Appendix 11-B
Anchor Handling Systems, Set Up and Handling
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## Revision History

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1 PERMANENT CHASER PENDANT (PCP)

The diagrams below apply to PCP components. In general, a swivel should not be used in the pendant system, only on the working wire. Illustrated below are recommended PCP system.

Note: It is recommended that chain connectors (kenter, etc.) are being used for connecting for all mooring line segments. The use of shackles in mooring line should be avoided.
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1. Pendant wire requirements:
   - The wire to be minimum 3" / 76 mm
   - The length of the pendant wire shall be a minimum of 200' / 61 metres. Some operations may require longer pendants.
   - The wire shall be galvanized and quality certified with gusseted thimbles to be heavy duty and galvanised.
   - Eye towards vessel/shark jaw shall be socket with an option for connecting a minimum 3" / 76 mm connecting link. It is recommended a 5-link chain tail is attached, to ensure the shark jaw on board grabs the chain tail to avoid damage to the pendant wire.

2. Connector minimum requirements (connecting link or pear link)
   - To be to R3 quality standard as a minimum
   - Minimum dimension 3" / 76 mm
   - Certified.

3. Surface Buoy requirements:
   - Use of steel drum buoy should be avoided
   - Load bearing capacity based on water depth and equipment weight
   - Shall have sufficient buoyancy related to weight
   - Marked in accordance with applicable regulatory requirements
   - Fixed pigtail
   - Sufficient, to be identified, depending on expected tension, an open common link is recommended for eyes at bottom end of pigtail
   - Pigtail is connected to a connecting link at the bottom

Note: Depending on mooring line dimension Shackles should be avoided in the mooring line.
2 PENNANT BUOY SYSTEM

Recommended design of a pennant buoy system with associated equipment: soft eye or socket.

*Note:* Open end link here means open common link.

Net buoy uplift to be 30% higher than carried weight in system

Pigtail / chain tail to fit 85T
shackle both ends

Length of wire system to be minimum water depth (+ 60mtr PCP if attached to anchor)
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3 WORKING WIRE/CHASER TERMINATION ON VESSEL

1. Use an appropriate rated swivel in the working wire to prevent wire spinning.
2. A closed socket termination is recommended for the working wire.
3. Minimum thickness of the working wire should be sized to the winch.
4. Use a pear link of an approved make.
5. Use correct wire length for the water depth, i.e. 1 ½ times water depth. Recommended design is below.

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4 PIGGYBACK SYSTEM

Recommended design of piggyback system - with associated equipment.

**Note:** The minimum breaking load of equipment between piggyback anchor and primary anchor shall be a minimum of 70% of the main anchor line minimum breaking load. Piggyback anchor shall be appropriate to sea bottom conditions based on the site survey.

Piggyback should be landed with use of a bridle system to ensure right anchor orientation.
5 CHASING PENDANT

Note:
Sling to be min. Ø19mm/6mtr long

Important:
1) Clear communication between winch, crane and AHV
2) Rig winch operator to monitor chain length paid out

PCP to/from Rig

Reception PCP

1. Connect tugger wire
2. Pull/position PCP tail into shark jaw and SECURE
3. Crane operator lower crane hook to deck
4. Release crane hook

Deliver PCP

1. PCP secured in shark jaw
2. Connect sling I and II
3. Connect crane hook in sling I
4. Open and lower Tow-pins to deck
5. Crane operator can lift PCP
6 Buoy off Prelaid mooring line – Safe Release

Vessel connects buoy off swivel, PW and runs out.
Vessel connects surface buoy to end of PW and buoys off using safe deployment method.

Surface Buoy
Rigging and Safe Deployment

200-400mtr water depth

Preparation

1. Socket placed in shark jaw
2. Wire sling in end of work wire around crucifix (lower part)

Deployment
Vessel to head back to anchor and take position fix of installed anchor (or marker buoy if anchor is not visible). Check that final anchor position is within the acceptance criteria given in Work Specification. An ROV can also be used to observe anchor penetration.
7 Fibre rope handling

This section covers the general use of deep rope polyester during mooring and unmooring operations.

Rapid developments in the field of synthetic fibres have led to serious alternatives for the traditional wire/chain systems in marine and offshore operations. The most important difference between fibre and wire ropes is the fact that there is extensive experience, both practical and in design, for wire rope in engineering applications, whereas, for fibre rope, this experience is built on a case-by-case basis.

The handling of fibre ropes shall be carried out by experienced and trained personnel.

References:
- Bexco Manufacturing report of Polyester Deiprope.
- Deiprope Polyester & Dyneema® mooring ropes manual 2004

General

Fibre ropes are extremely robust when handled in accordance with procedures, but can be very easily damaged if there is abrasion caused by 3rd party interaction such as wire ropes, anchor flukes, trawl lines from fishing vessels, welding spots on deck, etc.

Ropes shall under no circumstances be exposed to high temperatures such as welding, welding sparks, flare or grinding.

Ropes must not be exposed to chemicals. If this happens, rinse with fresh water and seek immediate advice from manufacturer prior to use.

A special sand and clay barrier is installed on all fibre ropes used for mooring operations (see figure):
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Mobilisation
The ropes should be spooled on to the vessel’s drum, under tension, using a spooling device which shall be either secured on the vessel’s deck or secured on the quayside leading to the stern of the vessel.

The Mooring Equipment Representative shall ensure that the following points are in place prior to commencing the loading of the fibre ropes:

- Clear deck policy is adhered to during the operation
- Ensure clear communication lines between spooling machine operator and vessel winch operator are in place.
- Ensure that there are no obstructions in the path of the fibre rope.
- Ensure that the vessel’s winch is free from any sharp edges.
- Check socket compartment for other wire rope / shackles that may damage rope. Also check that the dimensions of compartment are sufficient to fit the fibre rope eye + fittings.
- The Inner end of fibre rope needs to be fitted with a spool piece, shackle and 10-link chain adapter. This is to be connected to the wire forerunner on the vessel’s winch.
- The spool piece in the eye of the rope shall be secured by lashing 10-12mm ropes through dedicated holes in the steel spool.
- During spooling the fibre should never be in contact with the end-spool termination.
- If spools are to remain in the fibres, protective matting must be utilized on the vessel’s drum to avoid damages.

Connection of Sub-surface Buoyancy
When connecting subsurface buoys onto fibre rope segments during deployment, it is highly recommended to use rope HMPE fibres such as Dyneema, Spectra or equivalent.

It is critical to ensure the buoy is fitted on the exact location according to the procedures and that the rope is tight and well placed before over boarding.

The buoy and the grommet must be positioned prior to deployment in such a manner that there is no chance of entanglement in the shackle of the buoy.

Each grommet used shall have a minimum break load at least five times the uplift of the buoy, as per DNV-OS-E301 (July 2015) and shall have a polyester cover to minimise friction and wear damages. Also, the grommets shall be choked under the shackle by using polypropylene rope or shall be chocked on the shackle itself to avoid any entanglements.

Stopping off Fibre Rope
Should there be any need for stopping off the rope during deployment then due considerations shall be given to the tension involved, the dynamic loads and the water depth.

The ropes have a submerged weight of approximately 5 kg/m and a guideline for total weight of rope deployed over the stern roller should be as follows (reminder; this is only

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the rope weight):

- 100 m water depth: Approx. 500 kg
- 200 m water depth: Approx. 1000 kg
- 300 m water depth: Approx. 1500 kg
- 400 m water depth: Approx. 2000 kg
- 500 m water depth: Approx. 2500 kg.

Dynamic loads should also be taken into consideration when looking into the weights above.

It is generally recommended to use grommets of a diameter greater than 45mm to stop the fibre rope on deck as the smaller rope may cut the jacket.
8 Operation – Fibre in mooring lines

Several methods are being used for recovery and connecting fibre ropes in mooring lines.

The following description is of the most common of these methods where PCP is hang off from the rig and chaser stopper is between rig chain and fibre rope.

The following principles are recommended to be used for the different methods.

**Disconnecting MOU with fibre insert:**

- AHV to receive PCP from rig, connect work wire, chase out towards chaser stopper.
- AHV to retrieve chaser stopper while communicating with rig. Rig to pay out chain as required before recovering the chaser stopper to deck and secure.
- AHV to disconnect chaser stopper and connect work wire to chain segment and lower work wire. Chain segment should have sufficient length such that the fibre segment is not coming over the vessels stern.
- Vessel move towards rig while rig is recovering chain.

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- AHV to connect the 60m PCP to rig chain and deliver PCP to the rig.
- AHV to heave in work wire, recover and disconnect the chain segment and recover fibre and any Sub Surface Buoys
- AHV to connect swivel and 400m pennant wire to anchor chain and buoy off, using safe release method.

Connecting mooring line with fibre insert:
- AHV to recover Surface Buoy and pennant wire and secure the chain on deck. Remove any swivel from bottom chain.
- AHV to connect and pay out fibre and any Sub Surface Buoys, secure adapter on deck and connect chain segment to fibre adapter. Chain segment should be of sufficient length such that the fibre segment is not coming over the vessels stern.
- AHV to connect work wire to chain segment, move towards the MOU and receive 60m PCP from rig, and secure rig chain on deck.
- Rig to pay out chain while AHV to heave in work wire and secure the chain segment on deck.
- AHV to connect chaser stopper to rig chain and chain segment with a chaser ring installed towards the rig. Connect the 60m PCP to the chaser ring. AHV to report to rig and receive confirmation before lowering connection behind stern roller.
- AHV to lower chaser stopper while rig recovers chain, chase back towards rig and deliver back 60m PCP.

Note: When paying out fibre rope, pay special attention to fibre position on the stern. High tension should not be observed during pay out; the fibre should be on the stern roller and have a straight line towards the anchor or rig, in order to avoid high friction which may cause heat damage.

With the fibre rope and rig chain secured in shark jaw and the vessel positioned 90 degrees on the mooring line; allow the vessel to find its own equilibrium with decreasing power to avoid unnecessary use of power and strain to the equipment.

For deep water operations it is recommended to cool down the fibre with water spray when the fibre is passing the stern roller in order to avoid overheating.