Guidance Note : Umbilical Impact Testing

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1.0 INTRODUCTION

For Control Umbilical there exists limited specific information or guidance in the industry specifying test methods, set-up and acceptance criteria's relevant for impact testing. The test specifications used for Control Umbilical impact testing have often been related to pipelines or subsea structures which naturally have better resistance towards impact. In API 17E the impact test is mentioned, however, with no specific requirements.

This guidance note sets out to address the gaps in the referenced standards where Purchaser does not provide any specific requirements or criteria with the following objectives:

- Review and provide a summary of applicable standards and codes to determine applicable requirements, if any.
- To provide guidance on the typical practices used in the Umbilical Industry
- To provide a guidance on test procedures and test criteria

2.0 BACKGROUND

Impacts testing of Control Umbilical's are mainly performed to determine the level of resistance and robustness of the tested object because of it's design.
The level of impact resistance from the tests should be used as guidance for handling and can be used to determine the level of protection of the products when installed. For cases where the umbilical requires specific impact toughness this must be specified with impact energy and object shape in Purchaser's functional specification.

The guidance note will be limited to cover impact situations for static Control Umbilical's on seabed. Impact testing resulting from dynamic analysis will not be covered by this guidance note. Such unique cases have several variables and must be handled case by case; hence no riser impact as a result of interference will be covered.

3.0 REFERENCES

[1] API 17E: 2017
[2] ISO 13628-5: 2009

4.0 PURPOSE OF THE IMPACT TEST

Impact loads can be caused both by planned activities or it can be due to unplanned activities, i.e. accidental impact.
Impact loads that can be evaluated for an umbilical can typically be;

Defined functional impact loads*	Accidental impact loads**
Rock dumping Installation loads	Dropped object Trawl board impact Anchor line failure Hook/snag loads, such as dragging anchor

Notes:

* Planned impact loads defined by purchaser
** Un-planned impact loads

Accidental impact energy is normally not being regarded as design parameter for control umbilicals. Testing to determine impact capacity of the specific umbilical design can be performed. In case there is a risk for the umbilical to be exposed to impact loads exceeded manufacturers previous qualified design may require a qualification test to prove the umbilical design related to the impact loads defined by purchaser.

Impact testing of control umbilical can be divided in two categories:

1) Testing for planned impact loads, typically rock dumping or other requirements specified by purchaser.
2) Testing to determine impact resistance, following the intention of API 17E.

5.0 BASIS FOR IMPACT TESTING

5.1 TESTING FOR PLANNED IMPACT LOADS

The following information must be specified in the functional specification by the purchaser.

- Impact energy
- Shape of impact object
- Test bed condition

In case the control umbilical is planned to be rock dumped and the above information is not available the following can be used:

- Impact energy: 0,5 kJ
- Impact object: Flat plate 100mm along the length of the umbilical and sufficient to cover the diameter of the umbilical, with radiused edges
- Test bed: 100mm sand (dry)

5.2 TESTING TO DETERMINE IMPACT RESISTANCE

Testing to determine impact resistance can be performed with various test objects and load increments. This document presents test conditions that can be used. It is recommended to use conditions of test presented herein such that over time statistical data can be used to compare design variants. It is expected that impact damage at the higher energies may be significant and that this testing is for information only.

Proposed test conditions:

- Impact energy: 1, 3 and 5 kJ (these are suggested values only and others may be chosen dependent on the umbilical type and application)
- Impact object: Flat plate 100mm along the length of the umbilical and sufficient to cover the diameter of the umbilical, with radiused edges
- Test bed: 100mm sand (dry)

5.3 TEST SAMPLE

The impact test can be performed either as one sample per load step or several load steps on one longer sample. For single load samples it is important to have sufficient length to avoid any possible end effects and to allow for functional test of elements after impacting.

For test sample with multiple load steps, it is important that the sample has sufficient length to obtain a minimum distance between impact areas such that the load steps are to be considered as single impacts and allow for functional testing of elements. Therefore, there should be an evaluation of the critical hit point(s) and cconsideration should be given, when determining the length of the sample and location of the three impact tests, to try and replicate each test on a virgin area of the umbilical that are representative of each other.
It should be mentioned that in case of failure of a functional test after impact it should be possible to cut away the failed part and repeat the functional test in order to confirm functionality for the lower load step.

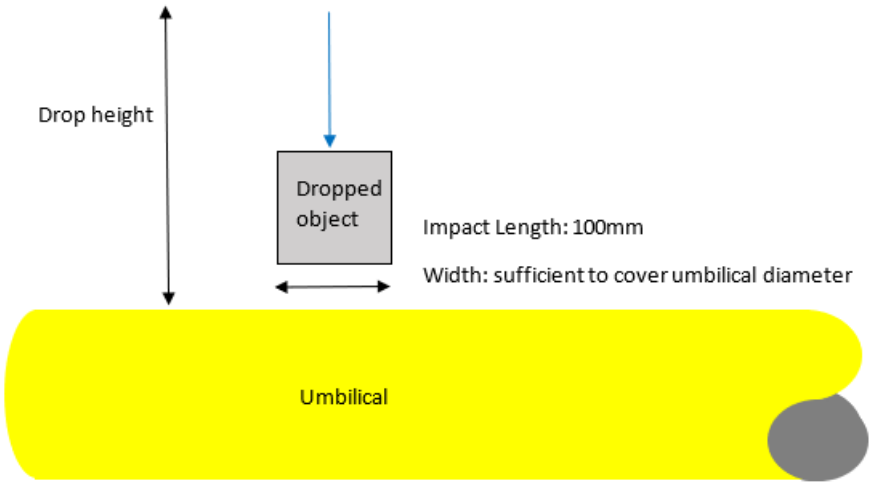

Figure 1: Representation of sample with impact location

5.4 TEST APPARATUS

The impact rig shall be designed to perform impact of the product in a safe manner to the various impact energies, as defined.
The test rig can be arranged for both vertical falling impact object or swing arm type rigging for horizontal impact.

5.5 INSPECTION AFTER TEST

The functional components within the sample shall be post-tested in accordance with the tests specified in ISO 13628-5 section 11 or API17E, whichever is relevant for the contract.

The product shall be dissected upon completion of impact testing, and be subject to various electrical, pressure or fibre optical test.

Perform dissection and visual inspection of umbilical elements and report findings.

5.6 ACCEPTANCE CRITERIA

Acceptance criteria for planned impact load test

The acceptance criteria shall be no deformation of any of the umbilical elements which can reduce design service life discovered during visual or dimensional inspection.

Visual cosmetic damage to the outer jacket is acceptable.

Acceptance criteria for accidental impact load test

For tests performed to document accidental impact load test resistance of the product, the testing is performed for information only.