characteristics shall be judged according to the submitted documentation. Hereby the maximum permissible tension load and the minimum breaking load of the umbilical shall be defined by the manufacturer.

For the use of lifting cables made of steel the maximum static tension load created by the safe working load shall not exceed 1/8 of the proven breaking load of the cable. For the use of lifting cables made of chemical fibre the maximum static tension load created by the safe working load shall not exceed 1/10 of the proven breaking load of the cable.

For the use of lifting cables for non-essential scientific devices a reduced breaking load of the cable may be approved in agreement with the Society under consideration of risk potential and intended use.

Further on, the functionality of the elements contained in the umbilical at maximum possible longitudinal extension of the umbilical shall be considered.

The umbilical shall be constructed to prevent torsion to the underwater system for the whole range of tensile stresses.

The strength members of umbilicals shall have sufficient stiffness to avoid overload of electrical conductors and fibre optics at design load, and shall be properly secured.

2.2.2 If there is no lifting cable or strength element included, the integrated cables and hose lines shall be protected from excessive stress at the connection points by suitable devices. The minimum tension load shall be defined considering the duty of the mission and shall be agreed with the Society and proven.

2.2.3 If buoyancy elements or weights are used to change the buoyancy behavior, these shall be securely fastened without damaging the umbilical.

No additional torsional effects shall be created.

2.2.4 Hoses with non-corrosion-resistant reinforcements shall be protected against the surrounding media.

2.3 Bending and buckling

Umbilicals shall be adequately arranged to avoid kinking. According to the structure of the umbilical the minimum bending radius shall be agreed with the Society.

The minimum bending radius of a single component (e.g. lifting cable, cable, hose assembly, etc.) shall not be larger than the minimum bending radius of the complete umbilical.

If special elements are used to avoid kinking, these shall be securely fastened without damaging the umbilical.
2.4 Hose lines

2.4.1 Lay out
The following is required for the layout of hose lines:
— Each hose line shall be designed for an internal burst pressure, which shall at least be 4 times for liquids and 5 times for gases of the maximum allowable working pressure.
— Hose assemblies to be subjected to external pressure, shall be designed for at least 1.1 times CDP for manned submersibles and 1.0 times CDP for ROVs and other elements.
— The maximum possible pressure difference Δp between inside and outside pressure shall be considered.
— Hot water hoses shall be designed for conveyance of fluids of temperatures not less than 100°C

2.4.2 Type test
Burst pressure test:
— Each hose assembly shall be subjected to internal pressure until bursting. The minimum burst pressure shall be for liquids 4 times MAWP, for gases 5 times MAWP

External pressure test:
— Hose assemblies which are additionally subjected to external overpressure have to undergo a hydraulic pressure test with 1.5 times the maximum possible pressure difference between inside and outside.

For further details see Standard for Certification No. 2.9.

2.4.3 Routine test
Within the series production the routine test contains the following test steps:
— Pressure test:
  Before integration into an umbilical, each hose shall be tested with an internal pressure of to 1.5 times MAWP (maximum allowable working pressure) for metallic hose assemblies and 2 times MAWP for nonmetallic hose lines.
— External pressure test:
  Hoses which are additionally subjected to external overpressure have to undergo a hydraulic pressure test with 1.5 times the maximum possible pressure difference between inside and outside.

For further details see Standard for Certification No. 2.9.

2.5 Fittings
Connecting elements and fittings shall:
— meet the same inside and outside design pressures as the umbilical,
— not unintentionally disconnect,
— be corrosion resistant and
— be suitable for the environmental conditions, loads and working media.

3 Electrical requirements

3.1 Lay out
For the lay out the following shall be considered:
— Flexible cables resp. highly flexible cables e.g. of class 5 acc. to IEC shall be used, whereby for energy supply cables a minimum sectional area of the single copper conductor of 2.5 mm² shall be provided.
If needed, empty spaces shall be filled with suitable filler material like petroleum jelly, to maintain form stability.

— Electrical cables and optical conductors shall be designed according to their specification. Therefore the maximum length shall be considered.
— For special duties it may be necessary to construct cables with longitudinal water tightness.
— For different cables with several levels of voltage negative influences between them shall be avoided.
— For cables mechanical forces shall not be transferred by the conductors or their insulation.
— Cables shall be provided at least cross-watertight.
— Each cable shall be designed for an external pressure which is at least for manned submersibles 1.1 times CDP and for ROVs and other elements 1.0 CDP. For diving systems it shall be designed to withstand an external pressure of at least 1.3 times the design depth.
— Extended exposure of cables in water shall not lead to a remarkable reduction of the insulation resistance.
— The minimum average thickness of insulating walls and temperature classes shall be in accordance with SHIP Pt.4 Ch.8.

3.2 Type test

Fundamentally the electric and electronic characteristics specified for the project shall be proven, e.g. by a type test according to IEC 60092-350/351.

The type test contains the following test steps:

— visual check
— check of dimensions, structure and marking
— the cross-watertightness of electrical cables/single conductors shall in general be tested with 2 x PN (cyclic). If the cables are integrated in a cross-watertight umbilical, the test may be cancelled in agreement with the Society.
— evaluation of voltage insulation strength according to Table 1.
— measurement of the insulation of energy supply lines with at least 500 V (guiding value: > 500 MΩ x km).
— for cables with a nominal voltage up to 1 kV a check of the insulation values shall be performed with a test voltage equal to 2 times the nominal voltage, but at least 500 V.
— for energy supply lines with a nominal voltage above 1 kV a check of the insulation values shall be performed with a test voltage of at least the nominal voltage.
— the test comprises the evaluation of the insulation value of all conductors against each other as well as of each single conductor against the external insulation layer.
— the measurement of the insulation shall be performed before and after the test for cross water tightness and after the test for voltage insulation strength.
— resistance measurement of all single conductors
— measurement of partial discharging according to IEC 60885-2 at voltages above 3.6/6 kV (U₀/U) for all single conductors of the cable
— impedance and capacity test depending on voltage and duty of mission in agreement with the Society
— check of compliance with the specifications for insulation, capacity and eventually impedance

Table 1 Test voltages for cables

<table>
<thead>
<tr>
<th>Um</th>
<th>kV</th>
<th>1.2</th>
<th>3.6</th>
<th>7.2</th>
<th>12</th>
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<tbody>
<tr>
<td>U₀/U</td>
<td>kV/kV</td>
<td>0.6/1.0</td>
<td>1.8/3.0</td>
<td>3.6/6.0</td>
<td>6.0/10</td>
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<td>AC test voltage</td>
<td>kV</td>
<td>3.5</td>
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<tr>
<td>DC test voltage</td>
<td>kV</td>
<td>2 x U</td>
<td>1.5 x U</td>
<td>1.3 x U</td>
<td>1.25 x U</td>
</tr>
</tbody>
</table>
3.3 Routine test

Within the series production the routine test contains the following test steps:

— visual check
— check of dimensions, structure and marking
— covering failure test, if applicable
— evaluation of voltage insulation strength according to Table 1
— the cross watertightness of electrical cables / single conductor is in general to be tested with \( 1.5 \times P_N \) (cyclic) according to Ch.8 Sec.3 Figure 2. If the cable is integrated in an umbilical which is cross watertight, this test may be avoided in agreement with the Society.
— the insulation measurement according to [3.2] shall be performed before and after the test of cross watertightness and after the test for voltage insulation strength.

3.4 Electrical connecting elements

Connecting elements shall be designed for the same external pressure as the cables. They shall not unintentionally disconnect and shall be corrosion-resistant. Electrically they shall follow the layout of the adjacent cables and shall in addition be watertight in longitudinal direction. The electrical and mechanical characteristics shall not be influenced in a negative way by the connecting elements.

4 Coil-up/coil-off mechanism for umbilicals

4.1

An adequate coil-up and coil-off mechanism shall be provided for the umbilical, which is tracking the umbilical without restriction of the freedom to move and without additional mechanical loads to the element under water.
If a control for following up umbilicals (TMS – Tether Management System) is provided for the mechanism, the requirements of [2.2] shall be considered.

4.2

The following requirements shall be considered for the design of coil-up and coil-off mechanism for umbilicals:

— specified operating conditions, e.g. wave height and type of support vessel
— safe working load SWL of the coil-up and coil-off mechanism for umbilicals considering the weight of the umbilical, its buoyancy in water (filled and empty) as well as the friction in water and dynamic effects, e.g. by the seaway
— the radius of the umbilical in the coil-up and coil-off mechanism shall not be less than the specified bending radius of the umbilical

Remarks:

\[ U_0 = \text{nominal main voltage between conductor and earth or metallic screen} \]
\[ U = \text{nominal main voltage between the conductors for which the cable is designed} \]
\[ U_m = \text{maximum permissible voltage for equipment} \]

1) test voltage case by case according to agreement with the Society
   The test period is in case of using AC as test voltage 15 minutes.
   The test period is in case of using DC as test voltage 1 minute.
— the most unfavourable arrangement of the umbilical in relation to the coil-up and coil-off mechanism (e.g. coil-up angle, position of the winch drum, application of guide pulleys, etc.) shall be considered
— the coil-up and coil-off mechanism shall be equipped with a power source which is in the condition to safely coil-up and coil-off the umbilical under the specified conditions
— the coil-up and coil-off mechanism shall be equipped with auxiliary drives to be able to finish an already started coil-up and coil-off procedure in a safe way if the main drive respectively the hydraulic pump are failing
— to avoid overstressing of umbilical and the coil-up and coil-off mechanism, measuring of the tension force shall be provided at a suitable position of the system, which triggers an alarm at the control station in case of exceeding the safe working load SWL
— the coil-up/coil-off mechanism shall be provided with a suitable emergency cutting tool.

5 Jettisoning of the umbilical
Where jettisoning of the umbilical is intended to be installed the following requirements do apply.

5.1
In case the umbilical is caught at an underwater obstacle and this hindrance cannot be removed by relevant manoeuvring, it may be necessary to separate the umbilical from the element under water and to initiate an independent surfacing procedure.

5.2
For manned submersibles it shall be possible to drop, respectively to cut-off the umbilical, from the inside of the submersible by the crew. The jettisoning system shall be so designed that two operational actions which are independent of each other and which need no electric energy are required to activate the separation.

5.3
For unmanned elements, for which jettisoning is required, the umbilical shall be dropped, respectively cut-off at the connecting point with the submersible, from the control station. The jettisoning system shall be designed so that an unintentional jettisoning is avoided.

5.4
For other underwater elements, the possibility for jettisoning shall be agreed with the Society according to type and mission duty.
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