

Diving Equipment Systems Inspection Guidance Note (DESIGN) for Surface Orientated (Air) Diving Systems

IMCA D 023 Rev. 2 August 2022





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IMCA D 023 Rev. 2

Document designation: this document is categorised as Recommended Practice.

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IMCA D 023 Rev. 2 – Version History

Date	Reason	Revision
August 2022	Updated to clarify any anomalies and bring the guidance into alignment with current industry good practice	Rev. 2
January 2014	Updated to incorporate equipment improvements and changed operating practices since first publication	Rev. 1
February 2000	Initial publication	

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1 Introduction

1.1 Background

In the early 1980s, in order to give some guidance to the offshore industry, IMCA's predecessor the Association of Offshore Diving Contractors (AODC) started to produce a number of reference documents, standards and guidance notes. This process continued through the 1980s. It was clear, however, that there was still considerable confusion with some diving systems being "audited" several times a year by different clients, each of whose representatives had slightly different interpretations as to what was required.

AODC published document reference AODC 052 - Diving Equipment Systems Inspection Guidance Note (DESIGN) - in February 1989 that sought to clarify any interpretations necessary and to identify a common standard that could be applied by all parties during an inspection. It was intended for use offshore in the UK sector of the North Sea but in the absence of other guidance it became a standard reference in many parts of the world, particularly where there were no specific national regulations.

Subsequently AODC expanded and revised the document which was re-issued as Rev. 1 in February 1995. This more comprehensive document covered both air and saturation diving systems. It was still based on the requirements of the UK sector of the North Sea but was adopted by many clients and diving contractors world-wide. Some users, however, found it to be complex and difficult to use.

With the increasingly international nature of the offshore diving industry, IMCA revised AODC 052 Rev. 1 in order to simplify it, clarify any anomalies which had shown up and adapt it for international use, rather than restrict it to North Sea use. It was also decided to split it into separate documents, one for surface diving (DESIGN for surface orientated (air) diving systems (IMCA D 023), published 2000) and the other for saturation diving (DESIGN for saturation (bell) diving systems (IMCA D 024), published 2001).

Subsequently, documents were issued in 2006 for surface supplied mixed gas diving (DESIGN for surface supplied mixed gas diving systems (IMCA D 037)) and mobile/portable surface supplied diving (DESIGN for mobile/portable surface supplied systems (IMCA D 040)). In 2014 a further DESIGN document for hyperbaric rescue facilities (DESIGN for the hyperbaric reception facility (HRF) forming part of a hyperbaric evacuation system (HES) (IMCA D 053)) was published. During a revision of IMCA D 024 in 2021, it was recognised that life support packages are likely to be in a different physical location to the rest of the equipment covered by IMCA D 024. Section 16 of IMCA D 024 was therefore split away from its parent document to provide a new separate document *DESIGN for Hyperbaric Rescue Unit (HRU) Life Support Packages (LSP)* (IMCA D 063).

IMCA DESIGN documents are periodically updated to clarify any anomalies and bring the guidance into alignment with the latest industry good practice.

1.2 Current Version of IMCA D 023

IMCA D 023 was revised and updated to Rev. 1 in 2014. This latest edition of IMCA D 023 *DESIGN for surface orientated (air) diving systems* has been revised, updated, and published as Revision 2.

It is intended that this document should be used in conjunction with *Code of practice for the initial and periodic examination, testing and certification of diving plant and equipment* (IMCA D 018). Cross-references to this Code are provided where appropriate.

1.3 Status of the Document

This document offers examples of good practice. It gives advice on aspects of a diving system that should be configured in certain ways in order to provide a safer system of working. It also identifies how inspection and testing can be carried out safely and efficiently.

The document has no direct legal status but many courts, in the absence of specific local regulations, would accept that a company carrying out diving operations in line with the recommendations of this document was using safe and accepted practices.

Any company which wishes to do so is free to carry out its operations in ways which do not comply with the recommendations in this document but in the event of an accident or incident it may be asked to demonstrate that the methods or practices that it used were at least as safe as if it had followed the advice of this document.

It is also recognised that other Codes or standards exist. In the absence of specific local regulations, companies carrying out diving operations are free to use this IMCA document or any other suitable standard as the basis for their activities.

1.4 Work Covered by the Document

This document addresses various aspects of a surface orientated (air) diving system as utilised within the offshore diving industry.

The aim of the document is to provide a comprehensive reference source addressing the philosophy of what equipment and layout is required for a safe diving operation plus the examination, test, and certification requirements necessary to meet agreed industry practice. This will apply anywhere in the world being:

outside the territorial waters of most countries (normally 12 nautical miles or 22.22 kilometres from shore);

OR

 inside territorial waters where offshore diving, normally in support of the oil & gas or renewable/ alternative energy industries, is being carried out. Specifically excluded are diving operations being conducted in support of civil, inland, inshore or harbour works or in any case where operations are not conducted from an offshore structure, vessel or floating structure normally associated with offshore oil & gas or renewable/alternative energy industry activities.

This document is intended to assist the following, among others:

- manufacturers and suppliers of diving plant and equipment;
- diving contractors commissioning new build diving systems;
- personnel involved in diving operations;
- vessel owners and marine crews involved with diving operations;
- staff involved in the maintenance, repair, test or certification of plant and equipment;
- client and contractor representatives;
- diving system auditors;
- all personnel involved in quality assurance (QA) and safety;
- concession holders or operators who have a duty of care.

IMCA has included recommendations in areas where there is a difficult balance between commercial considerations and safety implications. It is recognised however that safety must never be compromised for any reason.

1.5 National and Other Regulations, Standards and Codes

A number of countries in the world have national regulations that apply to offshore diving operations taking place within waters controlled by that country. In such cases national regulations must take precedence over this document and the contents of this document should be used only where they do not conflict with the relevant national regulations.

Any person carrying out offshore diving operations should establish whether there are any national regulations applying in the area where diving will take place, remembering that a number of countries have regulations which apply anywhere in the world to diving taking place from vessels registered in that country (the flag state).

There may also be international regulations, codes, or standards (such as International Maritime Organization (IMO) documents) that diving contractors either have to comply with or take serious note of.

1.6 Layout of Document

The information is presented in the form of detail sheets, each of which specifies the requirements for a generic item of plant or equipment, or a group of items, which are covered by the same criteria.

The testing requirements identified will normally correspond with the certification that the diving contractor maintains in a plant and equipment register, or records in the planned maintenance system.

Only generic items of diving plant and equipment are addressed, and the detail sheets do not include information on constituent parts of ancillary equipment.

1.7 Transition Period for Implementation

This document is a revision to recognise changes in good practice which have evolved over the years. For a period of one year following the publication of this revised DESIGN document (IMCA D 023 Rev. 2), IMCA Members may, if they wish, observe the requirements of the previous version of the document (IMCA D 023 Rev. 1). This is to allow IMCA Members the time to make any necessary adjustments to their diving plant and equipment and/or company management arrangements before fully implementing the requirements of the revised document.

In view of this, IMCA will continue to publish IMCA D 023 Rev. 1 alongside IMCA D 023 Rev. 2 for a period of one year, after which period of time IMCA D 023 Rev. 1 will be withdrawn.

1.8 Classification Societies

A number of classification societies publish rules for diving equipment. These normally require similar standards to this document; however, it needs to be understood that the requirements of a particular classification society may not be the same as the requirements of this document. Compliance with one does not mean automatic compliance with the other.

1.9 Use of the Completed Document

A completed and up to date version of this document should be available for a surface orientated (air) diving system prior to diving operations commencing.

The relevant item line in the document then needs to be updated each time a test becomes due or when a replacement certificate is issued.

It is intended that the overall document for a particular surface orientated (air) diving system will be re-completed no more frequently than annually (unless the system is moved from one vessel to another, for example) and that at other times, such as a change of client or jurisdictional location, all that is normally required is a check on the completed document, possibly supported by a small number of spot checks of equipment or certificates.

1.10 Annual Auditing of Diving Systems

IMCA guidance document Guidance on auditing of diving systems – Annual auditing of diving systems (IMCA D 011) – explains how IMCA's DESIGN audit documents can be used as the basis for an annual audit.

2 List of Acronyms

AODC	Association of Offshore Diving Contractors
ASME	American Society of Mechanical Engineers
ВА	Breathing apparatus
BIBS	Built-in breathing system
CCTV	Closed circuit television
DESIGN	Diving Equipment Systems Inspection Guidance Note
DMAC	Diving Medical Advisory Committee
DP	Dynamic positioning
ECU	Environmental control unit
FMEA	Failure modes and effects analysis
fsw	Feet of seawater
HAZOP	Hazard and operability study
HP	High pressure
IMCA	International Marine Contractors Association
IMO	International Maritime Organization
LP	Low pressure
msw	Metres of seawater
NDE	Non-destructive examination
PDF	Portable document format
PMS	Planned maintenance system
PPE	Personal protective equipment
PRV	Pressure relief valve
psi	pounds per square inch
PVHO	Pressure vessels for human occupancy
QA	Quality assurance
RA	Risk assessment
ROV	Remotely operated vehicle
SWL	Safe working load
UPS	Uninterruptible power supply

3 The Competent Person

3.1 General

From the inception of occupational health and safety law, there has existed the problem of how to apply constraints that are sufficient to protect persons at work but that are not so restrictive as to render them impracticable. For any given activity the level of risk can vary widely according to individual circumstances, and, in many situations, it would be unnecessarily burdensome to apply the same limitations to operations at the lower end of the risk scale as for those at the higher end. This is very much the case in the field of diving equipment, plant, and components.

Over the years, legislators have evolved the concept of "The Competent Person" to allow a flexible response according to the prevailing circumstances. There are many examples of its use in health and safety legislation.

Legally, the term "competent person" can refer to an individual, partnership, company, or other form of organisation.

3.2 Application of the Philosophy of "The Competent Person"

In the field of plant and equipment examination, test and certification, the alternative to using the concept of the competent person would be to precisely specify the qualifications, training and experience of persons undertaking any of these tasks, as well as exactly what has to be done on each occasion.

The difficulty of drawing up such detailed requirements would lead to a grave mismatch between the written requirements and what is required to secure adequate health and safety. In addition, the end result would lack the flexibility to allow work to continue broadly in the form in which it is known today. The concept of the competent person avoids this problem.

The normally accepted definition of a competent person, with regard to plant and equipment examination and test (rather than someone involved with maintenance), is:

"Someone who by virtue of their training or experience, or a combination of both, has such practical and theoretical knowledge and actual experience of the plant which has to be examined or tested as will enable him to detect defects or weaknesses which it is the purpose of the examination or test to discover and to assess their importance in relation to the safety of the plant."

The competent person should have the maturity to seek such specialist advice and assistance as may be required to enable him to make necessary judgements and must be a sound judge of the extent to which he can accept the supporting opinions of other specialists.

3.3 Types of Competent Person

In some cases, this document requires the competent person to satisfy themselves that the design or construction of diving plant and equipment makes it suitable for use. That requires a high level of diving expertise which will involve persons with a detailed knowledge of diving techniques and practices and the environment in which the plant will be used.

Other parts of the Code require a competent person to issue a certificate lasting for a period stating that the plant or equipment has been examined and tested and may be safely used. The competent person for these purposes should specialise in relevant aspects of the work and may be an employee of an independent company or an employee of the owner of the equipment, unless a specific legal requirement says this cannot be the case. If employed by the owner of the equipment, however, his duties should include this type of work on a regular basis, and his responsibilities enable him to act independently and in a professional manner.

The competent person should also be active in his trade or profession and be capable of making an independent judgement on the safety of what is being tested or examined or the activity that is being supervised.

For the more straightforward tests or examinations, this level of competence would normally be met by a technician specialising in this type of work (IMCA D 018, category 2) and in some cases may be met by the diving supervisor or the life support supervisor (IMCA D 018, category 1). For more complex tests and examinations, the competent person may require to possess specific academic or trade qualifications or to have access to specialised equipment (IMCA D 018, categories 3 and 4).

There are some circumstances, however, where diving plant and equipment is owned by the owner of an offshore installation or diving support vessel and national regulations may require that examination and testing of specific items such as pressure vessels, lifting appliances and other parts of the diving equipment is to be carried out by a competent person who is neither the owner of the installation nor his employee.

3.4 Categories of Competent Person

IMCA D 018 identifies in detail the various categories of competent person who are able to issue certificates confirming that plant and equipment has been examined and tested in line with the recommendations contained therein.

IMCA issues guidance on the assessment of competence, particularly for Category 1 and 2 personnel (Guidance on competence assurance and assessment: diving division (IMCA C 003)).

3.5 Appointment of a Competent Person

No official body appoints competent persons for the purpose of examining and testing diving plant and equipment. This is entirely a matter to be decided by the person or organisation that wishes to obtain the certification. The competence of any particular individual or organisation may, however, be challenged by any relevant national authority in its enforcement role.

3.6 Completing this Document

The completion of this document may be carried out by more than one person. In that case each person should be knowledgeable and experienced in the areas which they are completing.

The document may be completed entirely by employees of the owner of the diving plant or equipment or may be completed entirely by a specialist working for a client or third party. It may also be a combination of these. If the person completing the document is an employee of the diving contractor, then they would normally have no involvement in the day to day operation of that particular diving system.

In all cases the person(s) completing the document should have the necessary competence to form sensible judgements on the matters contained within it.

4 Responsibilities

4.1 The Diving Contractor

The diving contractor is required to ensure that all plant and equipment necessary for the safe conduct of a diving operation is available for immediate use. This also applies to all facilities provided on a standby or reserve basis which should also be available for immediate use.

In both cases this means that the items need to be examined, tested, and certified as suitable for use as necessary.

It is normally the responsibility of the diving contractor to ensure that a complete copy of this document is prepared for any individual diving system and is updated at regular intervals (normally as each certificate is renewed).

4.2 The Person Completing this Document

The person completing this document has two main areas of responsibility:

Firstly, he must satisfy himself that he has the necessary knowledge and experience and is indeed competent to carry out the checks, examinations, and tasks that he is being asked to do.

Secondly, he must carry out his duties diligently and thoroughly. His decisions can have serious safety implications for those who subsequently use the equipment or plant as they are heavily reliant on the person identifying any faults, omissions, or problems.

More detailed guidance on the system of auditing, types of auditors, etc. is contained in Guidance on auditing of diving systems (IMCA D 011).

5 Planned Maintenance Systems (PMS)

5.1 General

It is a basic requirement that plant, and equipment used in diving operations must be properly maintained in order to ensure that it is safe while being used. Whilst this document does not specify what sort of planned maintenance programme should be employed to ensure conformance, experience has shown that such a system is the best way to achieve systematic and effective maintenance.

It needs to be understood that PMS refers to the regular and planned maintenance of items of equipment and not just to their inspection, testing, and certification – although this may also be required as part of the PMS.

5.2 Planned Maintenance Programmes

These may be prepared in different formats such as:

- a series of notebooks or files etc., one being provided for each major item of equipment or for assemblies of equipment;
- a computer program, backed up by a hard or non-corruptible copy. The intent of this is to ensure that it is impossible to erase all of the records inadvertently;
- a card index system.

Whichever system is used provision must be made for the following:

- inclusion of manufacturers' recommendations and manuals, where appropriate;
- compliance with the requirements of this document where some types of certifications are achieved by means of the PMS;
- a record of planned work to be kept showing each item of maintenance and the interval at which it should be maintained, i.e., daily, weekly, monthly, yearly, etc.;
- a record of unplanned work, including repairs;
- traceability to the person who carried out the work as recorded on an item of equipment whether manual or computer systems are employed;
- records to be kept logically. There should be no doubt on which day maintenance has been carried out and by whom;
- ensuring that maintenance which has been delayed on a particular piece of equipment for any reason, is carried out at the first available opportunity to avoid a hazardous situation arising;
- availability of adequate spares to permit routine and non-routine replacement as necessary.

5.3 Relevance of PMS

While this document is not directly concerned with the planned maintenance system, it is unlikely that a diving system would be able to meet the requirements of the periodic examination, testing and certification advice contained in IMCA D 018 unless an adequate PMS existed. In this respect the PMS would normally be one of the matters considered by the person completing this document when deciding on the level of test and examination required by IMCA D 018 in relation to any specific piece of plant and equipment.

A PMS normally includes the daily/weekly/monthly examinations, tests, maintenance, etc. required for the safe and efficient on-going operation of the equipment. This will typically be based on manufacturers' recommendations and the requirements of the diving contractor's own procedures.

6 Key Features of this Document

6.1 General

Since this document is produced to give guidance and to minimise confusion, it is necessary to elaborate on a number of terms used in the document and also to explain the way in which it is intended that the document will be used.

6.2 Meaning of Terms Used

Within IMCA D 018 various terms are used extensively such as "examination", "visual examination", "function test" and "test". Detailed explanations of what these terms mean is included within the preamble to IMCA D 018 and should be referred to by the person completing this document in order to understand what any particular certificate actually shows.

6.3 Extension of Validity Periods

This document gives maximum validity periods for each certificate. However, it is obvious that an item with a validity on the certificate of 12 months does not become unsafe at 12 months and 1 day if it was safe at 11 months and 29 days.

This document recognises that diving plant and equipment often operates in remote locations where it is difficult to carry out the required testing. This may also be the case because of operational reasons where the equipment is in constant use.

Diving contractors are encouraged to plan ahead in order that certificates can be renewed in time. If, however, due to operational circumstances, a certificate cannot be renewed within the prescribed period, then an extension of up to a maximum of 30 days can be issued if the diving or life support supervisor operating the equipment confirms, in writing, that it is operating satisfactorily and appears in good condition. Where there is one or more qualified equipment technicians, whose duties include maintaining this equipment, then they should also confirm the equipment is satisfactory before such an extension is issued.

The issue of any such extension will need to follow the diving contractor's management of change (MoC) procedures.

The person completing this document should not themselves make the decision to extend validity periods but should, if relevant, establish if a written agreement exists as described above.

It must be clearly understood that the extension period referred to here is only in respect of compliance with this document. It does not provide extension where a government regulation may prescribe validity periods, nor does it vary any requirements of a classification society. Similarly, an agreement by a classification society or government body to extend a validity period of their certification does not alter the requirements of this document.

Any piece of plant or equipment whose certification validity has expired (subject to the possible 30 day extension above) should not be used again until it has undergone the necessary examination and testing by a competent person as laid out in this document.

6.4 Modifications

It is clear that modifications made to items of plant and equipment during the period of validity of a certificate can have an effect on the validity of the certificate.

Since there can be many different types of modification it is not possible to give specific guidance on what will and what will not affect the certification.

Replacement of the termination on a wire rope used for man carrying will certainly require a retest and recertification whereas replacing a small fitting on an LP air line with an identical fitting would be regarded as maintenance and would not normally affect the validity of the certification.

As a guide, however, replacement of one item with an identical or near identical item would not normally require full re-certification although simple tests such as a function test would typically be required – but even this will depend on the circumstances.

As a matter of good operating practice, any modifications made to, work carried out on or replacement parts fitted to diving plant and equipment should be recorded in a formal manner (such as using a management of change procedure) and details passed to the owner's/diving contractor's onshore offices unless this is part of the routine maintenance required under the PMS when then the actions will only require to be recorded within the PMS records.

It must be left up to the competence and judgement of the person carrying out the modifications and of the supervisor using the plant or equipment after modification as to whether full or partial re-certification is considered necessary.

6.5 Layout of Detail Sheets

6.5.1 Item Column

This column gives each piece of equipment, test, or item a unique number for ease of identification. These numbers have no technical significance.

6.5.2 Description Column

This gives a short description of the item for ease of identification. Where testing is required, a reference is given to the relevant section in Code of practice on the initial and periodic examination, testing and certification of diving plant and equipment (IMCA D 018).

6.5.3 Requirement Column

This describes exactly what the person completing this document needs to check for each item.

6.5.4 Need Column

This identifies the importance given to each requirement.

a) This signifies that the requirement is necessary and must be met. Only in the most unusual circumstances would a diving system be considered safe to use if a requirement with an A need had not been met.

- b) This also signifies a requirement which is considered as necessary but there may be other ways of meeting the requirement than the method identified in the 'Requirement' column. It is left up to the discretion of the person completing this document as to whether the requirement is being suitably met.
- c) This refers to a requirement which is optional and the absence of which would still allow the diving equipment to be used safely.

6.5.5 Response Column

This is where the person completing this document will write their comments and observations. It will be used to answer any questions asked in the 'Requirement' column (see 7.4 for details).

6.5.6 Certificate Issue Date Column

Where a certificate is required, the date of its issue should be entered here. The relevant part of the column is shaded if no certificate is required.

7 Completing the Document

7.1 Electronic/Paper

The document is available in two formats, hard (paper) copy and electronically. The paper version is perfectly acceptable and may often be used during inspections and checks (see section 7.3, however, regarding detail sheet section 11).

It is anticipated, however, that most users will prepare and maintain the document electronically as it is intended that it will be a dynamic document that is regularly updated as tests and, examinations are carried out and certificates re-issued.

7.2 Format

The document is available using Microsoft[®] Word, making extensive use of tables and Microsoft[®] Excel. These optimised versions are made available for electronic completion and delivery of the document by users.

A protected PDF version of this document as published, is also available.

7.3 Variations

The document has deliberately been made as flexible as possible, particularly when used electronically. If more space is needed in the 'Response' column, then it can easily be created.

If there is more than one of the same items on a particular dive system, then the section or part of a section should be duplicated and repeated. This means, for example, that if there are two surface compression chambers then that section would be completed twice, once for each chamber. Similarly, if there were, for example, six diving helmets, then the part on diving helmets would be completed six times within the overall section.

Detail sheet section 11 is different to the others in that it is intended that the two columns on the right side ('Response' and 'Certificate Issue Date') should be repeated for each compressor, pump, ECU etc. This will mean extending section 11 to the right by several more columns, depending on the number of compressors, pumps etc. involved. It is therefore likely that detail sheet section 11 will need to be prepared and maintained in an electronic format.

It is recommended that items not required for a particular system are not deleted but rather are marked as "not applicable". This will ensure that the tables in the various sections look similar to a master copy of the blank document, which may make it easier for a subsequent person to check.

7.4 Phraseology

It is obviously a matter for the person(s) completing the document as to exactly what they wish to say in the 'Response' column, but some form of explanation should be written down.

Single words or short phrases such as "acceptable", "suitable", "adequate", "yes", "meets the requirement" or similar should not be used as these provide no useful information to anyone reading the completed document. As a minimum, enough information should be given to allow a person reading the document to understand why the person completing it considers the 'Requirement' for a particular item to have been met.

Equally, where items of plant or equipment have unique serial numbers then these should be inserted in the 'Response' column.

In recent years some persons completing this document have used a number of photographs embedded electronically in the document as well as an explanation to demonstrate compliance and assist in a subsequent review of the document by others. It is certainly not a requirement that photographs are used but it may assist in cutting down long explanations or clearly illustrating a variation, deviation, non-compliance, or non-conformance.

7.5 Variations/Deviations from Requirements

The person completing this document should prepare a list identifying any items which do not fully meet the requirements of this document. This will assist in making sure these items are dealt with speedily.

If the item in question has a C in the 'Need' column, then variation/deviation does not signify a non-conformance. However, if the item is present but is not correct then it should be placed on the variation/deviation list.

7.6 Close Out

To assist in subsequent checking of this document a list should be available detailing how and when any variations, deviations or non-conformances have been closed out and completed. This list should form part of the document available to any client or other interested party for checking.

8 References

The following documents are referred to in this document. Further details on all IMCA/DMAC publications and their latest revisions are available from the IMCA website (www.imca-int.com).

Diving Medical Advisory Committee (DMAC)

Medical equipment to be held at the site of an offshore diving operation (DMAC 15)

IMCA

Guidance on competence assurance and assessment: Diving Division (IMCA C 003)

Protective guarding of gas cylinder transport containers (quads) (IMCA D 009)

Guidance on auditing of diving systems (IMCA D 011)

Code of practice for the initial and periodic examination, testing and certification of diving plant and equipment (IMCA D 018)

DESIGN for saturation (bell) diving systems (IMCA D 024)

FME(C)A guide for diving systems (IMCA D 039)

DESIGN for mobile/portable surface supplied systems (IMCA D 040)

Marking and colour coding of gas cylinders, quads and banks for diving applications (IMCA D 043)

Code of practice for the safe use of electricity under water (IMCA D 045)

Acrylic plastic viewports (IMCA D 047)

Minimum quantities of gas required offshore (IMCA D 050)

Pressure gauges and other forms of pressure monitoring equipment used in conjunction with diving operations (IMCA D 062)

Wire rope integrity management for vessels in the offshore industry (IMCA LR 001, IMCA HSSE 022, IMCA M 194)