Deep Life Ltd
Functional Safety
Certificate of Conformity

This is to certify that the following models of rebreathers:

"OR_Umbilical" for umbilical supplied commercial diving,
"OR_Incursion" for professional SCUBA diving,
"OR_Apocalypse Type IV iCCR" for recreational diving,
"OR_Apocalypse Type IV O2-CCR" for oxygen diving;

manufactured by EMA Ltd for Open Safety Equipment Limited at
16 Zetland Road, Hillington Industrial Estate, Glasgow, Scotland GW52 4BW,

conform to EN 61508:2004 Parts 1 to 3 to Safety Integrity Level 3.

The basis of conformity is a certified Functional Safety capability and process covering all relevant product life cycle stages identified in IEC 610508-1 Clause 7 from concept to production and validation, namely (1) Concept, (2) Overall scope definition, (3) Hazard and risk analysis, (4) Overall safety requirements (5) Safety requirements allocation (7) Overall validation planning, (9) E/E/PES safety related systems: realisation (hardware and software), (13) Overall safety validation. Processes are managed by Deep Life Ltd, King's Gate Lodge, Dalkeith, Scotland, EH22 1ST including audit of the relevent suprocesses operated by EMA Ltd, and have been applied to the products listed above.

The Functional Safety Capability and Process of Deep Life Ltd has been assessed by SIRA Certification Ltd and found to comply with

IEC 61508 Part 1:1998 Clause 6
Management of Functional Safety

When assessed using the

The CASS guide to Functional Safety Capability Assessment Issue 2a

CoC N. DL_S001
Issued: 5th March 2010

Certified Functional Safety Process
Certificate No.: CASS 00013/01
Certificate issued: 4th March 2010
Issued by: SIRA Certification

Signed:
Dr. Alex. Deas FIET
Director & Lead Technologist

Product description and scope of certification

This Certificate covers four models of rebreather in a product family called “Open Revolution Diving Rebreathers”. All rebreather models are marked with “Deep Life Open Revolution Compliant Rebreather” and a model number as follows:

- “OR_Umbilical” for the dual scrubber (DRB) eCCR/eSCR BMCL configuration.
- “OR_Incursion” for the single scrubber (SRB) eCCR BMCL configuration
- “OR_Apocalypse_Type_IV iCCR” for the single scrubber air, trimix and heliox recreational model. This is an Intervention CCR (iCCR) where the user intervenes to maintain the PPO2 using an electronics pod set that monitors the rate of that intervention and the breathing loop PPO2, Exhaled CO2 and E.A.D, intervening to bail out the diver if any of these parameters fall outside predefined limits (i.e. if the diver is not intervening correctly or the loop is outside predefined limits).
- “OR_Apocalypse_Type_IV O2-CCR” for the single scrubber pure oxygen recreational model.

All four rebreather models share parts extensively and are of the same generic design. The scrubber design, ports, counterlung construction, gas routing, flapper valves, seals, hoses and attachments are the same in all four models: that is, parts can be interchanged and are one family of products.

A detailed description of each model is presented in the User Manuals, Bills of Material, and Exploded Drawings. The Functional Safety process has been applied to all parts of the rebreather worn by the diver, including mechanics and interfaces.

Avoidance and control of equipment failures is achieved by the following measures:

1. Limitations of use set down in **User Manuals** for each model of rebreather
2. **Accident and Incident Studies**, for commercial diving, military diving and sports diving using rebreathers, with focus on functional safety implications and mitigation.
3. **HAZOP** Minutes for each part for which there is not a specific Design Verification Report, with focus on functional safety implications and mitigation.
4. **FMECA**, running to 8 volumes and which include results of HAZIDs and HAZOPs.
5. **Formal Verification models** covering each functional safety requirement in the E/E/PES, including fault modes where appropriate, applied for exhaustive validation.
6. **Comprehensive tracking of safety requirements** using a Mantis system.
7. **Engineering design documentation** complying with the certified Functional Safety process.
8. **Design Validation and Verification** of each subassembly and functional safety requirement.
9. **Standards compliance** assessments for all relevant standards.
10. **Consistent Application of a Certified Functional Safety Process** covering all relevant life cycle stages.

Management of functional safety

The products are supported by an appropriate functional safety management system that is certified to meet the relevant requirements of IEC 61508-1:1998 clause 6.

Certified Functional Safety Process
Certificate No.: CASS 00013/01
Certificate issued: 4th March 2010
Issued by: SIRA Certification

Product Certificate of Conformity issued against a certified functional safety process by:

Deep Life Ltd, Kings Gate Lodge, Dalkeith, Scotland. EH22 1ST

Conditions of Safe Use

The validity of the certified data is conditional on the user complying with the following conditions:

1. The user shall comply with the requirements given in the user manual in regard to all relevant functional safety aspects such as application of use, installation, operation, maintenance, proof tests, maximum ratings, environmental conditions, repair, etc;
2. Selection of this equipment for use in safety functions and the installation, configuration, overall validation, maintenance and repair shall only be carried out by competent personnel, observing all the Manufacturer's conditions and recommendations in the user instructions.
3. All information associated with any field failures of this product should be collected under a dependability management process (e.g., IEC 60300-3-2) and reported to the Manufacturer.
4. The user shall ensure that appropriate actions are taken to maintain the required risk reduction in the event that the diagnostics reveal a potential failure.

This certificate has been issued on the basis of the following undertakings by OSEL:

1. The release process for the equipment shall be as set down in the Manned Dive Plan including extended operational testing scheduled following CE certification to the PPE Directive.
2. All Mantis tracked requirements that are required to be resolved by the functional safety process of Deep Life Ltd shall be resolved by the above release process.

General Conditions and Notes

This certificate is based upon a functional safety assessment of the process managing the lifecycle stages of the products listed, the assessment having been made by Sira Certification Ltd including assessment of the relevant sub-processes contracted to EMA Ltd, and certified as set down below.

This certificate comprises three pages.