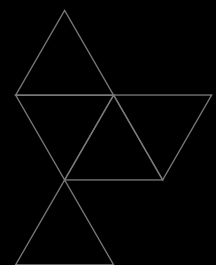




MARINE OPERATIONS: 500M SAFETY ZONE



Working together
to continuously improve
our safety performance



**STEP CHANGE
IN SAFETY**

MARINE OPERATIONS: 500M SAFETY ZONE

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Abbreviations / Terminology

Displacement	The weight of water that a vessel displaces when it is floating, which in turn is the weight of a vessel (and its contents)
DP	Dynamic Positioning
DPS	Dynamic Positioning System
ERRV	Emergency Response and Rescue Vessel
GOMO	Guidelines for Offshore Marine Operations
HSE	Health and Safety Executive
LOA	Length Overall
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MJ	Mega Joule
MSF	Marine Safety Forum
OIM	Offshore Installation Manager
PRS	Position Reference sensors
Trigger Point	Threshold, generally relating to environmental conditions, prompting review and/or risk assessment relating to the continuation or suspension of present operations
UKCS	United Kingdom Continental Shelf

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Reference Documents

The following reference documents and websites provide further information relevant to Marine Operations within offshore installation safety zones:

- Oil & Gas UK Guidelines for Ship/Installation Collision Avoidance
- International Marine Organization (IMO) International Regulations for Preventing Collisions at Sea
- HSE OTO-1999-052 Effective Collision Risk Management for Offshore Installations
- Guidelines for Offshore Marine Operations (GOMO)
- International Guidelines for The Safe Operation of Dynamically Positioned Offshore Supply Vessels 182 MSF
- International Marine Contractors Association (IMCA) Guidelines for The Design and Operation of Dynamically Positioned Vessels IMCA M 103



www.g-omo.info

www.marinesafetyforum.org

A short video is associated with this guidance document:

www.stepchangeinsafety.net/joined-up-thinking-packs

www.marinesafetyforum.org



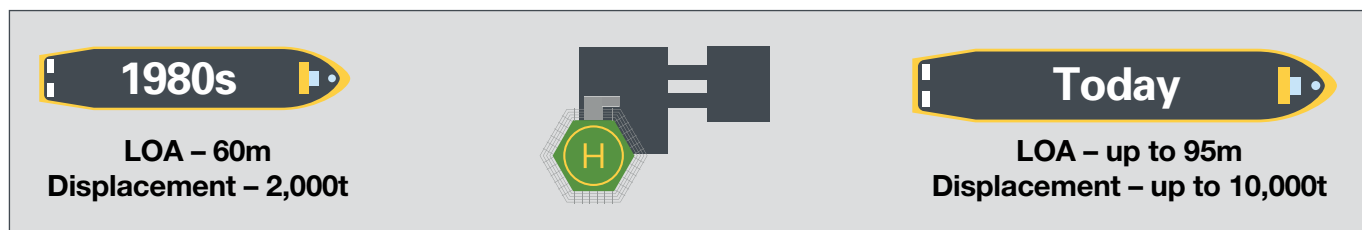
MARINE OPERATIONS: 500M SAFETY ZONE

Introduction & Background

This document is aimed at providing the offshore workforce with a better understanding of the hazards involved in offshore marine operations. It also provides an insight into how installations and vessels can work together to ensure safer marine operations within the 500m zone.

Offshore installations should be designed to withstand reasonably foreseeable accidental collision impacts. Current installation structural design standards such as BS EN ISO 19902 do not give a specific accidental impact energy value to be considered but require reasonably foreseeable collision events to be analysed and designed for. A collision energy value of 14MJ has traditionally been accepted as reasonably appropriate, representing a high energy collision (where substantial damage may be incurred but not lead to progressive collapse or endanger personnel), of a 5000t displacement vessel (typical supply vessel size), drifting out-of-control (at a speed of 4 knots), in a sea state with significant wave height of approximately 4m. However, accidental impact capability ranges of fixed installations ranges from 6MJ or even less to 25MJ for some modern installations.

Support vessel sizes are increasing in size and displacement, with some in excess of 15,000t.



Displacement (tonnes)	Vessel Speed (m/s)	Estimated Resultant Impact Energy (MJ)	
		Bow/Stern on collision	Beam on collision
2,000	0.5 (1 knot)	0.28	0.35
5,000	0.5 (1 knot)	0.69	0.88
5,000	2 (4 knots)	11.0	14.0
10,000	2 (4 knots)	22.0	28.0

The figures above are derived from the probable velocity achieved by:

- A vessel 'bump' when manoeuvring normally, 0.5m/s (1 knot) and:
- a vessel drifting in a significant wave height of 4m, 2m/s (3.9knots) as per BS EN ISO 19902:2007 A10.2.2.

In a number of events, the collisions/impacts have come from a drive-on scenario with higher vessel speed. For example, the impact energy for the collision between Big Orange XVIII and Ekofisk 2/4-W was estimated to be in the order of 58.7 MJ, the damage was such that the platform had to be replaced.

Some installations have particularly vulnerable risers where failure could occur due to relatively low impact. For example, the collision between the MSV Samudra Suraksha and the Mumbai High North platform severed one or more gas risers. The ignition of the leaked gas from the riser led to further riser failure, the fire engulfed the platform leading to the loss of 22 lives and the destruction of the platform.

MARINE OPERATIONS: 500M SAFETY ZONE

Introduction & Background



Statistics from HSE

Between 2013 and 2014, 14 Dangerous Occurrences relating to ship collision and marine operations within offshore safety zones were reported within the RIDDOR database. 2015 saw a further seven incidents of varying severity reported. These statistics are based on what has been reported to HSE and probably does not fully capture the occurrence of 'near misses'.

Data shows the greatest proportion of risk from collision comes from the vessels that are invited to enter the 500m zone, i.e. the ones that can and should be managed by the installation.

The Guidelines for Offshore Marine Operations (GOMO), OGUUK Guidelines for Ship/Installation Collision Avoidance and IMCA 182MSF provide comprehensive information on agreed industry good practice; it is anticipated that all will act in compliance with this guidance.

There is also an Offshore Technology Report 'Effective Collision Risk Management for Offshore Installations' (OTO 1999 052) that was made available by the HSE in 2000 which contains a wealth of useful information and guidance from a regulatory position.

Good Practice

There is support throughout the industry for every individual's right and responsibility to stop unsafe work. This is equally true with regards to a vessel approach, working alongside and departure from an installation. Excessive delays, overboard discharges, etc. must be reported to the appropriate person(s) (OIM, vessel owner etc.) and vessels removed from hazardous situations.

Improved planning and management of logistics could be one of various means of reducing the number of visits of a supply vessel. By reducing the number of visits necessary this leads to a reduction in the risk to the installation.

A vessel alongside represents a greater risk than one standing off a couple of hundred metres. The longer the vessel is there the greater the risk.

Just as we keep our work area tidy and put tools away when they are not being used so we should move vessels back when we are not directly working them. Platform crews should coordinate with the ship's Master when taking breaks or if there is a change in schedule.

If there is a vessel alongside and nothing has been happening don't assume that everything is ok. Ask someone why it is still there or speak to your safety rep. Remember, if the vessel's not close to the platform, it can't hit it. There is no harm in maintaining a chronic unease when there is a vessel alongside.

MARINE OPERATIONS: 500M SAFETY ZONE

Legislation & Responsibilities

Safety Zone Legislation

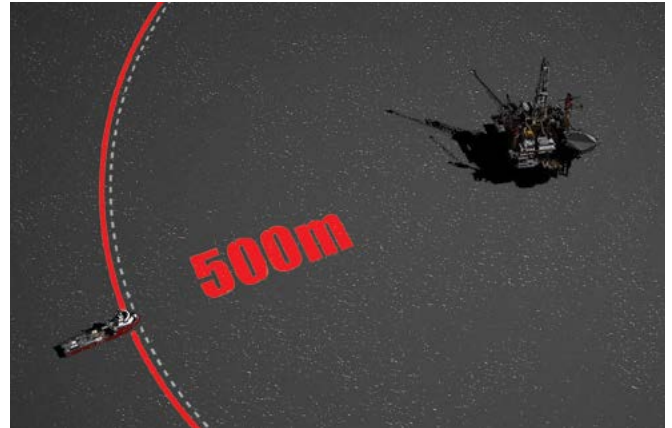
A safety zone is an area extending out from any part of an offshore oil and gas installation (typically 500m) and is established automatically around all installations which project above the sea at any state of the tide. Subsea installations may also have safety zones, created by statutory instrument, to protect them. These safety zones are 500m radius from a central point.

Vessels of all nations are required to respect them through the United Nations Convention on the Law of the Sea (UNCLOS) and Coastal State Legislation.

It is an offence (under section 23 of the Petroleum Act 1987) to enter a safety zone except under the special circumstances outlined below:

- to lay, inspect, test, repair, alter, renew or remove a submarine cable or pipeline in or near that safety zone;
- to provide services for the installation, to transport people or goods to or from the installation, under authorisation of a government department, or to inspect any installation in the safety zone;
- if it belongs to a general lighthouse authority and is performing duties relating to the safety of navigation;
- to save or attempt to save life or property;
- owing to bad weather; or
- when in distress

The Health and Safety at Work etc. Act (HSWA) 1974 applies both to installations and also activities considered to be in connection with the installation. The Health and Safety at Work etc. Act (Application Outside of Great Britain Order: AOGBO) applies the 'prescribed provisions' of the HSWA and Article 4 describes the connected activities.



Examples of such activities are:

- offshore support vessel operations
- heavy lift barge operations
- dive support vessel operations
- maintenance
- dismantling etc.

Responsibilities

Who is in charge?

The ultimate authority inside the 500m zone is the OIM. This includes authority over all vessels in that zone.

The OIM may delegate the responsibility for communicating with the vessels to someone else. This should be a recognised marine competent person.

- Do you know who is responsible on your installation?
- Do you have a designated marine competent person?
- What does your Safety Case say about controls which should be in place regarding marine operations?

Many Safety Cases primarily focus on errant vessel collision but, in most cases, collisions occur during normal operations, i.e. when the vessel is invited to be there.

MARINE OPERATIONS: 500M SAFETY ZONE

Legislation & Responsibilities

Duty Holder

The duty holder **must** have a Collision Risk Management system in place that has assessed the risk of collision from both passing and attending vessels and be committed to the ongoing effectiveness of the system. It should be appropriate to the risks particular to the installation and contain procedures for detecting and assessing any imminent collision and for managing the consequences. The system must ensure that all attendant vessels are suitable and are managed in such a way as to reduce the risk of ship collision so far as is reasonably practicable.

The Collision Risk Management system must ensure that Emergency Response can be implemented in a timely manner should collision occur.

The duty holder must regularly audit the system and update as necessary.

They must also provide competent installation personnel with an appropriate level of marine knowledge to be able to manage the marine operations undertaken within the 500m safety zone.

Installation OIM

The OIM has responsibilities for the safety, health and welfare and the maintenance of order and discipline of personnel on board the installation. He/she is also responsible for operations within the safety zone. The OIM can delegate this responsibility if necessary.



Vessel Master

The Master of the vessel has the overall authority for the health and safety of all personnel onboard the vessel, the safety of the vessel and the environment. As such, he has the overriding authority and responsibility to make decisions with respect to safety and pollution prevention and to request the company's assistance as required.

Within the 500m zone the OIM has the overall responsibility for the safety of the installation; as such vessels within the 500m zone come under the operational control of the OIM. The OIM has the authority to authorise, cancel, suspend or prevent the commencement of any operation which may affect the safety of that Installation.

Nothing relieves the Master of his responsibility for the health and safety of all personnel onboard the vessel, the safety of the vessel and the environment.

Regulating Authorities

Within UKCS waters, there is a Memorandum of Understanding (MOU) between the HSE, MCA and MAIB. This MOU allows differing government agencies to liaise and act to ensure the safety of installations and personnel.

Within the 500m zone the HSE has the responsibility for both UK and non-UK vessels as laid out within Schedule 2 of the MOU.

MARINE OPERATIONS: 500M SAFETY ZONE

Legislation & Responsibilities

Marine Responsible Person

Whilst the role of the marine responsible person is not currently a mandatory position, it is considered good practice to have someone with the relevant competence and knowledge fulfil these duties.

Responsibilities include:

- OIM-delegated responsibility for all marine operations within the installation 500m safety zone
- Control of all vessel movements in the 500m zone to ensure operations are carried out efficiently and effectively and to minimise time alongside the installation
- Co-ordination of multiple, marine-associated communications within the installation and between the installation and the vessel e.g. control room operator, crane operator, deck foreman
- Ensuring communications between vessel and installation are established prior to entry to the 500m zone and that they are maintained throughout the operation and on departure. This will include (but not be limited to):
 - o completion of all pre-entry and set-up checklists
 - o visual observation of vessel approach, vessel set-up checks at a safe distance from the installation and set-up at working position by installation
 - o monitoring of station keeping and operations whilst alongside
 - o monitoring changes to the operation and weather conditions (trigger points) and when vessels depart the 500m zone



An individual within an existing installation role may have an additional role as a marine competent person. Examples of roles typically used to fulfil these duties are:

- deck coordinator
- deck foreman
- crane operator
- drilling materials (allied marine duties)

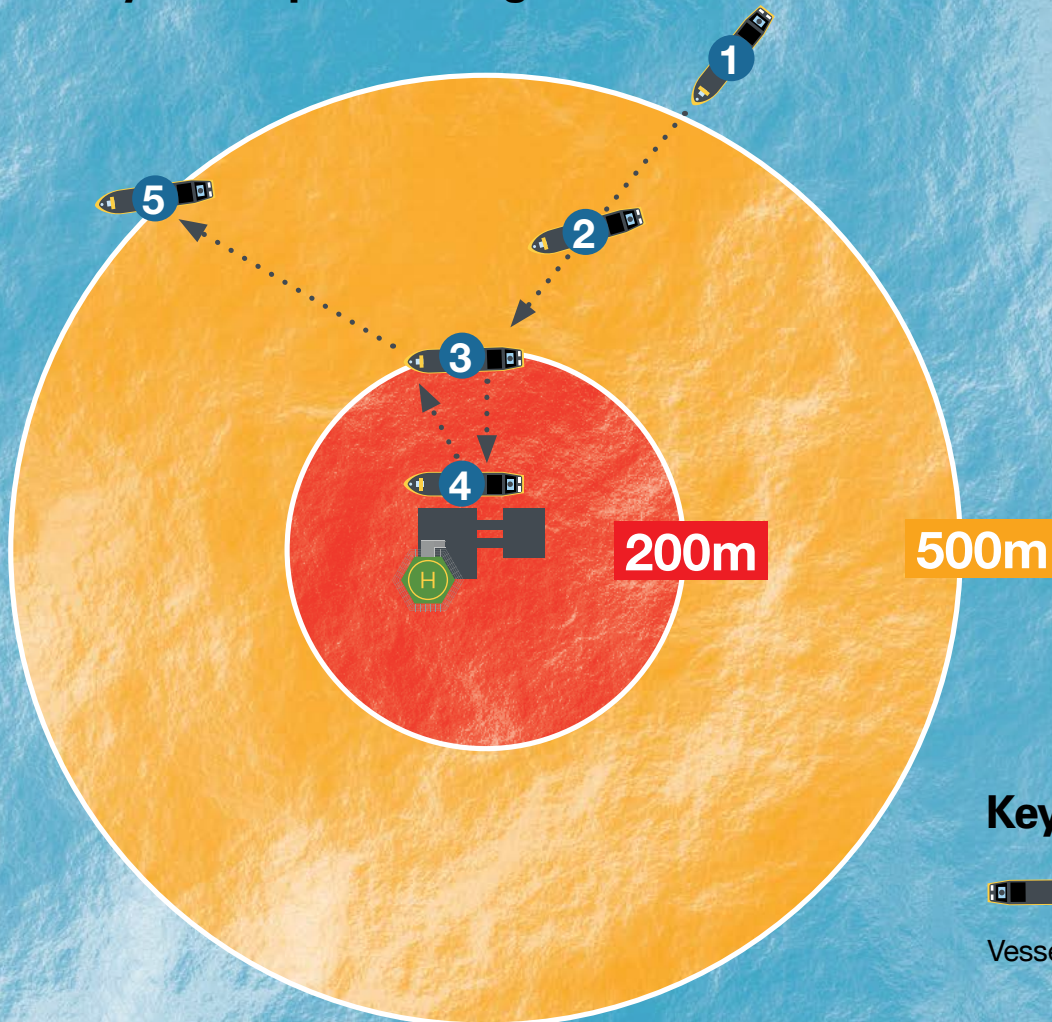
Marine Responsible Person Competence

- Marine Safety Forum (MSF) - Marine Safety Awareness Course or operators' equivalent training

*It should be noted that the role of 'Marine Responsible Person' may be covered by more than one individual.

MARINE OPERATIONS: 500M SAFETY ZONE

Pre-Entry > Set up > Working > Exit



Approach Passage & Pre-Entry

Visual contact - Ensure that visual contact is maintained with vessel once it enters the 500m safety zone and during approach to/departure from the platform. If there are any concerns about the approach, contact the vessel bridge immediately.

Things to watch for may include; the vessel is:

- approaching directly toward the installation
- approaching too quickly
- taking on a lot of water (waves breaking over the deck)
- struggling to maintain position (higher than expected current)
- not sitting correctly in the water (e.g. heavy list due to ballasting issues)

Position Summary

- 1 Approach passage & pre-entry
- 2 Approach (500m - 200m approx.)
- 3 Position set-up
- 4 Final approach (200m approx. - working position) & alongside working
- 5 Exiting safety zone

See next page for full explanations

MARINE OPERATIONS: 500M SAFETY ZONE

Pre-Entry > Set up > Working > Exit

1 Approach passage & pre-entry

- Vessel passage plans must not have installations as waypoints. Final waypoint must be offset from the installation
- Establish contact and ensure that radio-working channels are understood
- Pre-entry checks to be carried out in a drift off situation testing interaction / communications with installation. Determine who (on the installation) is responsible for maintaining contact with the vessel
- Should control of the vessel be transferred to another station (e.g. fwd to aft) or a different operating mode is selected (e.g. manual to full DP) then it should be ensured that all manoeuvring arrangements are responding as anticipated before undertaking any close proximity operations
- Discuss the planned approach and proposed work
- Any installation delays expected? Bulk transfer permits? Weather side working risk assessment? Installation staff availability? Notify vessel if any overboard discharges from the installation could affect operations
- DP reference system targets in correct position and ready (reflectors clean etc)
- Identify and set trigger and hold points which determine operation start/stop/hold or prompt a risk assessment or risk assessment review
- Vessel to confirm to installation once ready to enter safety zone

Only once the installation is fully satisfied that the vessel has undertaken the necessary pre-entry checks and that the work plan minimises the length of time the vessel will be required to be in close proximity to the installation should permission to enter the safety zone and proceed to the set-up location be given.

If it has been identified that working in a drift on condition will be required then, before permission to enter the 500m safety zone is given, a risk assessment must be undertaken by both the vessel and the installation, mitigations put in place as required and agreement between the OIM and Vessel Master made before allowing operations to be undertaken.

2 Approach (500m - 200m approx.)

Approach and work alongside installation to be made in the same mode as tested during pre-entry process. Should 'mode of operation' or control station be changed then the full range of system checks should be undertaken again to ensure that systems are operating correctly.

A correct approach should have the vessel coming alongside obliquely. The vessel should not approach head on.

- Speed is 3 knots or less, depending on the vessel type and weather conditions
- Escape routes identified

The faster the vessel comes in the harder it could hit the installation!

MARINE OPERATIONS: 500M SAFETY ZONE

Pre-Entry > Set up > Working > Exit

3 Position set-up

This is the process whereby vessel personnel determine how adequately the vessel is managing to hold position before starting the final approach. This should be done far enough away so that, if something goes wrong, the vessel crew have enough time to take corrective action.

It can take some time to acquire a stable position and allow a DP model to build up (up to 30mins)

Position set-up to take place well away from the installation (position such that installation collision avoided if equipment failure occurs during set up checks)

- $1\frac{1}{2}$ x vessel length for drift-off operations
- $2\frac{1}{2}$ x vessel length for drift-on operations

During this time the vessel personnel are to satisfy themselves that:

- DP references and sensors are stable
- Vessel motion is within operational limits
- Vessel machinery operation within limits i.e. power utilisation not greater than 45%

4 Final approach (200m approx. - working position) & alongside working

Once satisfactory set-up checks are complete and permission has been given by the installation to move to the working location, the vessel should be manoeuvred towards the installation in incremental steps (circa 10m) at a time using progressively smaller steps.

If the operation is going to involve working in a 'drift-on' condition, then a joint (installation and vessel) risk assessment must be undertaken.

- Speed \approx 0.5kts (0.3m/s)
- Minimum separation distances to be maintained

5 Exiting safety zone

Once operations are complete and the vessel is ready to depart the safety zone the following should occur:

- Confirm manifests / DG notes all on-board
- Hose(s) disconnected and clear
- Deck secure (sea fastened) for transit
- Vessel secure
- Move to set-up position
- Depart safety zone in a controlled manner following recommended speeds as per entry process
- Transfer controls once outside safety zone
- Once outside safety zone vessel to obtain instructions (client control etc.)
- Provide ETAs for next location

MARINE OPERATIONS: 500M SAFETY ZONE



Alongside / Working & Trigger Points

Whilst the vessel is within the safety zone, the following conditions should be monitored by vessel and installation personnel to ensure suitability to continue normal operations:

- weather / environmental conditions (wind strength & direction, sea state, currents, visibility)
- vessel motions
- other vessel traffic
- maintaining good communications
- sufficient personnel on bridge, deck and engine room for intended operation
- bulk hose operations (depending on weather, SIMOPS i.e. bulk transfers and deck cargo operations may take place at the same time if all parties agree)
 - o rigging and connections
 - o condition, position and adequacy of floatation devices
 - o crane driver to remain within crane cab
 - o in the event of an Installation alarm; make safe and disconnect
- monitoring overboard discharges from installation
- crane movement

Possible Delays

When working alongside the installation, possible delays to the operation can come from many factors including (but not limited to):

- helicopter operations
- installation drills / GPA
- meal breaks / installation personnel unavailability / shift changes and handovers
- crane SIMOPS – other Installation activity
- change in plan or loading sequence
- sea state, visibility, wind or current reaching operational limits
- ERRV drills

If any delay becomes extended, then it is prudent to release the vessel outside of the 500m safety zone until operational status returns to normal.

MARINE OPERATIONS: 500M SAFETY ZONE

DP Reference System Information

What is keeping the vessel in place?

The positioning systems on vessels have multiple referencing systems to ensure they know exactly where they are when they are alongside.

But did you know some of these are on your platform?

Many platforms will have repeater beacons or reflectors which the vessel will use as a reference to assist them in knowing their exact position relative to your platform. It is critical that these are not moved or tampered with in any way.

Do you know where they are or what they look like? Are they clearly marked?

There have been cases where these have been moved while a vessel is alongside. And as they have moved, the vessel has followed them.

If you are responsible for marine activities you should know where these devices are. These are safety critical.

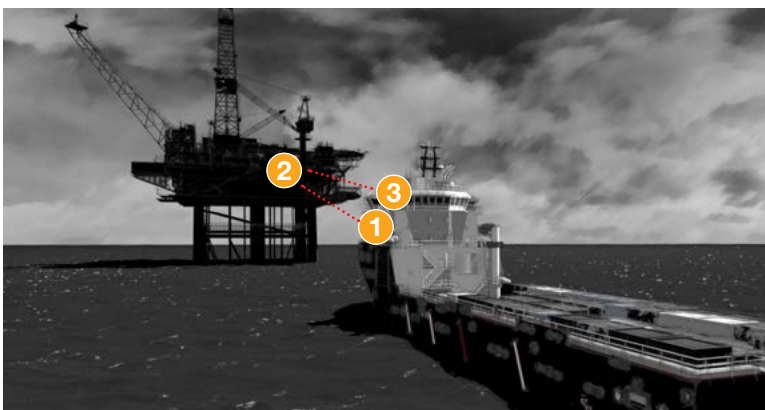
What are they?

Position reference sensors (PRSs) are critical for the vessel when using Dynamic Positioning (DP) when the vessel is both navigating and station keeping in the 500m safety zone.

What types are there?

There are two types of PRSs that require targets:

1. **Radar** – Sends out a low power radar signal to an electronic target which is known as a “responder”
2. **Laser** – Sends out an infra-red (invisible) low power laser beam to a reflective target, typically a tube or prism cluster



How do they work?

There are three main parts to any relative position reference sensor:

1. A sensor mounted on the vessel which sends out a signal
2. A target located on the asset which bounces or reflects the signal back to the sensor
3. A console on the vessels bridge

The sensor locks onto the target either on approach or after entering the 500m zone. The sensor then feeds the position of the vessel relative to target (distance and bearing, and optionally heading) into the ships DP system and allows the ship to manoeuvre precisely and safely in the safety zone using DP. Many vessels have both types of sensor on them for redundancy – e.g. due to environmental or operating conditions other reference sensors may become unusable; the laser and radar ensure that DP status is maintained.

MARINE OPERATIONS: 500M SAFETY ZONE

Sensor Target Information



Sensor Type	RADAR
Target Type	Electronic Responder
How do they work?	<p>Responders powered with either an external battery, an internal re-chargeable battery pack, or directly from mains.</p> <p>Responders only lock onto the radar sensor when they have power and are switched on.</p> <p>Range is 600m to 1000m depending on the type of sensor on the vessel.</p>
Maintenance	<p>Keep clean and ensure that the re-chargeable battery is charged, that the battery pack still has power, or mains is present.</p> <p>The battery pack lasts for approx. 1 year and the rechargeable versions require charging every couple of weeks. Mains power is permanent.</p> <p>Responders should always be mounted using an approved bracket.</p>
What will stop them working?	<p>NO POWER Responders need power. If the battery (rechargeable/or pack) or mains power dies, then the sensor cannot lock onto the target.</p> <p>Broken Cables</p>
What should you never do?	<p>Never block the line of sight between the target and the vessel.</p> <p>The sensor may lose the target and lose position and bearing information, which may affect the DP system.</p> <p>Never move the target from its location whilst in use. It has been put there for a reason!</p> <p>If the vessel is locked onto the target and the target moves, the vessel may also move. Particularly dangerous for close to asset station keeping.</p>
Good Practices	<p>Use multiple targets whenever possible. The use of multiple targets provides redundancy for each sensor type</p> <p>Optimal target location Ensure that target locations are optimised – contact manufacturer for details</p> <p>Warning Label's Ensure that targets are labelled with an appropriate label advising that; "this is a critical piece of vessel positioning equipment which should not be moved, covered or tampered with"</p>



MARINE OPERATIONS: 500M SAFETY ZONE

Sensor Target Information



Tree-style



Rugged



Tube style

Sensor Type	LASER	
Target Type	Reflective Prism Target	Reflective Tube Targets
How do they work?	Prism targets usually come in a cluster of 4 to 8 prisms. Each prism is made of glass that looks like a mirror. They reflect light back to the sensor and have a maximum range of 2.5km	Tube targets are cylindrical and are typically 1m to 2m long These targets reflect the laser light back to the sensor. Maximum range is approximately 500m.
Maintenance	To achieve maximum range targets must be kept clean – regular inspection and cleaning is important for safe operations. Prism should always be mounted using an approved mechanism.	To achieve maximum range targets must be kept clean – regular inspection and cleaning is important for safe operations. Tube targets should always be securely mounted to avoid damage.
What will stop them working?	POOR MAINTENANCE Prism targets must be clean. PRISMS KNOCKED OFF Tree-style prism clusters are prone to having prisms knocked off. The rugged prism is designed to stop this. NOTE: The reflectivity of prisms is very high and the signal is much brighter than any other reflective equipment on the asset.	POOR MAINTENANCE Targets must be clean and not damaged or worn. Tape can easily get scratched, dented or peel off. OTHER REFLECTIVE SURFACES NEAR BY Do not place in locations where people with Hi-Vis jackets are present. These highly reflective jackets can provide “false” reflections to a laser system. POOR WEATHER VISIBILITY Functionality is significantly reduced in poor visibility weather.
What should you never do?	Never block the line of sight between the target and the vessel. The sensor may lose the target and lose position and bearing information, which may affect the DP system. Never move the target from its location whilst in use. It has been put there for a reason! If the vessel is locked onto the target and the target moves, the vessel may also move. Particularly dangerous for close to asset station keeping.	
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