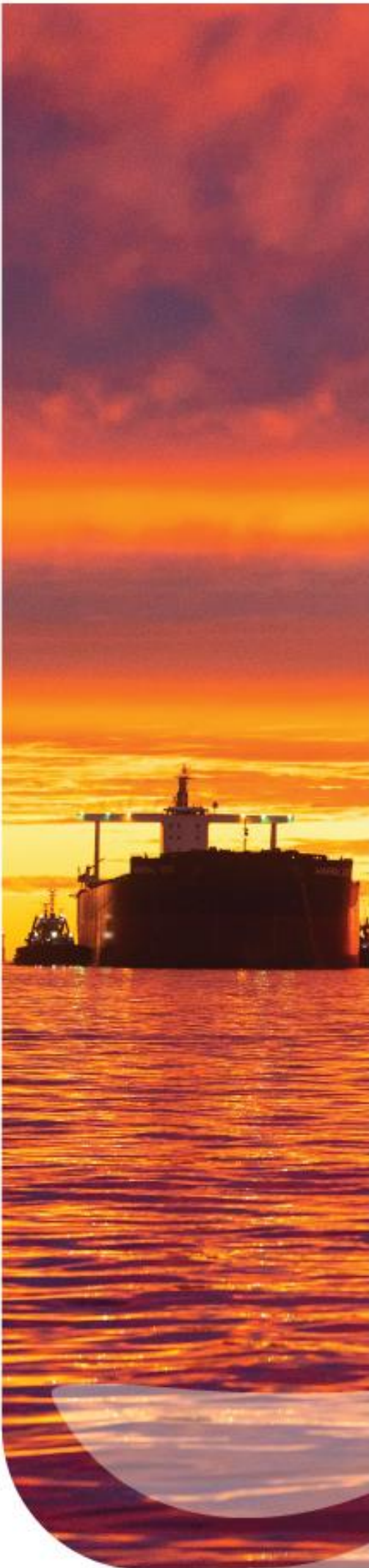




# PILBARA PORTS WEST – MOORING DIVE INSPECTION STANDARDS AND DELIVERABLES

A185553



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## 1. MEASURING MOORING COMPONENTS

### 1.1 Introduction

The purpose of this document is to outline the required mooring component measurements. Typical mooring components are shown below with a description and illustration of the required dimensions.

The mooring component dimensions are generally the bar diameters, in way of the points of contact between the mooring components, along the mooring line axis.

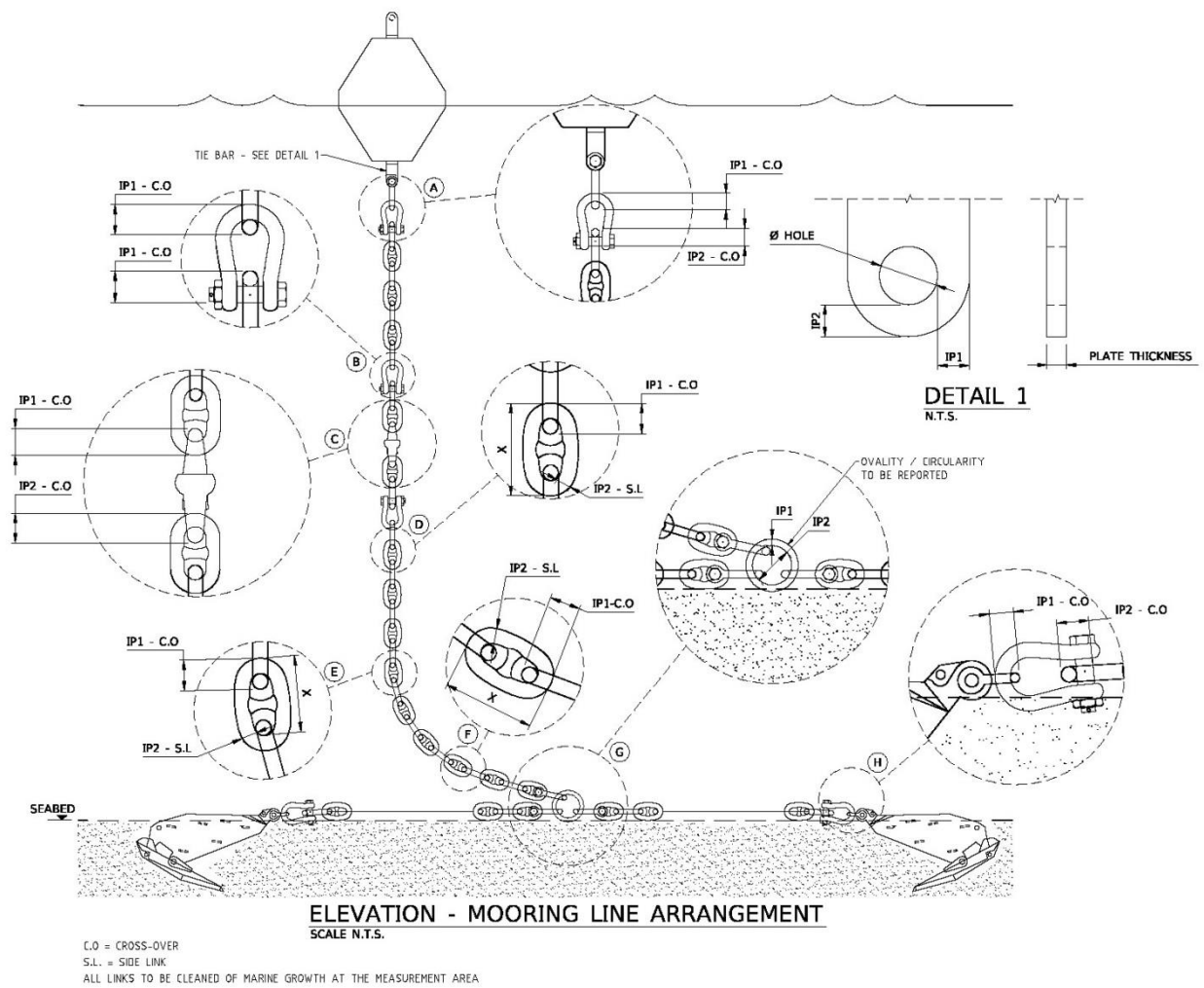


Figure 1 - Typical Mooring Arrangement

## 1.2 Chain

Three measurement points should be obtained for the riser and each of the ground legs. For the riser, the points are:

- One link near the surface (first link below the buoy – splash zone)
- A link at about half the water depth
- One link at the beginning, two links in the middle and one link close to where the chain makes contact with the seabed (thrash zone)
- For each of the ground legs (if visible and easy to inspect)
- One link near the mooring ring
- A link roughly halfway in between these two points
- Link just before the chain buries into the seabed

The specific dimension that is required is the diameter of the bar in way of the contact point between links/connecting hardware. More specifically, the required orientation of the diameter dimension is along the mooring line axis, as shown in the diagrams in figure 2.

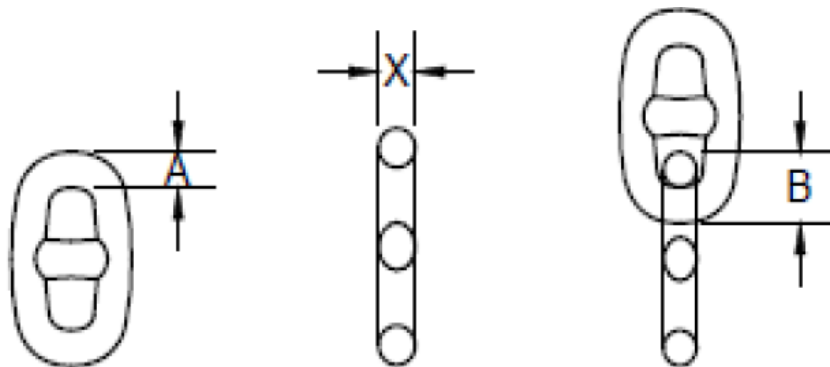


Figure 2 - Correct and incorrect chain measurements

The diagram on the left shows the required single bar diameter, measurement (A), along the mooring line axis. The diagram in the middle shows the incorrect bar diameter measurement (X), which is not along the mooring line axis. In most cases the chain will be under tension, which means that the single bar diameter measurement will not be possible. In this case the required measurement is shown in the diagram on the right, which is the crossover diameter (B).

For the riser chain, the crossover measurement is required if under tension.

For chain that is not under tension, a measurement of the single bar diameter will be more practical. When measuring the single bar diameter, ensure to measure

along the centre line of the chain (as shown in figure 2) rather than the side of the chain.

For the end link of the chain when the chain is in tension, measure the double bar diameter with one bar belonging to the last link and the other belonging to the second last link.

### 1.3 Kenter and Pear Shackle

For the kenter and pear shackle ensure that:

- the lead plug is intact and over the pin;
- the pin is secure;
- any wear or gaps are checked;
- an image is provided.

### 1.4 Bow Shackles, Joining Shackles and Anchor Joining Shackles

For these shackles, measurements are required at the bow and at the pin, shown in the diagram below as (A) and (B), respectively.

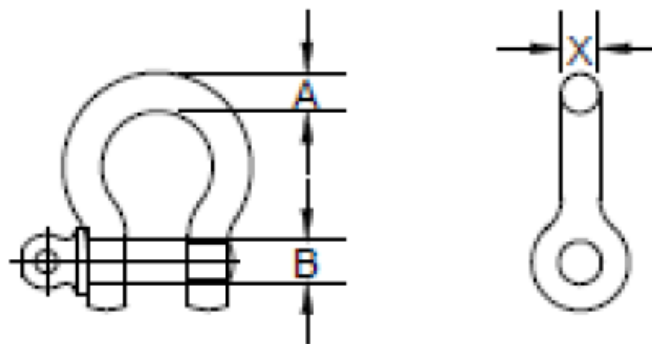


Figure 3 - Correct and incorrect shackle measurements

As shown in the left diagram, the measurements need to be taken along the mooring line axis (A, B), rather than laterally in the right diagram (X).

The pin diameter needs to be taken at the contact point with the above mooring hardware, as this area will generally be most worn.

If the shackle is in tension, then the crossover measurements are required, as shown in figure 2 (B). If the shackle is slack then the single bar diameters are required, as shown in figure 3 (A, B).

### 1.5 Ground Ring

With ground rings, the ideal scenario for taking measurements is that all of the connecting mooring lines are in tension. If this were the case, the measurements shown in figure 4 would be required; a crossover measurement at every shackle and also a single bar diameter at an arbitrary point along the circumference.

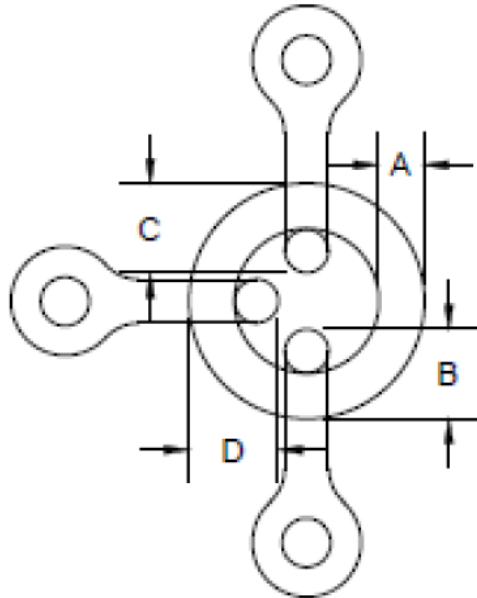


Figure 4 - Required measurements for a ground ring

In the case of one of the shackles being slack, two single bar diameters will be required; one at the bow of the shackle and the other one at the ground ring bar. The dimension at the ground ring bar should, ideally, be taken at the usual contact point with the slack shackle. If this part of the ground ring bar is not accessible then the diameter at an arbitrary point around the ground ring bar will suffice.

When filling out the mooring component inspection record, only the single bar diameter is required to be filled in for the ground ring as the diameter at the shackles will be part of the shackle measurement.

### 1.6 Bifurcation / Tri Plate

In some cases the mooring ring is replaced by a bifurcation plate. The holes for the shackles should be inspected for:

- excess wear and corrosion;
- excess deformation of the steel; and
- an image should be provided.

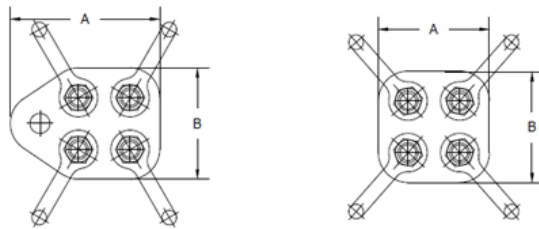


Figure 5 - Bifurcation Plate

### 1.7 Swivels

Two measurements are required for a swivel, one at the eye and the other at the bow as shown by dimensions (A) and (B), in figure 6. As the swivel is part of the riser leg, it will always be in tension and therefore double bar diameters are required.

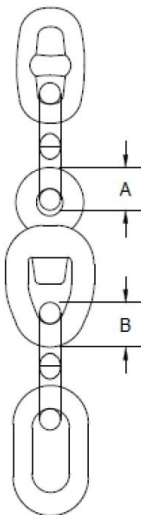


Figure 6 - Required measurements for a swivel assembly

The mooring components may be added to or amplified by a Mooring Engineer/Naval Architect, and are to be referenced in conjunction with the Naval Architect's drawing. The inspection form can be printed from the Klein Moorings Management System (KMMS) prior to the inspection for reference of component format. If you are unable to provide information on components an explanation in the comments section should be provided.



## 2. PHOTOGRAPHS

Good quality photographs without distortion or blurring should be provided, for **all mooring components inspected**. The photographs should be clearly cross referenced with the mooring component inspection record. The photos should be uploaded in the components section of KMMS or provided in a separate attachment in the case of a maintenance report when required.

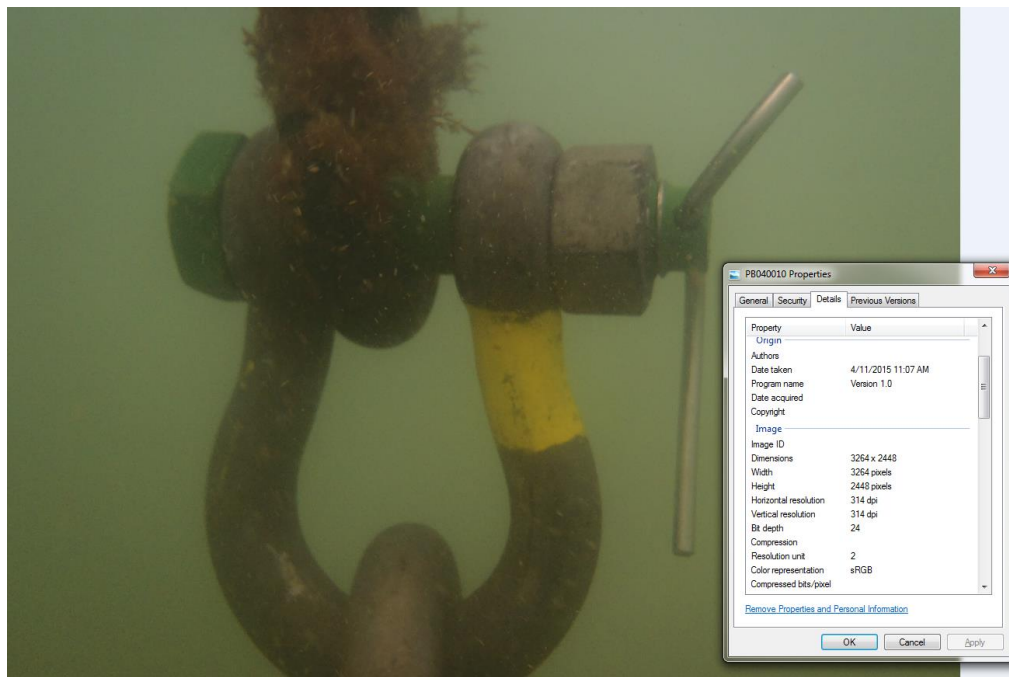


Figure 7 - Example good quality photograph

## 3. BUOY

### 3.1 Upper Portion

- Record buoy type, position and any markings.
- Measure and record buoy freeboard and orientation (i.e. listing). If the buoy is listing determine which compartment has water in it (if applicable).
- Record buoy's overall condition (i.e. indents, paint condition, corrosion) and report any visible damage.
- Identify each component attached to buoy (i.e. shackles, rings etc) and measure diameter of each.
- Check and report the condition of buoy mooring arrangements (diameter, plate thickness etc.)
- Check and report condition of buoy tension bar if applicable (diameter, thickness etc.).
- Hawser connection point should be at the top of the buoy.
- Ensure a good quality photograph is taken of buoy upper portion.



### **3.2 Illumination and Number**

Inspectors should report on the navigation lighting, solar charging and reflective materials and number on the mooring. Reflectors should be present at all four quadrants.

### **3.3 Buoy Lower Portion**

- Record marine growth thickness.
- If there is little or no marine growth check and record the type and condition of the protective coating.
- Report any dents or other visible damage.
- Check and report on condition of buoy lower mooring arrangements (diameter, plate thickness etc.).
- Check and report on condition of buoy tension bar if applicable (diameter, thickness etc.).
- Record number size and location of installed anodes (if applicable).
- Ensure that each anode is securely attached to the buoy.
- Ensure a good quality photograph is taken of buoy lower portion.

### **3.4 Connecting Hardware**

- Identify and record component type (shackle, detachable link, anchor joining shackle etc.).
- Record components overall length and diameter.
- Report any loose, broken or missing parts (eg; lead in kenter shackle, # of missing/loose studs).
- Check and report condition of locking safety pins and associated mousing.
- Record distance from the buoy of each component.
- Ensure that the hawser is not entangled in the riser.
- Measure least diameter of shackle pin immediately below the buoy, inspect whether these pins exhibit any outward movement.

## **4. SWIVEL**

- Check swivel for marine growth.
- Record components overall length and diameter.
- Report any loose, broken or missing parts.
- Record the swivel distance from the position of the buoy.

## **5. RISER**

### **5.1 Riser Chain Assembly**

- Record chain type
- Use appropriate tools to clean the following locations in readiness for measurements:
  - a chain section below buoy
  - a chain section about halfway
  - a chain section above the ground ring

If the riser contains more than one shot of chain, clean links and take measurements at both ends and near the centre of each shot.

- Measure and record crossover measurements at the cleaned links.
- Record length of one of the links at each area.
- Check for pitting, measure diameter and depth of any pits found, and record results.
- Record distance from the buoy where each measurement is taken.

## **6. GROUND RING / CONNECTING MECHANISM**

- Record the latitude and longitude from the ground ring/connecting mechanism. A small 'pop' float can be used to ascertain the ground ring position by GPS in degrees, decimal minutes e.g. 20°42.756.
- Record types of ground ring/connecting mechanism assembly observed.
- Measure and record the inside diameter of the ring.
- Check and report any distortion of the ring from circular that might indicate over-stressing.

## **7. GROUND TACKLE**

### **7.1 Connecting Hardware**

- Identify and record component type (shackle, detachable link, anchor joining shackle etc.).
- Record components overall length and diameter.
- Report any loose, broken or missing parts.
- Check and report condition of locking safety pins.
- Record position of each connection component by leg number and number of metres from ground ring.

### **7.2 Ground Leg Assembly**

All the ground leg assemblies should be inspected and where there is more than one leg, they should be clearly identified (direction from ring to anchor). The following information requires recording:

- Record chain type.
- Use appropriate tools to clean the following for measurement, noting where sections are buried and cannot be observed:
  - A chain section of each leg below the ground ring; and
  - A chain section about halfway between these two areas.
- Measure and record crossover measurements of the cleaned links. If one or more legs extend considerable distances before entering the bottom, clean links and take measurements at both ends and near the centre of each visible shot. If the chain is not in tension, single link measurements should be taken and recorded.
- Record length of one of the links at each area.

- Check for pitting, measure diameter and depth of any pits found, and record results.
- Record each anchor leg length from ground ring to bottom and from where it touches bottom to where it becomes buried.
- Using a compass, note and record the relative bearing of each leg from the ground ring.

## 8. ANCHORS

If visible each anchor should be inspected, and the following should be recorded.

- Anchor type and size
- Anchor position (a small 'pop' float should be used to ascertain the anchor position by GPS)
- Anchor orientation (i.e. flukes buried, flukes up, anchor on its side, anchor facing wrong direction etc.)
- Good quality photographs should be taken of each anchor to show embedment and orientation

## 9. UNACCEPTABLE MOORING DESIGN

Having the hawser attached to the riser chain below the buoy is an unacceptable mooring design as per figure 8.

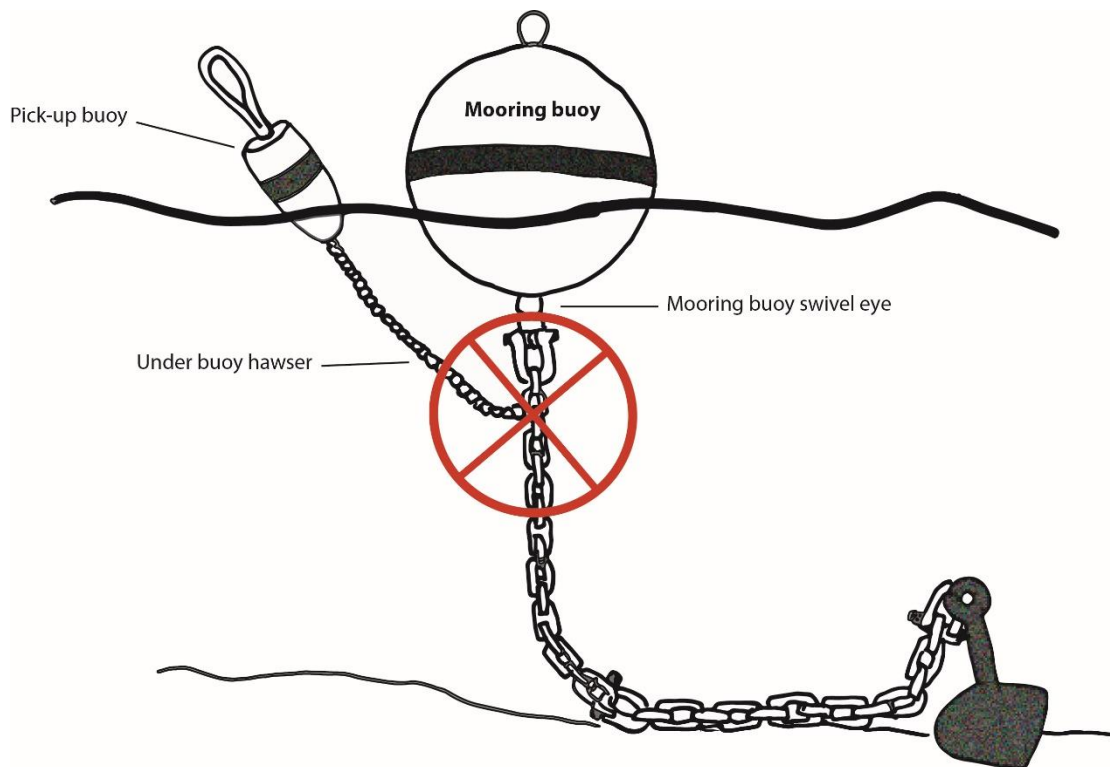


Figure 8 - Example Unacceptable Mooring Design

## 10. DOCUMENT AMENDMENT TABLE

VERSION	PREPARED BY	DATE	AMENDMENT
4	Donna Banks	01/04/2016	Reviewed and updated to align with Pilbara Ports Moorings Handbook and KMMS administration
5	Judith van Manen	23/05/2018	Revised and updated
6	Gemma Singleton	19/03/2020	Revised, reformatted and updated
6	Gemma Singleton & Prashanta Kaushik	03/10/2024	Revised, reformatted and updated
7	Sydney Keremelevich, Gemma Singleton & Prashanta Kaushik	25/02/2025	Revised, Reformatted and Updated

## 11. PROCESS OWNER

The Assistant Harbour Master is responsible for this External Document.

Date approved: 08/04/2020

Review date: 25/02/2025

Version: 6

Approved by: Harbour Master