# MARB048 (was MARB012)
# Undertake maintenance of machinery systems and structure

# Introduction

- Verify maintenance requirements
- Establish maintenance systems
- Organise maintenance activities
- Supervise maintenance tasks
- Perform planned maintenance activities
- Maintain fire and emergency equipment
- Perform breakdown maintenance
- Monitor, adjust and report on implementing the maintenance plan
- Carry out damage control procedures

# *Advantages of Planned Routine Maintenance* -

- *Ensures that the vessel operates safely and efficiently at all times*
- *Reduces risk to plant and personnel during periods of operation*
- *Adds to the efficiency of a vessel's operation by reducing the risk of breakdown at sea*
- *Assists in early detection of faults thus reducing expensive breakdown costs*

*Vessels are routinely slipped according to Survey requirements to carry out regular maintenance and*
*to comply with Statutory Requirements concerning inspection and survey*

# ***Advantages of planned routine maintenance***

- ***Due to the costs involved and the down time of the ship it is imperative that maintenance is well organised and prepared for otherwise the efficiency of the operation will be effected.***

- ***AMSA Domestic Vessels and Class Society Rules vessels have survey requirements for the vessel to be removed from the water for out of water survey every 3 and 5 years, so effective organisation of the maintenance is needed to ensure integrity between haul outs and inspections.***

- ***Maintenance schedules for all items inaccessible when the vessel is afloat must be done plus any known faults logged in the Defect Register where jobs may have been allocated to next slipping.***

# *Advantages of regular slipping*

- *To inspect external underwater area of hull, fittings and stern gear for physical damage.*
- *To carry out routine maintenance on underwater areas such as scraping, painting and anti fouling of hull To inspect external underwater area for defects/deterioration unique to material and type of hull as follows -*

Steel — *corrosion, erosion, electrolysis, condition of external welds. This can include thickness testing if required*

*Aluminum — corrosion, erosion, electrolysis, condition of welds. This can include thickness testing if required*

Wood — *movement of planking, condition of planking, condition of fastenings and caulking below the waterline, treating for rot where required and prevention and/or repair of planking where attacked by marine parasites.*

Fiberglass reinforced plastic — *de-lamination and osmosis*

- *To inspect rudder, propeller, propeller shaft and associated stern gear including astern brackets and bearings and to carry out maintenance where required*

- *Inspect and clean keel cooling pipes and refrigeration condensers and examine for damage and wear*

- *To inspect and replace sacrificial anodes where fitted*
- *To inspect and carry out maintenance on shipside valves below the waterline*

- *Clean and inspect transducer's and speed log fittings*

- *Drain and clean and paint bilges, Ballast tanks, Storage tanks, cofferdams,  because its possible to get them really dry with no condensation on areas below the waterline.*

# Planning Ships maintenance

- *Maintenance should be planned at regular intervals in accordance with manufacturer's instructions and company's policy*

- *Maintenance should be planned to keep the engine or engines running efficiently and reliably between maintenance schedules*

- *Maintenance schedules should be broadly established based on the hours of running. Items such as fuel injectors, inlet and exhaust valves and turbo blowers are required to be overhauled at regular intervals as per manufacturer’s recommendations.*

- *Items such as coolers, inter-coolers, fuel and lubricating oil filters, air filters , Water filters and strainers, starter motors, alternators, heat exchangers, Batteries, Emergency Power supplies, should also be routinely checked, cleaned and replaced*

- ***Planned Maintenance** should be carried out on various parts of the engine (and other machinery and the hull) when due. e.g. — various items of a diesel engine should be checked every 1000 hours; a major overhaul may be due at 5000 hours to meet with manufacturer's requirements , survey requirements and company policy*

- ***Lubrication oil sampling should be done at regular intervals** and results noted. Depending on results, maintenance might have to be carried out at an unscheduled period which could prevent major damage to the engine or financial loss to the company.*
- ***Poor oil sample results may also bring about shorter service periods.***

- *The ship's electrical installation should be routinely maintained and needs special consideration due to statutory requirements and environment*
- *Ship's electrical systems are often subjected to greater deterioration because they operate in a marine environment and often in enclosed engine rooms in a hot salty atmosphere.*
- *Batteries should be regularly checked and renewed on signs of dropping performance or within a period of time. This could be 12 months depending on company's policy*
- *ELV systems, such as navigation lights, require regular inspections to ensure reliability and sufficiency of insulation*
- *Low and medium voltage electrical switchboards and plant should be regularly inspected by a suitably qualified person in order to meet the requirements of AS3000 in order to meet statutory requirements Electrical inspections must be recorded and electrical reports must be retained on board with the ship's documents.*

# Ships Structure

- All parts of the ship require regular Maintenance
- Hatches, watertight doors, dead lights, port lights
- Vent closing devices
- Through hull openings , valves, freeing ports closing devices
- Bow thruster, stern thruster
- Bow doors and operating equipment,
- Cranes, Booms, Derricks, Winches, Hiabs
- Life boat davits and Cranes,
- Fire and bilge pumping systems
- Cargo pumping systems
- Life saving equipment

# Maintain Life saving and fire fighting and fire detection equipment

# Life Saving Appliances

**What are Life saving appliances**
**Life jacket and their lights ,whistles, and reflective tapes**
**Life rafts and the supplies in them**
**First aid kits and the expiry date on items in it require a 3 monthly stock take and replenishment**
**EPIRB and the batteries that power them and their registration**
**SARTS and their batteries, survival suits, EEBDs,**
**Radios, Life boats, rescue boat, Flares, code flags, signal mirrors, Horn, smoke canisters, dye canisters, man over board smokes, life rings, Life buoy lights, search lights, torches, personal EPIRB, MOB alarms,**
**Many of these Items have expiry dates and need regular replacement, If an item has reached its expiry date it is no longer serviceable and must be replaced before proceeding to sea**

# Life Saving Appliances

- In order for these appliances to be immediately ready for use at any time it is essential that their operational status and preparedness be monitored continually with regular monthly checks by the vessels crew, and findings recorded

- Life boat and rescue boat motors test run monthly and supply's check
- Bi monthly operational and crew training drills
- 12 monthly inspections and certification of life rafts with changing of the essential rations and perishable supplies.

# Fire protection  equipment and devices

- Fire detection systems require regular checking by Qualified person/s to ensure that they are in operational order check back up battery condition, test call points, smoke and heat sensors and alarms every month and recorded.

- Check condition of water tight bulkhead doors and sealing devices, automatic door closers and ventilation fan emergency shut offs. These are also static fire protection devices.

- Record  checks and fix all faults before sailing.

# Fire fighting equipment

- Every piece of fire fighting equipment shall have a regular maintenance schedule and inspection regime on top of the statutory inspections by a licenced qualified person every 12 Months.
- Engineers and crew should be inspecting and testing each piece of equipment every month at least and recording the results.
- Drills shall also be carried out every 2 months at least to ensure the crew know how to efficiently operate the equipment on board and recognise faulty equipment

# Fire fighting equipment

**Monthly Checks on board**

Check pumps main and auxiliary work efficiently
Check water intake filters are not blocked
Check all valves work including fuel shut off valves
Check hose connectors are not seized and they work
Check fire extinguishers are charged, powder is free
Check all equipment storage brackets are sound
Check all equipment is within inspection dates
Fire plans are in place and readable
Check BA and EEBD cylinder pressures

# Fire and Lifesaving appliances

## <u>Fire and life saving  consumables</u>

- Batteries in Radios, EPIRBS, SARTS, Torches, Life raft lights, life jacket lights, Dan buoy lights, Fire panel back up batteries
- Supplies in first aid kits on the vessel and in the life raft and boat
- Life raft and Life boat emergency rations and water.
- MOB smoke signals,
- Flares in the life raft, life boat and the main vessel
- Powder and chemicals in the fire extinguishers.
- Air in the BA and EEBD normally changed each year at service.
- Hydrostatic releases on the life rafts are in date
- Chemical pipe repair bandages and epoxy repair putty have expiry  dates
- Any more you can think of ??

# Fire and Lifesaving appliances

## Legislation,

- Marine orders part 28 deals with life saving and fire equipment testing and maintenance for RAV's and vessels under a class society.
- The Commonwealth Navigation act 2012 for RAV's and vessels under a class society and the National Law act 2012 for DCV's
- NSCV and the USL code also cover these items for DCV's

Follow Class society rules if under class.

- A Certificate for safety equipment each year by an approved surveyor to ensure that it all meets statutory requirements is required for RAV's and vessels under a class society.
- For a DCV safety equipment is checked by a surveyor depending on the survey frequency allocated to the vessel in the 5 year cycle

# WEEK 5 August 29 to Sept 4

## DAILY & WATCHKEEPING CHECKS

| Description | Mo | Tu | We | Th | Fr | Sa | Su |
|---|---|---|---|---|---|---|---|
| Regular machinery space inspections | | | | | | | |
| Check fuel system for leaks | | | | | | | |
| Check all bilge levels including bow thruster | | | | | | | |
| Check all oil levels including bow thruster | | | | | | | |
| Check the engines fresh water gravity tank | | | | | | | |
| Check voltage and frequency | | | | | | | |
| Check backup generator | | | | | | | |
| Check steering operation & oil level | | | | | | | |
| Sludge off & fill fuel oil settling tank/ Day tanks | | | | | | | |
| Check refrigeration operation and temperatures | | | | | | | |
| Sludge moisture from air receiver if applicable | | | | | | | |
| Check the air conditioning system | | | | | | | |
| Fill out engine room log sheet | | | | | | | |
| Update Oil Record Book | | | | | | | |

**WEEKLY MAINTENANCE**

Check Bow door operation
Grease all machinery
Run and test harbour genset
Check deck crane / Boat davit
Check battery banks
Check domestic water supply
Order fuel, oil &consumables
Work requests and defect reports

**MONTHLY MAINTENANCE**

Complete and hand in monthly reports
Check all remote fuel shut-offs
Exercise and lubricate seawater valves
Clean sea water strainers
Wash ships air-conditioning filters if applicable
Check general Alarm
Check all lights and light fittings

Faults found

Signed Engineer Date

**<u>Voyage and pre departure checks</u>**

These are risk assessment tools as well as maintenance checks and should be done and documented;

- ***Prior to departure;***
- ***Check on board consumable items such as fuel, lubricating oil, refrigeration gas, victuals etc.***
- ***Check condition of spares such as fuel filters, lubricating oil filters, high pressure fuel pipes to injectors etc.***
- ***After discharge of cargo, check cargo holds for damage during rough weather if encountered on previous voyage***
- ***Check maintenance manuals for routine maintenance due and arrange for this to be carried out before departure. Refer to Vessel SMS.***
- ***Check machinery and secure loose gear in anticipation of a change in sea and weather conditions***

*During voyage*

- ***Set up and maintain effective engine room watch***
- ***Operation of equipment, visual inspection of machinery, monitoring gauges, oil levels and pyrometers,***
- ***Checking of bilge levels, Water tight doors and void spaces.***
- ***Safety checks on emergency equipment***
- ***Crew training drills***

*On completion of voyage*

- ***Prepare maintenance and repair schemes***
- ***Visually inspect equipment and systems for faults Complete running logs and maintenance reports***
- ***Checks faults which may have caused damage or changes to the seaworthiness of the vessel following an emergency***

# Dealing with defects and repairs

- Commonwealth regulations and the NSCV  require that  all Ships are maintained in a seaworthy state at all times Safety management systems on board vessels document the correct procedures to be followed by the crew.
- All defects and repairs/ maintenance must be documented.
- Most larger company's require that all defects are reported to fleet engineers and managers so they know the state of their vessels at sea
- Log all defects on a technical defect reports
- Make up defect Log/Register for the vessel identifying each report by a unique number
- Sign off completed defects
- Make up and maintain maintenance logs and reports

# Dealing with defects and repairs

Safety Management System

## Technical Defect Report

| | | | |
|---|---|---|---|
| VESSEL: | | DATE: | |
| Master/Chief Engineer | | Machinery item / System | |
| STATUS: Major defect | Minor Defect | improvement | Defect No: |
| Does this incident require Class notification: No Yes - Details: .................................................................................... | | | |
| Description of Defect: | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Describe possible cause of defect: | | | |
| | | | |

# Dealing with defects and repairs

Describe possible cause of defect:

Will assist be required by Contractors if so what type of contractors;

Rectification work done;

Master/Chief Engineers Signature:

# Dealing with defects and repairs

Safety Management System

## VESSEL DEFECT REGISTER

VESSEL: MV Whatever

SHEET No. ONE

| DEFECT NO. | DATE | FAULT | CHECK DATES | DATE RECTIFIED | BY |
|---|---|---|---|---|---|
| 01/13 | 26/1/13 | Oil leak from steering pump | 1/2/13 | 27/1/13 | Dave James Chief engineer |
| 02/13 | 28/1/13 | Exhaust gas leak port exhaust silencer | | | |
| 03/13 | | | | | |
| 04/13 | | | | | |
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# Dealing with defects and repairs

- Carry out daily maintenance items and record.
- Carry out weekly maintenance items and record.
- Carry out monthly maintenance items and record.
- Maintain records of safety equipment checks.
- Maintain records of pre start checks of all deck machinery.
- Maintain records of all pre start and cold room temperatures ( max 3hr).
- Maintain engine running logs
- Maintain generator running logs and electric voltages, amperage and frequency.
- Maintain oil record books
- Maintain Asbestos register where it is and how risk is managed if required

# Monthly Equipment check lists

Safety Management System

DECK EQUIPMENT CHECKLIST

| | | | | |
|---|---|---|---|---|
| Vessel: | | Date: | | |
| EQUIPMENT | | YES | NO | COMMENTS |
| 1 | **Windlass:** | | | |
| | Controls and signage | | | |
| | Brakes bands and control arm | | | |
| | Clutch mechanism and linkage | | | |
| | Cable and linkages | | | |
| | Foundation support | | | |
| 2 | **Fwd winches:** | | | |
| | Controls and signage | | | |
| | Brake band and control arm | | | |
| | Clutch mechanism and linkage | | | |
| | Wire/Synthetic Rope condition | | | |
| | Sheaves/fairleads and capstans | | | |
| 3 | **Forecastle:** | | | |
| | Doors, hinges and closing assembly | | | |
| | Rubber seals | | | |
| | General area condition/cleanliness | | | |
| | Lighting (240v) | | | |
| 4 | **Fore Deck / Main Deck:** | | | |
| | Breathers (including gauzed openings) | | | |
| | Hydraulic pipes & hoses | | | |
| | Freeing ports / scuppers | | | |
| | Sounding points (for damage) | | | |

# Monthly Equipment check lists

| | | | | |
|---|---|---|---|---|
| | General area condition/cleanliness | | | |
| | Lighting (240v) | | | |
| 4 | **Fore Deck / Main Deck:** | | | |
| | Breathers (including gauzed openings) | | | |
| | Hydraulic pipes & hoses | | | |
| | Freeing ports / scuppers | | | |
| | Sounding points (for damage) | | | |
| | Paint condition | | | |
| | Deck condition | | | |
| | Working lights | | | |
| | 3 Phase outlets | | | |
| | Doors, hinges and closing assembly | | | |
| | Fuel points & hoses (within test dates) | | | |
| | Cargo equipment (chains/straps ....) | | | |
| 5 | **Accommodation area:** | | | |
| | General condition/cleanliness Doors, | | | |
| | hinges and closing assembly | | | |
| | External signage (Muster, Fire | | | |
| | Flap....) External lighting (24/240v) | | | |
| | Internal lighting (24/240v) | | | |
| | Internal amenities (showers ..... ) | | | |
| | White goods (fridge, freezers .....) | | | |
| | Emergency exits (clearly marked and visible without lights [luminescent stickers]) | | | |

# Monthly Equipment check lists

| | | | | |
|---|---|---|---|---|
| | General condition of boat | | | |
| | Equipment check list complete | | | |
| | Davit condition and base plate | | | |
| | Wire rope and windlass | | | |
| | Certificates current | | | |
| 10 | **Mast/s and associated:** | | | |
| | Rigging Lights | | | |
| | Day shapes | | | |
| 11 | **Life Raft/s:** | | | |
| | Support brackets | | | |
| | Securing points | | | |
| | Hydrostatic Release in date Life Raft/s in date. | | | |
| 12 | **Wheelhouse:** | | | |
| | Publications in date | | | |
| | Charts corrected | | | |
| | Navigation equipment working | | | |
| | Compass deviation card correct | | | |
| | Radios in good order | | | |
| | EPIRB in date | | | |

**Note*** Mark "YES" if equipment is satisfactory. Mark "No" if defective.
If unable to rectify defective equipment at time of inspection a Defect report and entry into Defect Register will need to be carried out and repair of the defect organised.

**Inspection completed by:**

Name: ______________________

Position: ______________________

**Master**

Name: ______________________

Signature:

# Monitor and Supervise

- The larger the vessel the more crew you may have at your disposal and the more work will need doing
- Planning and work rosters are essential for good work flow and productivity
- All worn or damaged equipment needs examining for likely causes of failure and evaluating for change of maintenance periods.
- Parts need ordering and stocks need maintaining a very important part of managing maintenance.
- Large repairs need costing and reports writing for owners approval before undertaking work
- Contractors need organising for work that can not be done by crew to suit vessel schedule.

# Break Down Maintenance

- In the event of breakdowns
- Assess for possible fault and cause.
- Review possible actions and resources available
- Formulate a plan
- Review plan with Master or owners.
- Make full repair or temporary repair as appropriate
- Test repair
- Order replacement parts to replace parts used
- Make up reports and logs

# Damage control

- Extra care must be taken in **heavy sea conditions** as freeboard may be reduced due to the vessel rolling. Tank breathers, hawser pipes leading to chain lockers etc. may allow the flow of water into these spaces and may require sealing to prevent this.
- A rapid change in vessel trim for any reason may also reduce freeboard to a point where low lying hatches, flush deck openings etc. may be at risk of allowing water ingress.
- Any non-conformities that may risk the vessels water tight integrity and permit flooding must be recorded in the engine room log and reported to the master on at least a daily basis. Any non-conformities that frequently re-occur or require shore side assistance must also be reported to the vessels managers immediately so corrective action can be arranged.
- Damage control drills must be carried out regularly as per company directives and NSCV regulations. These drills must be then recorded by the master in the deck log.

# Damage control grab bag

- It is a good idea to have on board a dedicated grab kit for damage control. This kit should be kept for emergencies only and be regularly checked that the contents have not been pilfered and are still in good condition.

- The kit should contain things like, but not limited to pipe bandages, wooden plugs and wedges, shoring gear, a putty like substance that will cure underwater such as “ferropre” or “devcon”, hammers and mallets. Dunnage and timbers of various lengths are also very handy for shoring any hull damage.

- Any emergency repairs made in this fashion are temporary repairs at best and must be rectified by qualified shore side personnel ASAP.

# Damage control

- Damage that can occur from hull breach, striking an submerged object, start pumps, assess damage, temp repair.
- Under water hull fitting failure, block hole, wooden bungs, plugs
- Pipe rupture, bandages, rubber and hose clamps, epoxy paste

# Legislation

**International legislation examples;**

Marpol, Solas, IMDG code

**Commonwealth and Domestic legislation;**

Commonwealth Navigation act 2012 and Marine orders 0 to 99 (for RAV's and DCV'S under a class society)

National Law act 2012 and NSCV (for DCV'S )

USL code (for existing DCV'S that have been grandfathered)

Occupational Health and Safety (Maritime Industry) Act 1993

**State Legislation;**

DCV'S also need to comply with any state maritime legislation when within state waters.

In Queensland for example TOMPA, TOMPR.

Local harbour regulations (See the port procedures for that particular port).

Each state also has OH&S acts and regulations to be complied with.