IMCA

The International Marine Contractors Association

Guidance on
The Selection of Vessels of Opportunity for Diving Operations

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- Safety, Environment & Legislation
- Training, Certification & Personnel Competence

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There are also four regional sections which facilitate work on issues affecting members in their local geographic area – Americas Deepwater, Asia-Pacific, Europe & Africa and Middle East & India.

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This guidance has been developed under the direction of the IMCA Diving Division Management Committee by a workgroup of members active in the IMCA Asia-Pacific Section.

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The Selection of Vessels of Opportunity for Diving Operations

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1 Introduction

There are regions in the world that still depend on the use of vessels of opportunity from which to carry out surface supplied and saturation diving work. The vessels available in these regions exhibit varying degrees of 'fitness for purpose' and, therefore, on occasion it is necessary to properly brief clients as to what is and what is not a suitable platform from which to carry out the work. The range of vessels may vary from a derrick lay barge to a DP vessel, to a four point moored vessel. Each diving platform will have its own characteristics which need to be assessed to enable the diving work to be carried out safely and successfully.

2 Scope

The purpose of this document is to provide guidance to both clients and contractors when selecting a vessel of opportunity for diving operations. The guidance provided is not designed to be exhaustive but is intended to cover the minimum requirements that should be satisfied.

Many countries do not have specific regulations that govern offshore diving operations and in such cases best practices should prevail which incorporate the clients requirements and specifications together with the diving contractor's safety management systems and IMCA codes of practice/guidelines.

This document provides generic guidance on assessing the suitability of 'vessels of opportunity' for diving operations and provides an indication of factors to be considered in selection of the diving support vessel (DSV).

This guidance is broad-based and should be considered in conjunction with specific project requirements such as:

i) Type or nature of tasks to be undertaken – construction, inspection, repair or survey, e.g. deck space, cranage, access at site, considerations, etc.;

ii) Depth of operation;

iii) Duration of diving operations – the DSV should have sufficient catering supplies, fuel, fresh water, diving gas storage capability for the expected period of operation taking into account any logistical arrangements for re-supply;

iv) Environmental conditions – The DSV needs to be capable of providing the expected workability in the prevailing environmental conditions (wind, waves, currents, sea and air temperatures, fog, ice, etc.);

v) Suitability of accommodation and messing facilities to support the diving operation.

From a marine perspective, it is recommended that the DSV be inspected in accordance with guidance document IMCA M 149 – *Common Marine Inspection Document* – (ref. 1) and the results of the audit reviewed to assess its suitability for the required operation.

3 Safety

3.1 General Safety

Vessel safety standards are controlled by various bodies (e.g. classification societies and International Maritime Organization (IMO)), and are subject to internationally recognised standards (e.g. the International Safety Management Code (ISM) and the International Convention for the Safety of Life at Sea 1974 (SOLAS) as currently amended). Therefore, it should be unnecessary to impose further audit criteria, over and above those directly pertaining to diving operations. However, to ensure a vessel's compliance with international standards, it is recommended that only vessels classified under the major classification societies are acceptable for use as 'vessels of opportunity'.

A list of major classification societies is as follows:

- American Bureau of Shipping
- Lloyd's Register
- Det Norske Veritas
- Bureau Veritas

- Germanischer Lloyd
- Class NK (Japan)
- Rina (Italy)
- BKI (Indonesia)
- Any other approved national classification body.

Under classification society rules, vessels are usually certified for a maximum number of personnel, for whom emergency equipment should be provided accordingly. Deck loading and stability calculations are normally also subject to classification society approval. Changes to the power system configuration may also be subject to such approval.

Vessels classed by a less well recognised society, should be subject to independent audit. An 'out-of-class' vessel or a vessel where any 'condition of class' rectification date has passed should not be considered.

It is recommended that the vessel is audited utilising the IMCA M 149 – *Common Marine Inspection Document* – and should also comply with the diving contractor's vessel audit/inspection procedures and requirements, if any.

All vessel marine crew, especially the key personnel (i.e. the master, chief engineer and DP operators) must be appropriately qualified and should have appropriate experience. Some of these key marine crew should be involved in the project hazard identification process which needs to be performed prior to the actual start of diving operations. All identified risks should be eliminated, mitigated or carried forward as residual risks to be dealt with on site by suitable processes (job hazard analyses, etc.).

The vessel should have a fast rescue craft (FRC) with appropriate competent crew or other equivalent small craft capable of being deployed and recovered by suitable means, i.e. cherry picker crane/revolving davit mechanism. This rescue craft needs to be adequately equipped and kept in a state of complete readiness at all times.

3.2 Permit to Work System

The vessel should have a permit to work (PTW) system in place for all foreseeable tasks that may be performed on the vessel, clearly identifying the vessel authority in charge of issue and close-out of the PTW. This should include diving operations and a suitable 'permission to dive request' protocol on which adequate lock-out of propellers and thrusters, if applicable, is an integral part. A briefing document should be developed to ensure that the vessel's PTW system is adequately interfaced with any applicable client/operator PTW which control any works on the client's facilities.

3.3 Standard Operating Procedures

At all times, the vessel should have a set of standard operating procedures onboard which clearly define the following, as a minimum:

i) A marine management system incorporating an adequate safety management system;

ii) Safety plan(s);

iii) Mooring/anchoring procedures/DP procedures;

iv) Emergency and contingency procedures;

v) Recently completed IMCA M 149 – *Common Marine Inspection Document*;

vi) Undesired event reporting procedure and hazard observation reporting system (normally as part of the safety management system).

3.4 Project Specific Safety

Site specific safety plans should be documented, discussed and mutually agreed with the vessel operator during operational planning, and a number of protocols should be developed covering:

- Mobilisation plan;
- Vessel shut down and notification procedures;
- Signals and external notifications;
- Communication between dive station and watch keepers;
- Watch keepers duties and responsibilities;
- Simultaneous work operations performed by vessel crews;
- Emergency and evacuation procedures;
- Utilisation of vessel services (where appropriate);
- Bridging document between vessel/diving contractors management systems and those of the client applicable to the specific area of operation;
- Type and frequency of emergency drills.

4 Deck and Working Areas

In selection of a suitable vessel for diving operations a number of factors should be considered.

4.1 Deck Area

The deck area should be adequate to safely locate all the required plant and equipment. Deck layout plans need to be developed with special attention paid to access and egress of personnel for both normal and emergency situations (i.e. adequate stretcher access). The layout needs to take into account appropriate siting of the dive control station in relation to the deployment position of the diving stage or bell and for surface supplied operations the location of the diver deployment to the deck decompression chamber area. In addition an adequate clear working area should be available adjacent to the diver deployment basket or bell as required by the workscope. This area may also be used for evacuation of personnel at deck level by personnel basket, if this method of recovery is included in a project safety plan.

4.2 Freeboard/Stability

Careful consideration should be given to vessel freeboard in selecting a suitable vessel for diving operations. Vessels where decks are constantly awash, even in moderate seas, should be considered unsuitable for diving operations.

The overall size and stability of the vessel should also be considered with respect to expected weather conditions, given that work cannot safely be carried out on a rolling deck and attempted launch and recovery of bells and diving stages may cause injury to both occupants and deck crew.

The vessel operator should be required to check the vessel's stability incorporating all the required plant and equipment for the diving operations.

Minimum recommended free board is approximately 1.5 metres. Vessels should be equipped with suitable diver launch and recovery systems for the safe access and egress of divers. Primary and secondary systems should be provided. Suitably designed diver ladders should be provided for vessels with low freeboards. For vessels with higher freeboards, adequate mechanical means of launch and recovery of divers need to be provided.

4.3 Deck Strength and Sea-Fastening Arrangements

Prior to mobilisation an engineering assessment needs to be conducted to verify strength of the vessel deck. The information required for the engineering assessment would be a data sheet or deck layout

general arrangement drawing that specifies the dimensions, centre of gravity and weight of each individual piece of plant and equipment required for the project. Once the total weight of the project equipment has been calculated, dividing this by the deck space available for the plant and equipment will give the load/unit area (e.g. tonnes/m^2). The vessel deck needs to be able to support this load. The vessel deck load capacity is usually specified in the vessel specifications. Specific local checks for areas of high load need to be carried out (i.e. for winches and launch/recovery areas) and, if necessary, grillages provided to spread the load as required.

The data sheet or deck layout drawings are required for input into the vessel's stability calculation sheets.

As part of the selection process, consideration needs to be given to the method of attachment of the diving plant and equipment to the vessel's deck. It is essential that all diving equipment is adequately secured to the deck, normally by welding. Pre-project planning should include placement of equipment and sea-fastening to be used. Strong points, such as frame spacing for equipment attachment, should be identified, as should areas where welded connections may not be carried out, typically above fuel and oil tanks.

Sea-fastenings need to be adequately designed in conjunction with the vessel's deck and under-deck strength. Welded connections need to be carried out by suitably approved welders to a recognised procedure. Non destructive testing (NDT) and load testing of critical connections (i.e. launch and recovery systems, etc.) should be carried out by competent persons.

Guidance document IMCA D 018 – *Code of Practice on the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment* (ref. 2) provides guidance on the required testing.

4.4 Vessel Plant and Machinery

During the selection process, hazards associated with exposed vessel equipment need to be considered in conjunction with the intended diving operation. For example, special attention should be made to mooring ropes and wires and where those wires run along the deck – 100% coverage with suitable covers should be in place.

The location of thrusters, propellers, intakes and discharges need to be considered. Diver deployment areas need to be positioned to minimise any hazards to the divers as a result of these items. Umbilical management plans need to be developed to mitigate any risks of diver entrapment.

5 Mooring/Positioning

The type of mooring or positioning system needs to be carefully considered when selecting the vessel so that a safe diving 'platform' can be provided.

5.1 Dynamic Positioning (DP)

A large volume of information and guidance exists on the use of dynamically positioned vessels for diving operations and further discussion is beyond the scope of this guidance.

Three equipment classes for DP vessels have been defined by IMO Maritime Safety Committee (MSC) Circular 645 (ref. 3), which recommends that DP vessels are assigned an equipment class. Equipment class 1 is the lowest level and equipment class 3 is the highest level of redundancy. DP DSVs are expected to be at least DP equipment class 2. DP equipment class 1 vessels should not be used to support diving operations. See guidance document IMCA M 103 – *Guidelines for the Design and Operation of Dynamically Positioned Vessels* (ref. 4).

Key DP personnel should have appropriate training and experience. IMCA has produced guidance on this issue – IMCA M 117 – *The Training and Experience of Key DP Personnel* (ref. 5).

Relevant DP documentation should be onboard and in the owner's/operator's office (ref. 6).

If a DP vessel is being considered for selection, reference should be made to guidance document IMCA D 010 Rev. 2 – *Diving Operations from Vessel Operating in Dynamically Positioned Mode* (ref. 7).

5.2 Four Point Mooring

Depending on the type of diving operation to be undertaken, a minimum of a four point mooring is required. Further redundancy should be assessed on a case by case basis.

Where four point (or greater) moored vessels are being considered for selection, consideration should be given to the type of anchor and length, size and condition of wires in respect to the operational conditions. In-date test certificates should exist for all mooring system components.

As part of the selection process, anchor patterns need to be developed to ensure that the selected vessel is capable of being safely positioned for the intended works, taking into consideration the safety and integrity of adjacent and subsea facilities.

Anchor winching operations should be controlled from the vessel bridge or control room and winches should be fitted with remote payout and tension meters to allow control and monitoring of mooring status. Some vessels are capable of self-laying a four point mooring. However, it is normal that an additional anchor handling vessel may often be required to assist the DSV to lay, move or recover the anchor spread. Both vessels should be equipped with suitable positioning systems to ensure the safe deployment by anchors and wires.

It is recommended that vessels selected for supporting diving operations carry, as a minimum, DGPS equipment and personnel competent to use this equipment. This equipment can be used to position the vessel at the required location and also to display the vessel's position in relation to any subsea plant (pipelines, wellheads, etc.). It is also an essential tool for detecting loss of position of the vessel (i.e. due to anchor drag). Where the vessel is used to deploy moorings over or close to subsea plant, it is important that the DGPS equipment is integrated in real time to the DSV navigation equipment.

5.3 Other Moorings

The type of operation will determine if the selected vessel will need to moor in a different configuration. A common method of mooring a vessel for diving operations is via two forward anchors and soft mooring lines from the stern of the vessel to a platform or rig. Prior to mobilisation, the available lengths of anchor chains or wires should be established and confirmed as of adequate length for mooring in the depth of water. Both chains should also be inspected for integrity and compatibility with the anchor gypsies throughout their length, particularly if the vessel is used infrequently for diving operations or mooring in this configuration, as corrosion may be present in the commonly unused sections of chain.

As part of the selection process, soft mooring lines should be inspected and where wear is present replaced. Mooring lines should be of adequate length to moor the vessel as required without joining shorter lengths (knots weaken rope by up to 50% and make handling dangerous), abrasion protection requirements should be assessed and protection fitted to areas of likely wear. Mooring in this type of configuration is extremely difficult without powered stern capstans, which should be considered essential for vessels used in this way.

For some operations, such as working alongside floating structures on turret moorings, the diving vessel may rely purely on soft lines for mooring alongside. In such cases, a minimum of four mooring lines should be used (bow, stern and two springs) and fendering should be adequate to protect both vessels from hard contact.

IMCA has published information comparing moored and DP vessels – see IMCA M 134 – *Comparison of Moored versus Dynamically Positioned Diving Support Vessels* (ref. 8).

5.4 Acoustic Positioning

Some vessels of opportunity will have hull mounted transducers as part of the vessel's equipment for use with acoustic positioning systems such as ultra short base line/long base line (USBL/LBL). Other vessels may required to be fitted with transducer poles at suitable locations for subsea positioning purposes. The location of both permanently and temporarily installed transducers in relation to the intended diver deployment position should be considered during selection of the vessel.

6 Accommodation and Messing Facilities

Vessels of opportunity are often not designed to cater for additional personnel associated with diving operations and, therefore, it is important that the quantity and suitability of accommodation and messing facilities are adequate for the intended operations. It is imperative that off-duty personnel receive adequate, undisturbed rest periods between shifts. It is recommended that a maximum number of four personnel share a single cabin and circumstances where personnel are required to share accommodation with personnel working different shift patterns should be avoided wherever possible. Diving superintendent, diving supervisors, inspection controllers and other key personnel should be provided with single cabin accommodation with desk space. All cabins should be provided with environmental control systems suitable for the location of operation, e.g. air conditioning with a constant air supply helps to minimise the spread of viral infection.

Sufficient and clean toilet and shower facilities should also be available and a recommended minimum ratio is one toilet and shower to every four personnel.

In all cases, and especially where temporary or 'portacabin' type accommodation is used, careful consideration should be given to noise and vibration and where used, such accommodation should be sited away from the working deck, especially in operations requiring the constant running of plant or deck machinery.

Adequate catering facilities and crew should be available to provide three meals for each shift. Adequate laundry facilities should be provided either on a self serve basis or by the catering/stewards crew. The mess area should be large enough to accommodate at least one team to sit comfortably at shift change times. Where appropriate there should be sufficient facilities to support a 24-hour diving operation.

7 Medical Facilities

One separate cabin or dedicated hospital should be allocated for use as a sick bay (with one bunk) equipped with adequate emergency first aid equipment.

As part of the necessary emergency response planning, adequate facilities need to be provided for the evacuation of sick or injured personnel from the vessel.

8 Additional Services

8.1 Communications

Reliable communications systems with adequate back-up are essential for the performance of the works. This includes vessel-to-shore communications, such as satellite systems, in-field (VHF or UHF) and vessel internal systems (PA, PABX, etc.). The minimum requirement for the vessel-to-shore communication system should be a satellite-based system (Mini-M or similar), incorporating voice, e-mail and fax facilities. Although VHF and SSB radios provide adequate in-field communication, they should not be considered primary source for relaying messages to a fixed station such as an installation radio room, for on-passing information/advice, especially in diving emergency situations where direct contact between the dive site and diving doctor or other specialist is essential.

Dedicated communications should be provided between key stations (bridge, dive control, ROV control, cranes, etc.). DESIGN (ref. 9 for air diving systems, ref. 10 for bell diving systems) provides additional advice on communication requirements. CCTV systems should also be provided where possible. It is basic good practice for there to be at least two communications systems between bridge/DP and dive control, both of which should be continually available; and one should operate without the need for external supply. Suitable alarm systems should be provided in relevant locations so they can be activated to abandon diving operations in the event, say, of loss of position or degraded status of the vessel (ref. 11).

8.2 Power Supplies

Vessel power supplies may be unstable and develop spikes that are potentially damaging to sensitive equipment. Diving operations would normally only be carried out using a dedicated deck generator

under the control of the diving supervisor. Adequate planning for refuelling deck generators must be considered during the planning stages of the project.

Where a vessel generator is used as a back-up power supply, it should only be done from a generator operating independently of the vessel's own power usage, including redundancy.

Certain changes to the configuration of the vessel's electrical system may be subject to classification society approval.

If, after checking by a suitable electrician, it is decided that the vessel power can be safely used, then careful attention should be paid to the length and routing of cable runs to ensure that no accidental damage can occur to cables. Breakers should be fitted and consideration given to the load requirements. Isolation transformers should also be used. Care is also required to ensure that the switchboard short circuit rating is not exceeded.

Care must be taken, at the time of mobilisation, that the power cables are separated and well clear of oxygen or gas lines with oxygen compositions greater than 25%.

8.3 Cranage

Diving operations often involve deploying subsea loads. Adequate facilities need to be provided to suit the project workscope. Existing cranage needs to be checked to ensure that it is fit for purpose. For example, can crane hooks be submerged? Is there adequate wire to reach the working depth? Is the equipment suitably rated taking into account dynamic amplification factors required for subsea lifting? etc. The method of attachment of the load to the crane should be considered to avoid the possibility of the load becoming detached or reattached accidentally. IMCA guidance exists on crane hooks – AODC 018 Rev. 1 – *Attachment of Loads to Lifting Hooks during Diving Operations* (ref. 12)

In addition to the crane(s) possessing valid certification, the competency of the crane drivers needs to be verified. The crane driver needs to be able to communicate directly in a common language with the diving supervisor and dedicated hardwire communications are required between the crane and dive control.

8.4 Life Saving Appliances

Diving operations by their nature require dedicated personnel to be accommodated on the vessel in which case the vessel's lifesaving appliances need to be reviewed for adequacy. Additional life jackets, life rafts and other safety equipment may be required. Additionally, it may be necessary to ensure that the vessel's classification is not compromised.

8.5 Fire-Fighting Appliances

Installation of diving plant onto a vessel of opportunity may require that the vessel's fire-fighting systems need to be modified or supplemented in order to provide adequate fire/smoke detection and suppression systems. This should be considered during the selection process.

8.6 Other Vessel Services

The installed diving plant may require the following services:

- compressed air;
- potable water;
- cooling/sea water;
- sewage holding tank facilities.

If the vessel is to supply these services, checks should be carried out to ensure that reliable and adequate pressure and flow rates can be provided. For safety critical services, such as cooling water supply to environmental control units, redundant supplies need to be provided.

The need for signs identifying life support and other key diving systems services should be assessed and appropriate signs provided, where necessary.

8.7 Hyperbaric Evacuation Systems (HES)

If the vessel of opportunity is to be used for saturation diving then an adequate hyperbaric evacuation system (HES) should be provided by the diving contractor. The HES should be capable of being launched independently of the vessel's main power supply. As HESs vary considerably in design, all interfaces with the vessel need to be adequately addressed to ensure that emergency procedures are workable and not compromised.

9 References

1	IMCA M 149	*Common Marine Inspection Document*
2	IMCA D 018	*Code of Practice on the Initial and Periodic Examination, Testing and Certification of Diving Plant and Equipment*
3	113 IMO	*Guidelines for Vessels with Dynamic Positioning Systems* (IMO MSC Circular 645)
4	IMCA M 103	*Guidelines for the Design and Operation of Dynamically Positioned Vessels*
5	IMCA M 117	*The Training and Experience of Key DP Personnel*
6	IMCA M 109 Rev. 1	*A guide to DP-related documentation for DP vessels*
7	IMCA D 010 Rev. 2	*Diving Operations from Vessels Operating in Dynamically Positioned Mode*
8	IMCA M 134	*Comparison of Moored versus Dynamically Positioned Diving Support Vessels*
9	IMCA D 023	*Diving Equipment Systems Inspection Guidance Note (DESIGN) for Surface Orientated Systems (Air)*
10	IMCA D 024	*DESIGN for Saturation Diving Systems (Bell)*
11	(IMCA – due in 2004)	*Guidance on Operational Communications: Part 1 – Bridge and Dive Control*
12	AODC 018 Rev. 1	*Attachment of Loads to Lifting Hooks During Diving Operations*