

Cross-Hauling of Bells

International Marine Contractors Association

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This guidance document was prepared for IMCA, under the direction of its Diving Division Management Committee, by members of the IMCA Asia-Pacific Section.

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I Background

Diving bell cross-hauling is a technique used to get the diving bell closer to the work site when the distance between the bell at its normal deployment position and the work site makes diving operations either unsafe or impractical even with the use of an extended umbilical.

The cross-hauling technique, whether on barges, diving support vessels (DSVs), platforms or structures can be divided into two main categories – either the static line or the winch-operated method. This note provides guidance on both methods.

More detailed guidance on examination, testing, certification and other requirements is given in IMCA D 018 - Code of practice for the initial and periodic examination, testing and certification of diving plant and equipment (Ref. 1) - and in IMCA D 024 - DESIGN for saturation (bell) diving systems (Ref. 2).

2 General Safety Considerations

All diving projects should be properly and safely managed. An assessment of the general principles of the diving technique to be used should be carried out, as well as the needs of the particular operation.

The following principles apply:

- General requirements for safety, equipment and personnel as set out within the IMCA D 014 IMCA international code of practice for offshore diving (Ref. 3) and the diving contractor's own diving procedures;
- An adequate safety management system;
- Hazard identification and risk assessment;
- Provision of working procedures approved by relevant parties as defined within the safety management system;
- Detailed briefings prior to commencement of diving operations.

These principles apply to all types of diving operations. Cross-hauling should only be used if the results of the risk assessment indicate it is a safe method of operation. In particular, the risk assessment should consider:

- Predictability of the weather conditions to determine the feasibility/duration of cross-haul operations, taking
 into account the extended time period for recovering the bell and effects of vessel movements (heave, pitch
 and roll) on the load transfer process;
- The position of existing seabed structures relative to the cross-haul route and their height above the seabed;
- Working from or in the vicinity of installations, taking into account the additional time to recover the bell;
- Tidal conditions which need to be taken into account for calculating cross-haul wire lengths;
- Any problems with reduced visibility at the worksite;
- The position and movement of anchor wires, pipe davits, etc. in relation to the cross-haul position and route of the bell transfer movement;
- The need for protection of the main bell umbilical during cross-hauling. In particular, ensuring that the minimum bend radius is not exceeded, that the umbilical is not twisted or kinked and that the catenary does not become excessively large as the umbilical is being paid out or recovered;
- Consideration should be given to the umbilical radius during the transfer and umbilical loop as the umbilical is paid out;
- Consideration should be given to the cross-haul distance in relation to the water depth in case of failure of the cross-haul wire, in that the cross-haul distance should not be greater than the water depth;
- Any lifting operations in the vicinity of the cross-haul route;
- Consideration of the status of both inner and outer bell doors during cross-hauling;
- The internal pressure within the bell in relation to the maximum depth the bell could reach during the crosshauling operation;
- The extended umbilical lengths when undertaking this technique from a vessel operating in dynamically positioned mode;

• The ability of the secondary recovery system to cope with the extra weight of cross-hauling components.

The 'permit to work' system should specifically address bell cross-hauling operations to ensure that any activities taking place at the cross-haul locations will not endanger or place in jeopardy the bell, the divers, or the cross-haul equipment.

If there is an intent to use a cross-hauling point mounted on anything other than the launch and recovery vessel or installation from which the diving bell is being operated then extensive additional extra risk assessment will be required to consider the risks involved. If the diving bell is being launched from a vessel operated on dynamic positioning then it is very unlikely that a safe method of cross-hauling can be found using a connection point other than that on the dynamically positioned (DP) vessel.

3 Principles

In cross-hauling, the diving bell is transferred from its natural vertical normal deployment position to the new position by the attachment and operation of a second lifting wire to the bell.

The attachment point of the second wire should be as close as possible to the main lifting attachment point to ensure that the bell remains as vertical as possible when the load is transferred to the cross-haul wire. This can be achieved in a number of ways, such as using an alternative existing lifting point, pad eye, slings or chain arrangements. The existing lifting point could also be used with the installation of a 'delta plate', provided that it has been designed to prevent accidental disconnection.

Whatever attachment point arrangement is chosen, it should be designed to appropriate lifting standards, and should be tested and certified as detailed in IMCA D 018.

Two methods are recognised for this deployment technique - use of a static line and use of a winch wire.

The requirements for the rigging components, winch, etc., will be determined by the intended use of these components. If they are intended for use as part of a secondary recovery system for the diving bell, they will require to comply with IMCA D 024, section 4, sub-section 4. If they are not intended to form part of a secondary recovery systems but are for cross-haul use only, they will require to comply with IMCA D 024, section 4, sub-section 8.

If the cross-haul equipment is to be used as a secondary recovery method for the bell and will be used to lift the bell in air, then the cross-haul rigging should have a safety factor of 8:1 of the fully manned and outfitted weight of the bell in air. If it is only intended to recover the bell to the surface then this safety factor of 8:1 need only be applied to the fully manned and outfitted weight of the bell in water. In either case they should comply with the inspection and testing requirements of IMCA D 018.

A typical cross-hauling sequence utilising an ROV and cross-haul equipment designed for secondary recovery is shown on page 6.

4 Methods

4.1 Static Line

For this method it is necessary to have sufficient water depth to adequately compensate for the length of the cross-haul wire rope sling (the static line). The water depth at the cross-haul location needs to be accurately determined. The sling should in turn be of the correct length to enable it to be run underneath/along the vessel/barge or across the structure to reach the remote point at which the load transfer commences underneath the bell launch position.

As each situation is unique, it is important that the water depth and the cross-haul distance be accurately calculated and this calculation verified by a competent person.

As it is very unlikely that a static line will be intended as part of a secondary recovery system, the requirements for rigging and the other components will normally be those contained in IMCA D 024, section 4, sub-section 8.

The anchoring or suspension point on the deck for the static line connection should be adequately structurally engineered and the design should be supported by the necessary calculations. This needs to cover both the attachment device itself (i.e. pad eye) and its connection to the deck. The anchor/ suspension point could be either a temporary suspension point or a purpose built permanent structure allowing for any necessary offset from the side of the vessel or structure. The suspension point can also be a certified davit.

- All attachment welds should be non-destructively tested and adequately load tested. Certification should be provided and retained at the work site;
- All components, such as slings, shackles, swivels and rigging, should be fit for purpose and carry valid test certification;
- The cross-haul sling should be made from wire rope, preferably non-rotating and/or have a swivel within the rigging arrangement.

Full details of relevant test and inspection requirements can be found in IMCA D 018.

4.2 Winch-Operated

The winch operated method allows the cross-haul wire (winch wire) to be adjusted up or down during the cross-haul operation.

The first cross-haul operation conducted at a location and subsequent new operations conducted on reaching a new location or depth are the most critical as the pay-out of the cross-haul winch wire needs to be accurately determined. Thereafter the cross-haul winch and bell wires and umbilical can be marked and the bell deployed in the same manner to the marked location on the wires for any subsequent dives in the same location and depth.

The requirements for the rigging components, winch, etc. will be determined by the intended use of these components in accordance with IMCA D 024, section 4, sub-sections 4 or 8 as relevant. However, if available, preference should be given to using a man-riding winch for cross-haul operations.

- All directional sheaves should be of the correct size for the wire ropes and protected, where appropriate;
- The wire rope, if designated as man-riding, should be non rotating, or have a swivel included in the rigging arrangement;
- The last load-bearing sheave in the rigging arrangement positioned at the end of the suspended arm, davit, crane or similar should be allowed to swivel allowing the sheave to follow the lay of the winch wire;
- The cross-haul suspension arm, davit or crane boom should be of sufficient SWL capacity and allow the necessary offset from the side of the vessel or structure;
- The wire should not normally be allowed to run over the side of the vessel or structure without sufficient offset from the side of the vessel or structure to adequately protect the cross-haul winch wire from damage or unnecessary wear and tear. Other methods can be considered to protect the wire such as the use of a rubber fender or similar to stop chafing;
- Any fabricated structures associated with the cross-haul arrangement should be adequately structurally engineered. This should include the attachment of these structures to the deck;
- All associated welds and sheaves should be load tested and non destructively tested with the appropriate certification produced.

If intended as part of the secondary recovery system, the cross-haul winch should be of the man-riding type and certified to the SWL for the load required. Full details of relevant test and certification requirements can be found in IMCA D 018.

5 Deployment

Adequate deck lighting is required at both the bell deployment point, and the cross-haul point. The lighting should allow clear visibility of the lay of the wires and the bell umbilical through the water.

If the diving supervisor's view of the deck cross-hauling rigging arrangement is obstructed or impaired, consideration should be given to the installation of CCTV with monitors set up in dive control.

Wherever possible, a remotely operated vehicle should normally be used to monitor the descent of the bell and the cross-hauling operation.

Once it is ascertained that the bell is suspended on the cross-haul sling or winch and in position, the bell diver should exit the bell. Before he moves to the work site he should inspect the lay of the main umbilical and bell winch wire as well the overall position of the bell in relation to the work to be performed. Adjustments to the main winch wire and umbilical should be carried out as directed by the diver, on agreement with the diving supervisor.

6 Personnel

The use of bell cross-haul techniques poses additional risks to divers when compared with normal bell diving operations.

6.1 Bell Diving Supervisor

The bell diving supervisor is in charge throughout the cross-hauling operation. The supervisor will need to liaise closely with other members of the dive team, including the cross-haul winch operator as well as with other personnel involved such as the deck foreman, crane driver etc.

The bell diving supervisor should be familiar with cross-hauling techniques. In the absence of experience in the technique, a supervisor should have received adequate familiarisation in cross-haul operations. In-house familiarisation training should be carried out with content, date and performance recorded. It should not be assumed that an experienced bell diving supervisor will have the training, knowledge or experience for the safe performance of cross-haul diving operations.

6.2 Diving Team Members

All the diving team members should have received familiarisation training in the cross-haul procedures.

6.3 Cross-haul Winch Operator

It is important that the cross-haul winch operator is competent and familiar with the type of winch being used. The winch operator will need to remain at his post through the cross-haul operation unless otherwise directed by the supervisor.

6.4 Manning Levels

The use of a dedicated cross-haul winch operator may increase the diving team size. The provision of adequate and suitable personnel in the dive team will need to be carefully considered during the planning of this type of diving operation.

7 Communications

Effective communications are essential to ensure a safe and efficient operation. The supervisor should have direct voice contact with all appropriate personnel associated with the operations such the bell winch operator, the cross-haul winch or crane operator and the divers. Hard wired communications should be used, and the communications should be checked and confirmed by all parties involved.

Communications between the diving supervisor and other relevant personnel (such as the marine crew or offshore installation manager) are important during the diving operation so that all parties are kept aware of the status of any unusual situation.

As with umbilical lengths during DP diving operations, a drawing showing water depth, worksite depth, obstructions in the area, intended cross-haul route, etc., could be useful.

8 Emergency Procedures

All personnel involved in the cross-haul operation should be familiar with the emergency procedures and have participated in emergency drills. This matter is covered in more detail in IMCA D 024.

8.1 Bell Winch

When carrying out cross-haul operations, consideration for the emergency recovery of the bell needs be carefully planned. The cross-haul winch and its rigging may be capable of recovering the bell. However, to move the bell back to its mating position may be a complex task and contingencies will need to be carefully prepared.

8.2 Cross-Haul Winch

It is normal that there will be existing emergency procedures for the main bell winch equipment, but it is important that adequate contingency procedures and equipment redundancy for the cross-haul winch be put in place prior to the commencement of cross-hauling operations.

9 References

- Ref. I IMCA D 018 Code of practice for the initial and periodic examination, testing and certification of diving plant and equipment
- Ref. 2 IMCA D 024 DESIGN for saturation (bell) diving systems
- Ref. 3 IMCA D 014 IMCA international code of practice for offshore diving

