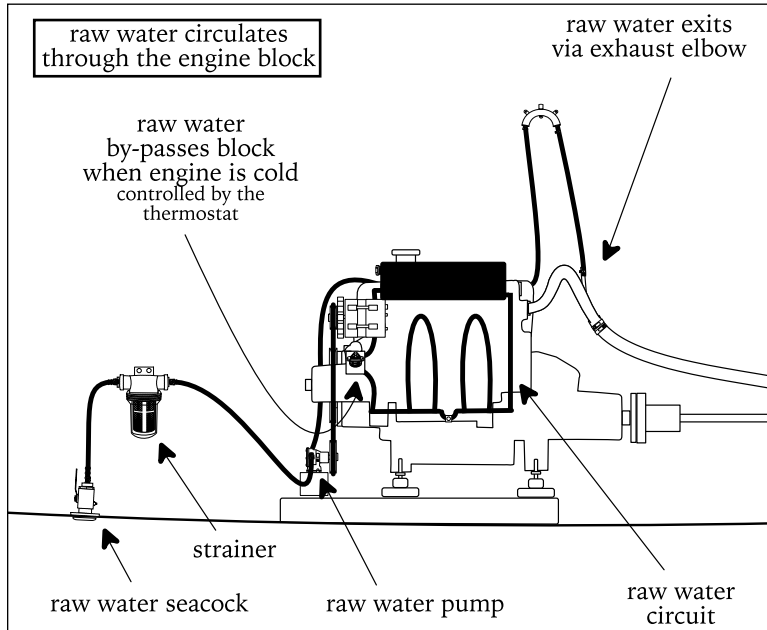
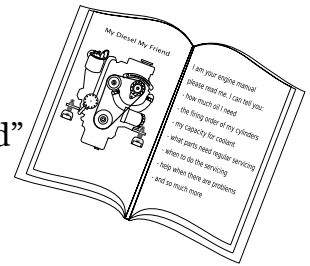


# Winter Lay-Up Task Sheet - Marine Diesel Basics ⑥

## DIRECT COOLED where danger of *freezing*

what needs to be done to protect the complete *system* and keep everything in good condition

### Identifying a Direct Cooled marine diesel engine:



- 1) check in the engine manual - "direct cooled"
- 2) the header tank contains water only (no coloured coolant)
- 3) larger direct cooled engine may have a heat exchanger connected to the oil circuit (oil cooler) but no coolant circuit.
- 4) direct cooled engines are rarely found in salt water, which is very corrosive.

### CAUTION

Use only the correct Task Sheet for the type of engine cooling system and the most severe conditions to be expected. Severe damage, even engine destruction, can result if the correct tasks are not completed.

See other Lay-Up Task Sheets:

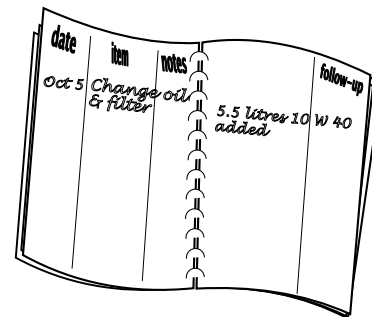
- (3) Indirect Cooled - NO freezing conditions
- (4) Indirect Cooled - **freezing** conditions
- (5) Direct Cooled - NO freezing conditions

### Importance of the Maintenance Log

Keeping an accurate record of work done, components dis-assembled or removed for service, and jobs yet to be completed is especially important when a vessel may be laid-up for many months, or if a different person may do the re-commissioning. Relying on memory alone will inevitably lead to lapses - hose clamps missing from a seacock, stuffing box left tightened etc.

A Maintenance Log can also help identify trends and give early warning of developing problems before they become serious (and potentially expensive).

The Log can be simple - 4 columns in a 2-page notebook spread works well: Date, Item, Notes, Follow-Up.



### Four Reasons Why Proper Winter Lay-Up Is Essential

- 1) failing to correctly winterize the engine etc. can crack the engine block and other accessories.
- 2) removing contaminants, such as dirty oil and filter. Sludge can block engine passages (galleries). Transmission fluid additives wear out, leaving parts unprotected.
- 3) preventing deterioration, such as battery sulphation, rusting, impeller damage, and permanent boat odours. A clean, tidy lay-up also saves work on recommissioning the vessel.
- 4) inspecting and replacing items, such as hoses & belts, before they fail causing serious problems.

Much more information and complete illustrated guides on how to complete all these tasks are shown in Marine Diesel Basics 1 - Maintenance, Lay-Up, Winter Protection, Tropical Storage, Spring Recommission

the first **VISUAL** guides to marine diesel systems

# Winter Lay-Up Task Sheet - Marine Diesel Basics

DIRECT COOLED where danger of **freezing**

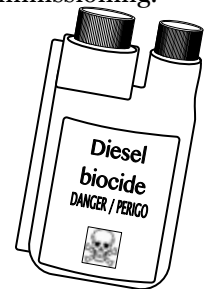
what needs to be done to protect the complete *system* and keep everything in good condition

## Engine Essentials

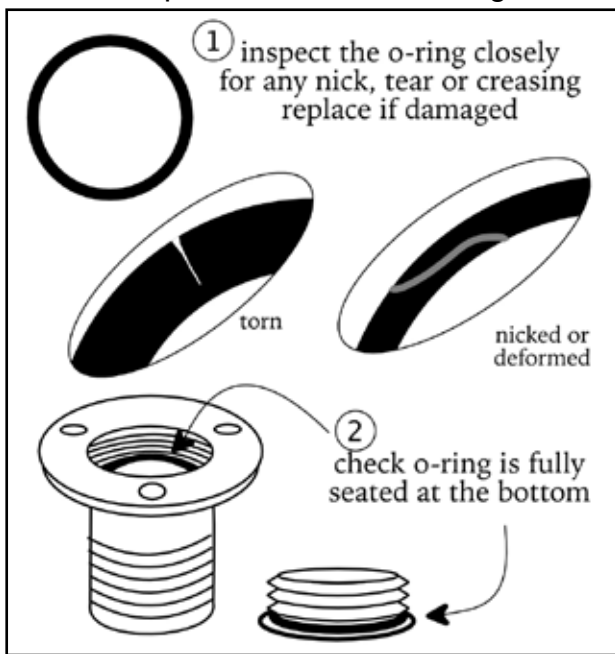
- slacken the belts (alternator, raw water pump) - removes tension on bearings and is a good opportunity to inspect the belts and pulleys for wear and roughness.
- wipe down all engine surfaces with an oily rag or spray lightly with oil - protects against rusting (oxidation). Wipe **clean** all wires and hoses because oil, diesel fuel and ATF fluids will degrade them over time.
- clean the bilge - leaving water in the bilge raises the humidity, accelerating rusting (oxidation) and encouraging mildew. Bilge water can provide a pathway for stray current if the bilge and float switch are left connected. Over time, oily, contaminated water creates a "boat odour" which permeates everything and is hard to remove.
- write down in the Maintenance Log all work done during lay-up - parts dis-assembled, removed, valves closed, service tasks completed and jobs yet to be done etc. This greatly simplifies recommissioning.

## Diesel Fuel

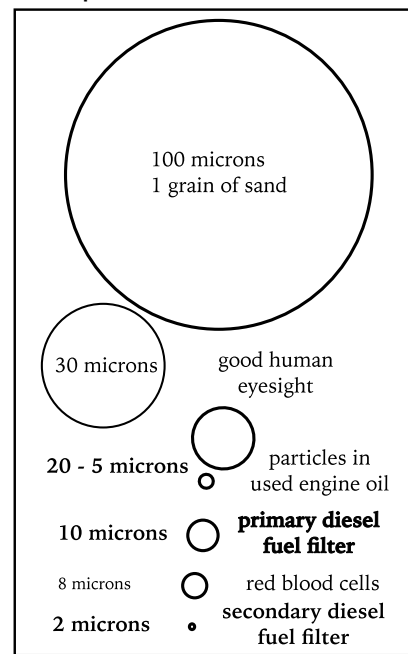
- add a prevention dose of diesel biocide on the last fuel fill - HUM (hydrocarbon utilizing organisms such as fungi, yeasts and bacteria) can multiply in the water/fuel interface and later plug fuel filters and lines. The amount of moisture forming in a partly filled tank is minimal.
- inspect the fuel deck fill o-ring and screw down cap tightly - the deck fill is the first defence against water getting into the fuel tank, where HUM can grow.
- change primary fuel filter (and 2nd filter every 2nd year) + bleed engine - it's not possible for human eyes to see contamination smaller than about 30 microns. Avoid refilling the fuel filter with unfiltered fuel.
- check fuel vent cannot back-flood with water - but do not plug as air in the fuel tank needs room to expand and contract with changes in temperature.
- close all fuel valves - if a hose or connection fails, fuel can syphon from the fuel tank and flood the boat.



Inspect the Deck Fill O-ring



Comparison of Micron Sizes



Much more information and complete illustrated instructions to complete all these tasks are shown in Marine Diesel Basics 1 - Maintenance, Lay-Up, Winter Protection, Tropical Storage, Spring Recommission the first **VISUAL** guides to marine diesel systems

# Lay-Up Task Sheet - Marine Diesel Basics

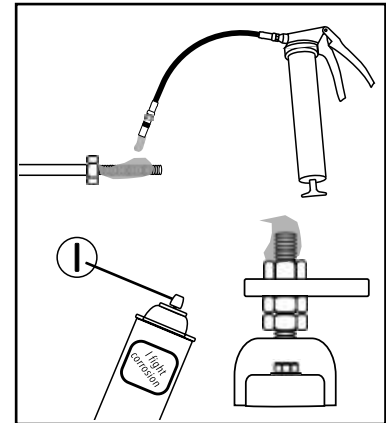
## DIRECT COOLED where danger of *freezing*

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### Lubrication

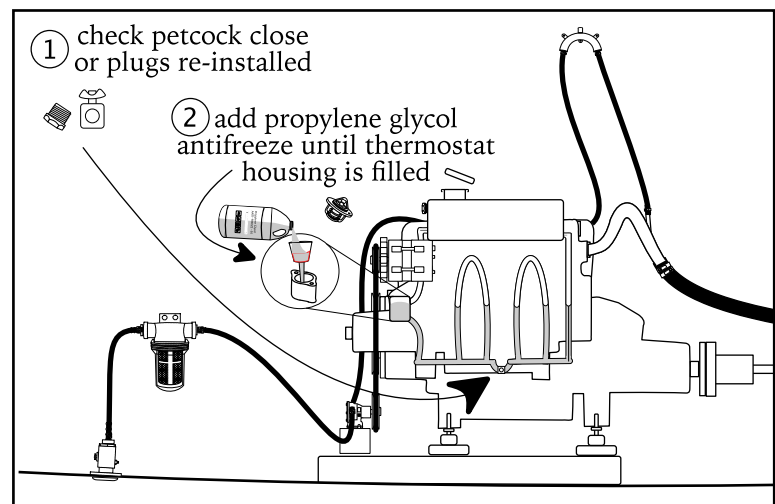
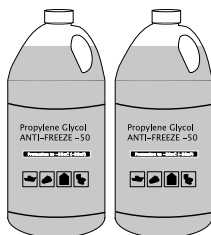
- change engine oil and filter - essential to minimize corrosion and the build-up of sludge, which can block oil passages (galleries), by removing the contaminated oil which contains acids and carbon residues.
- change transmission fluid - especially important if the gearbox has overheated (darkening of the fluid). Additives in ATF do wear out, so changing once a year is cheap insurance.
- grease control cable ends & engine mount threads - slowing down corrosion during lay-up helps avoid future problems.
- lubricate ignition key slot - a quick spray of oil (WD40 etc.) can prevent corrosion and sticking.
- check injection pump & governor dipsticks (if fitted) - look on the pump or in engine manual - some have their own mini dipstick and may need to be topped up.

Greasing threads avoids Seizing



### Raw Water Cooling

- check all hoses and hose clamps & replace if needed - Squeeze hoses (as well as visual inspection) because hoses can bulge or collapse internally. Check the underside of hose clamps for corrosion.
- drain all water from the engine block. This is essential** - merely running propylene glycol anti-freeze through hoses to the exhaust will not protect the block. Water must be drained from the bottom of the block.
- check anode(s) in header tank, oil cooler, engine block - replace if 50% consumed. Anodes protect more "noble" metals such as bronze, aluminum & stainless steel from corrosion. See engine manual for locations.
- remove the thermostat - this is necessary to make sure antifreeze reaches all passages in the lower part of the engine block. A new gasket may be needed, as the old one is likely to disintegrate when removed.
- fill the engine block with propylene glycol antifreeze - make sure the drain, petcock or plug is closed at the bottom of the engine block. Fill until the antifreeze reaches the thermostat housing. Select the grade of antifreeze for the maximum coldest temperature, not the average maximum cold.
- re-install the thermostat - make sure the surfaces are smooth and perfectly clean. Replace the gasket if necessary. The housing will leak if the gasket is damaged.
- add propylene glycol antifreeze to the header tank until almost full - trapped air will be forced out when the engine runs.



Much more information and complete illustrated instructions to complete all these tasks are shown in Marine Diesel Basics 1 - Maintenance, Lay-Up, Winter Protection, Tropical Storage, Spring Recommission the first **VISUAL** guides to marine diesel systems

# Lay-Up Task Sheet - Marine Diesel Basics

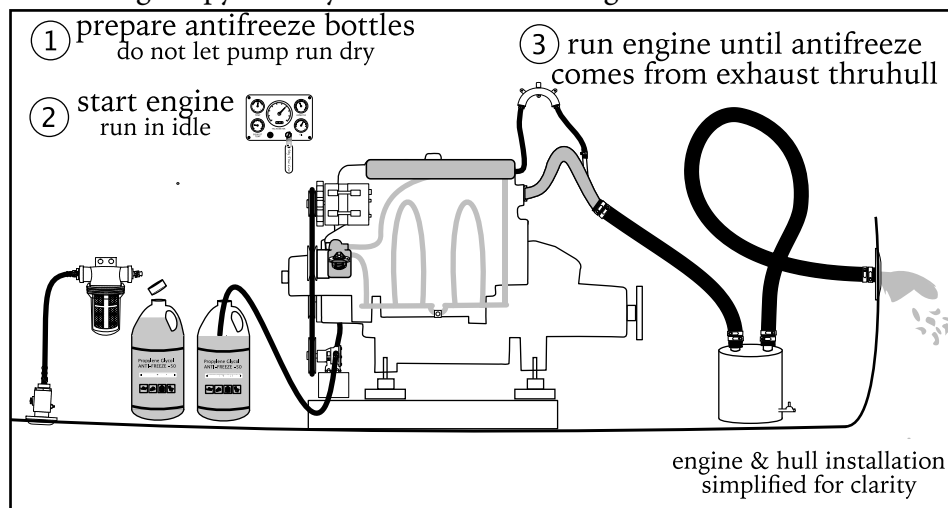
## DIRECT COOLED where danger of **freezing**

what needs to be done to protect the complete *system* and keep everything in good condition

### **Raw Water Cooling** *continued*

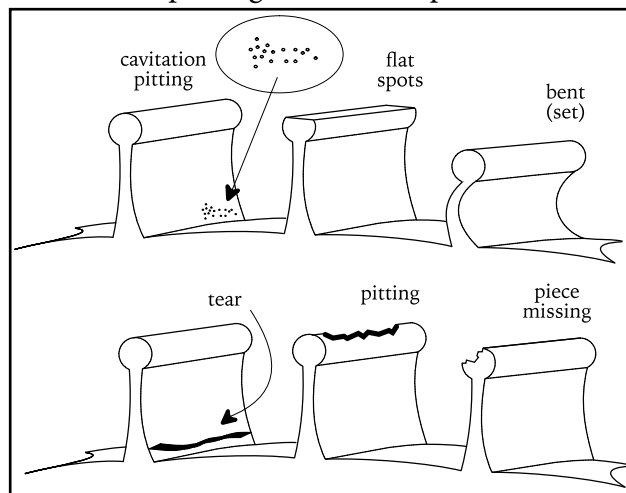
- add propylene glycol antifreeze to the raw water cooling circuit - run the engine with the raw water hose before the strainer or the raw water pump immersed into one or more jugs of antifreeze.
- run the engine until coloured antifreeze comes from the exhaust - make sure the engine block has been drained of raw water and filled with propylene antifreeze before running antifreeze through the cooling circuit. Failure to do this will leave water in the engine block which will likely crack in freezing conditions.

#### Flushing Propylene Glycol Antifreeze Through the Raw Water Circuit



- drain the raw water hoses and the raw water strainer, if not filled with antifreeze.
- remove and inspect the raw water impeller (seacock closed if boat in water!) - it's not possible to properly inspect an impeller without removing it from the pump housing (because it is slightly compressed). Leaving an impeller installed during lay-up will cause several of the vanes to become permanently bent ("taking a set") which reduces the pump's efficiency when in service.

#### Inspecting a Rubber Impeller



Much more information and complete illustrated instructions to complete all these tasks are shown in *Marine Diesel Basics 1 - Maintenance, Lay-Up, Winter Protection, Tropical Storage, Spring Recommission* the first **VISUAL** guides to marine diesel systems

# Lay-Up Task Sheet - Marine Diesel Basics

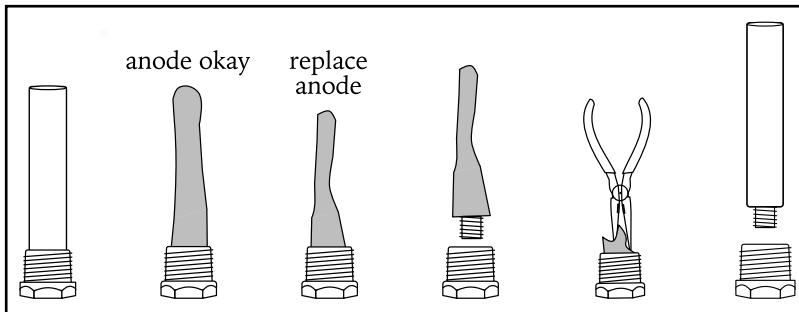
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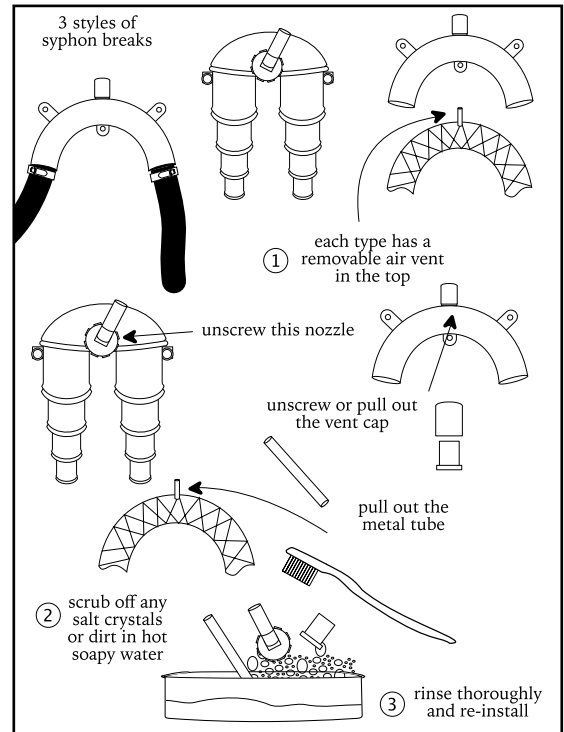
### Raw Water Cooling *continued*

- dismantle and rinse the syphon break in fresh water to remove any scale or salt crystals - take care to re-assemble correctly. A blocked syphon break can cause the engine to back flood.
- drain the water-lift muffler - best practice, rather than leaving a mix of water and antifreeze which may not protect the muffler from freezing damage.
- vessel taken OUT of water - open seacock. Vessel IN water - close all seacocks. Lay-up out of the water is an opportunity to service seacocks; ensure they open and close easily; that handles are not corroded.

### Replacing a Pencil Anode



### Cleaning the Syphon Break



### Breathing (Air Intake & Exhaust)

- clean air filter - even in the “clean” marine environment - hair, sand, belt dust, insulation etc. can block the air intake, making the engine less efficient. Encourage as much ventilation through the engine room as possible.
- seal air intake with plastic - keeping humidity out of the engine will slow down internal engine corrosion. Use silica gel or cat litter inside the filter housing to cut humidity (esp. in high humidity areas).
- disconnect the wet exhaust hose from the exhaust manifold *or* the wet exhaust hose from the water-lift muffler - seal the end to keep humidity out of the exhaust manifold and the engine.
- block wet exhaust thruhull to prevent rodents entering the vessel - not necessary in all locations, but rodents can do a surprising amount of damage when left undisturbed.

Much more information and complete illustrated instructions to complete all these tasks are shown in Marine Diesel Basics 1 - Maintenance, Lay-Up, Winter Protection, Tropical Storage, Spring Recommission the first **VISUAL** guides to marine diesel systems

# Lay-Up Task Sheet - Marine Diesel Basics

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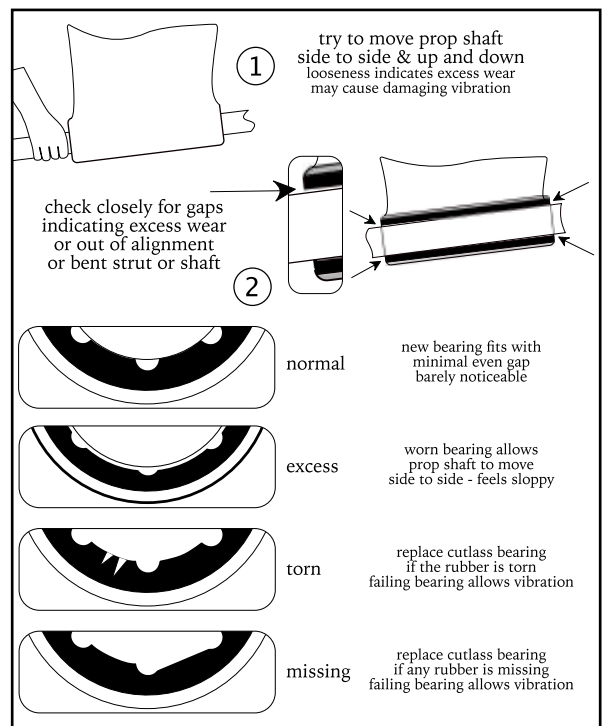
### Electrical

- clean battery top and terminals - dirty terminals attract moisture which encourages corrosion, often causing intermittent connection problems. Dirty terminals are a common source of voltage drop.
- check electrolyte levels and add distilled water if needed - exposed battery plates will die as soft sulphates harden, thus reducing the capacity of the battery. (Sealed batteries should not need servicing).
- trickle charge battery(s) using a sealed marine battery charger or solar panels - do not leave unattended for long periods. Do not use a wind generator as this will not "self-disconnect" when battery(s) charged.
- disconnect terminals from battery (leave bilge pump connected if vessel in water) - even a small unintended drain can discharge the battery over time, causing soft sulphates to harden. Battery should always be fully charged before storage. (Only necessary if battery(s) will not be trickle charged).

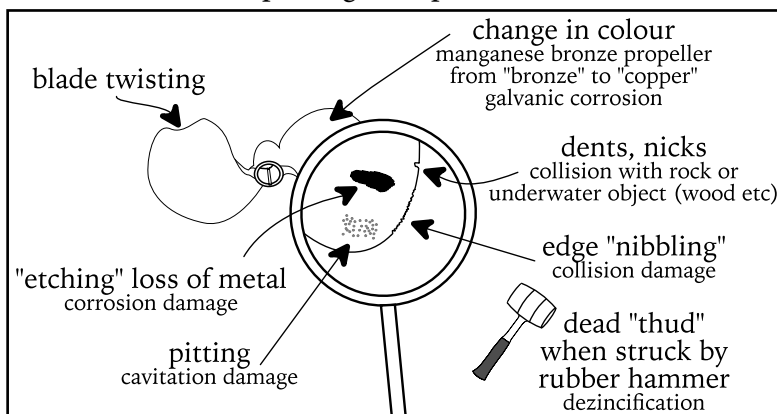
### Drive Train (coupling, shaft, stern gland, cutlass bearing, propeller)

- Tighten the packing gland of a traditional stuffing box (vessel IN the water)
- Loosen the packing gland (vessel OUT of the water) - write down reminder in Maintenance Log!
- Inspect the cutlass bearing (vessel out of the water)
  - wear on the cutlass bearing may indicate out of alignment, bent shaft, bent strut, misaligned coupling.
- Inspect the propeller shaft anode - replace if 50% consumed. Anodes are an important part of the electrical protection of all metals on a boat. They should not be painted.
- Clean the propeller, strut and shaft to inspect - (vessel out of the water) - remove any line, netting, seaweed etc. caught on the shaft which can deprive stainless steel of oxygen causing pitting corrosion.

#### Inspecting a Cutlass Bearing



#### Inspecting a Propeller



Much more information and complete illustrated instructions to complete all these tasks are shown in Marine Diesel Basics 1 - Maintenance, Lay-Up, Winter Protection, Tropical Storage, Spring Recommission

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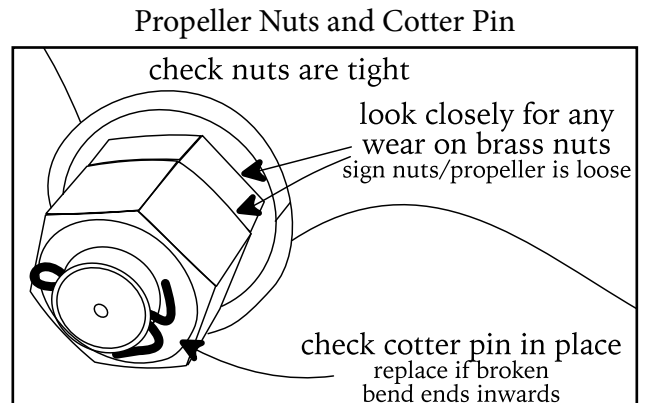
# Lay-Up Task Sheet - Marine Diesel Basics

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### Drive Train *continued*

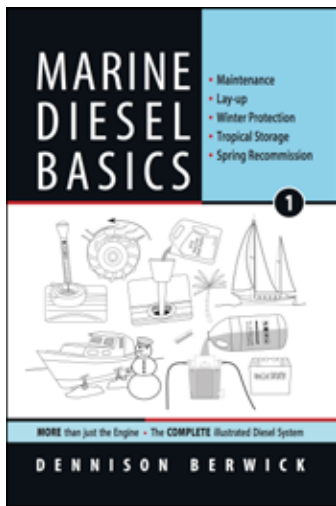
- Inspect the propeller, prop nuts & cotter pin (vessel out of the water) - imperfections can cause noise and vibration. Dezincification is the loss of zinc from brass alloys, leaving the weakened metal a pinkish colour.



### QUESTIONS?

Need more information on **how** to complete these tasks, and what tools & supplies are needed?

- Marine Diesel Basics 1 **shows** how to complete tasks in clear drawings with simple instructions.
- chat with Dennison Berwick via Live Chat on the [marinedieselbasics.com](http://marinedieselbasics.com) website.
- ask a question on the Marine Diesel Basics Facebook page.



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**Seeing is understanding!** With more than 300 illustrations on 224 pages, Marine Diesel Basics 1 shows how to:

- 1) complete all basic maintenance tasks of the marine diesel system - fuel, lubrication, cooling, breathing, electrical, and drive train (coupling, shaft, shaft seal, propeller)
- 2) lay-up (winterize) the complete system and to prepare for tropical storage (high heat and humidity)
- 3) recommission (“summerize”) the system to ensure reliable and trouble-free service

- step-by-step instructions in clear, simple drawings
- explains all parts of the system
- lists all necessary tools and supplies to get each task done
- covers sailboats, motorboats and narrowboats
- indirect and direct cooled diesel engines
- saildrives – maintenance, lay-up, recommissioning
- Task Lists and Index

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