Qualification Procedure for IU cables and ICC

KM3NeT_QUAL_2020_005_v3

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CPPM

Abstract

This document describes the pressure qualification tests procedure to be applied to the cables instruments-to-interfaces and ICC module of the Instrumentation Unit for the KM3NeT project.

Recipients

The KM3NeT PSC, The KM3NeT Calibration Group

Document Status

Revision	Date	Comment	Reviewed by	Approved by
			XX	YY

Revision History

Revision	Date	Description
Draft	01/04/2020	First draft
V1	02/04/2020	Reviewed by Pascale
V2	03/04/2020	Add UUT UPIs
V3	08/04/2020	Check availability ICC blind plug

1 Table of Contents

2 Documentation

2.1 Abbreviations

Abbreviation	Description
DU	Detection Unit
IU	Instrumentation Unit
IL	Instrumentation Line
IMM	Inductive Modem Manager
PBS	Product Base Structure
ICC	Inductive Cable Coupler
CU	Calibration Unit
TRR	Test Readiness Review

2.2 Reference Documents

Abbreviation	Title	Reference
RD1	KM3NeT TDR	KM3NeT_DS_TDR
RD2	KM3NeT CRD	KM3NeT_DS_CDR
RD3	KM3NeT Qualification Plan	KM3NeT_QUAL_2018_001
RD4	KM3NeT Qualification Procedures	KM3NeT_QUAL_2018_002
RD5	Qualification plan of the CU	KM3NeT_QUAL_2019_010
RD6	ORCA IU Definition Document	KM3NeT_CALIB_2019_017
RD7	IU interface-to-instrument cables plans	KM3NeT_CALIB_2020_001

3 Introduction

This document describes the pressure qualification tests foreseen on the 3 different types of ORCA IU instrument-to-interface cables [RD7] as well as the ICC [RD6].
All these items are only electrical, no optical fibre. The level of voltage used in these cables are max 16 VDC so no problem related to the safety
It will be the support for the Test Readiness Review (TRR) that should be held before to start the qualification processes.

- PBS of the cables to interfaces products (3 different types):
  KM3NeT PBS: 4.3.3.10.1 + 4.3.3.7.1 + 4.3.3.6.1
- PBS of the ICC:
  KM3NeT PBS: 4.3.3.2

Remark: Possibly these test will also include a pressure test of the acoustic emitter (which is processed in a different TRR)

4 Quality and organisational issues

4.1.1 Status of NCR-DCR-Waiver of the item under test

See with Pascale and Laurence

4.1.2 List of people committed

Sylvain Henry
Pascale Keller (responsible of the IU)

5 Definition of the qualification tests

5.1 Pressure test

5.1.1 Objectives and expected results

The goal is to check the service pressure of a container from the point of view of the mechanical resistance, sealing and moulding.

5.1.2 Material configuration

5.1.2.1 Unit under test (UUT)

- 3 types of interface cables terminated with blind plug on each side

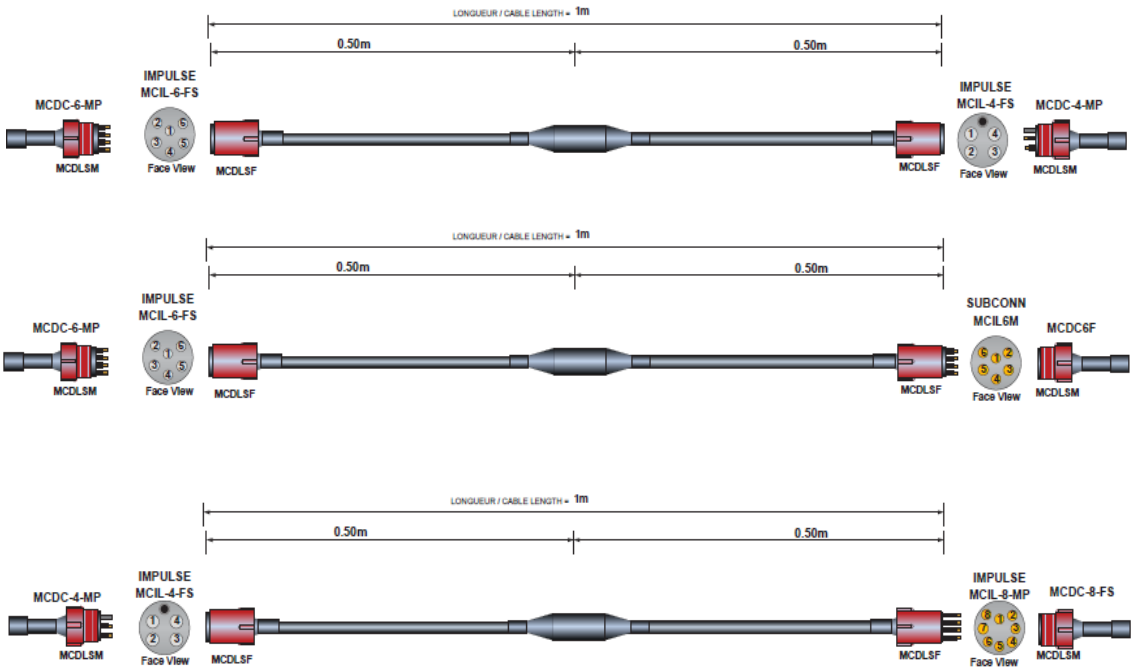

Figure 1: interface cables

- ICC module
  1 cable coupler module terminated with blind plug (available)

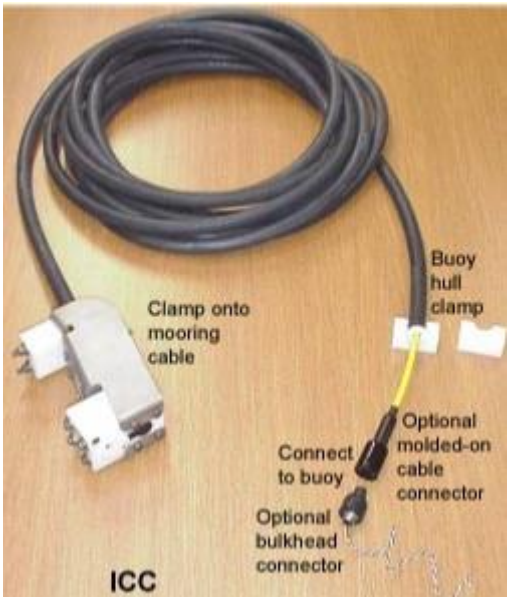

Figure 2: ICC module

The UPI of the UUT are the following:

- 4 cables miniSVS:

4.3.3.7.1/MINISVS/1.1
4.3.3.7.1/MINISVS/1.2
4.3.3.7.1/MINISVS/1.3
4.3.3.7.1/MINISVS/1.4

- 3 câbles CTD:

4.3.3.6.1/DO/1.1
4.3.3.6.1/DO/1.2
4.3.3.6.1/DO/1.3

- 3 câbles AQD :

4.3.3.10.1/NORT_NI/1.1
4.3.3.10.1/ NORT_NI/1.2
4.3.3.10.1/ NORT_NI/1.3

5.1.2.2 Test equipment

Hyperbaric chamber of Euroceanique at Le Rousset (FRANCE)
The main characteristics are:

- Max pressure: 600b
- Ramping; controlled
- Dimensions: Length 1000mm x Diameter 600mm

Remark: Device already used several time for the KM3NeT qualification (ORCA base module flanges, ARCA base module cylinder)

Figure 3: Hydrostatic pressure vessel

5.1.2.3 Mechanical support equipment

No mechanical support needed. The UUT will be put directly in the chamber

5.1.3 Test and monitoring of the material

Before and after the pressure test:
The cables will be tested both electrically (measurement of the resistance of each path) and from a functional point of view (communication with the instruments using the CPPM existing test bench)

During the pressure test:
Visual inspection

5.1.4 Pass/fail criteria

Measured parameters criteria:

- Resistance measurements still to be performed. The success criteria would be ±5% from these values

- Functional tests :
  Serial communication with a PC to send and receive data to each interface-instrument couple.
  4 miniSVS-SBE44 couples (3 + 1 spare specific cables)
  3 CTD-SBE44 couples (2 + 1 spare specific cables)
  3 Aquadopp-UIMM couples (2 + 1 spare specific cables)

Visual inspection criteria:

- absence of any visible deterioration on the cable body and at the connectors
- integrity of the pins
- No trace of water

5.1.5 Test procedure

This procedure aims to test the equipment for use at the ORCA site at a depth of 2500m. The level of constraint will be defined according to this.

P_t : Test pressure
P_S : Service pressure (250 bars for the ORCA case)

	Ramping speed	**Test pressure**	**Temperature**	**Duration**	**Number of cycles**
Qualification tests	12 bar/min	$P_t = P_S$ x **1.5** P_t = 375bars	Room Temperature	1h	1
	Visual inspection in between				
	12 bar/min	$P_t = P_S$ P_t = 250 bars	Room Temperature	48h	1

5.1.6 Tests organization

The UUT are ready at CPPM
The test site is very close to CPPM
There is 2 options:

- The UUT will be sent to Euroceanique and the test and inspection will be carried out by the technician of the company (in this case a procedure for inspection will be provided) In this case, note that Euroceanique is also the company that performed the moulding of the cables and they have all the competences for an inspection (except for the ICC done by Seabird)
- The CPPM team will be present for the first test step and will proceed to the visual inspection

The decision will be taken according to the schedule and the availability of the people at the moment of the tests
The foreseen planning is **end of April-Mid May**