

# WATERTIGHT TESTS FOR OBSEA EQUIPMENTS IN THE HYPERBARIC CHAMBER

**Norman Carreras, Marc Nogueras, Alejandro Arbós, Antoni Mànuel**  
**SARTI (Remote Acquisition and Data Processing Systems), UPC (Technical University of Catalonia)**  
**Rambla de l'Exposició, 24, Ed. VG5**  
**08800 Vilanova i la Geltrú (Barcelona) SPAIN.**  
**Tel.:(+34) 938 967 200 eMail: marc.nogueras@upc.edu**

*Abstract - Description of the procedures to assure the proper water protection of the equipments to be installed in the OBSEA subsea observatory.*

*Keywords - OBSEA, hyperbaric chamber, Watertight tests, pressure, sensors*

## I. INTRODUCTION

In order to be able to perform the required tests to assure the leakproof capacity of the watertight devices of the OBSEA project, in the SARTI installation there is a hyperbaric chamber. This chamber is an IBERCO model IB-80 with a capacity of 816 liters and with an approximate internal length of 1570 mm and diameter of 800mm. With this chamber is possible to perform test with a maximum pressure of 20 bar what it means a simulated depth of 200 meters. Using this equipment has been done a set of tests to guarantee the proper operation of the whole

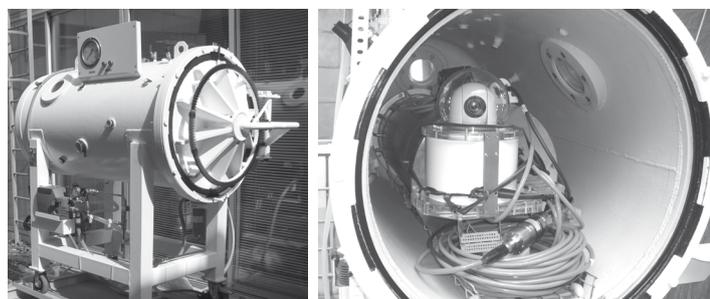


Fig. 1. Hyperbaric chamber

Fig. 2. Preparation of the test

system (cylinders, cabling and connectors) of the OBSEA project. In the fig. 1 is shown the hyperbaric chamber available in the SARTI development center.

## II. DISCUSSIONS AND RESULTS

One of the main difficulties when performing tests in the hyperbaric chamber is the connection of the devices under test (DUT) to outside of the chamber. The chamber has several penetrators in many sizes for the wall crossing using pressure watertight cable glands. The problem with these cable glands is that they allow the pass of the cable but not the connector of the cable end. It means that some tests using optical or submarine cables must be carefully planned in advance and using accessories to be able to perform the connection.

In order to test the totality of the components of the OBSEA subsea station first it has been done several tests with any isolated component and then has been done compatibility tests with several components in the same time but always with the limitation that the cables already terminated in both ends cannot be used to transmit data outside to the chamber and that the internal size is not big enough to test the whole station at once.

The components that have been tested are:

- The main junction box, (1000 x Ø 400 mm).
- The submarine cable termination box (600 x Ø 200 mm)
- Underwater IP Camera System OCEAN PRESENCE Technologies OPT-06
- Bjorge NAXYS Ethernet Hydrophone 02345
- CTD Sea-Bird Electronics SBE 37-SMP MicroCAT
- Underwater connectors from GISMA series 10 (electrical) and series 40 (electro-optical)
- Underwater electrical and optical cables
- Ethernet to serial special cable
- Some mechanical accessories

The cylinders and watertight boxes have been tested firstly without cables, connectors or electronics inside. These tests have been done at several pressures

from few deciBars to the maximum allowed depth for the box checking for leakages in each test. With this procedure has been possible to detect structural defects and assembling faults without the inconvenience of destroying any component.

With these tests have been detected some leakages in the protecting caps of the junction box and in a welded seam of the termination box.

Once the leakproofness of the stainless steel boxes has been asserted the underwater connectors has been installed to allow the connection to the external devices. The connectors are designed to resist the adverse conditions of the marine environment and to allow wet connections of new instruments with the station in the seafloor. After that, new tests have been done to corroborate the correct assembly of the connectors.

Then we were able to install electronics inside the boxes and connect it to the exterior of the chamber using the cable glands. With these tests has been possible to monitor the heat generated for the power supplies and redesign the internal distribution to improve the dissipation and avoid hot areas. The other strategy that has been choice to increase the heat dissipation is the increment of the internal air pressure using dry air.

In order to test the hybrid cable (power and optic) we have done additional tests with the junction box and termination box connected together with this cable. Do to is not possible to take one end of the optical cable out of the chamber, to test that the pressure is not affecting the optical communication, it has been done a loop connection using four fibers of the hybrid cable between the two Ethernet switches of the junction box. Then the Ethernet connection has been got out the chamber electrically through and instrument port and cable gland. The three oceanographic instruments currently installed in the OBSEA station have also been tested in the hyperbaric chamber in order to validate the manufacturer specifications. For the CTD, in addition, has been tested the special cable that is converting the serial data to Ethernet. This cable has a plastic box with electronic inside, to protect this electronic from the water pressure the box has been filled with epoxy resin. All this instruments has been tested, first, alone directly connected to an external computer, and then, all together connector to the junction box (see fig. 2). These tests have been useful not only to test the waterproof of the components but also to verify that all the electronics are compatible working together and also to confirm that the humidity sensor is really useful to detect small leakages before than water will reach the internal electronic.

## III. CONCLUSIONS

The tests have been useful to detect leakages in the assembly of some connectors and manufacturing faults that have been corrected before the installation in the seabed. These tests have been helpful also for the thermal characterization of the junction box when it is immersed in water to redistribute the internal components. Finally it can be certified that all the components resist more than twice the water pressure of the place where they will be installed.

## REFERENCES

- [1] M. Nogueras, J. Santamaria, A. Mànuel, "Construction of the OBSEA Cabled Submarine Observatory" *Instrumentation Viewpoint*, Num.6, pp33-34, autumn 2007.
- [2] C. Artero, M. Nogueras, S. Shariat-Panahi, A. Mànuel, et al., "Diseño del sistema de control y adquisición de datos del Observatorio Submarino ExpAndible (OBSEA)". SAAEI08. Cartagena (España). Septiembre 9-11 de 2008.
- [3] SARTI. <http://www.cdsarti.org>