

# Guidelines for Lay-Up of Ships

## GAC Ship Lay-Up Solutions (GLUS)

Powered by **Bibby Ship Management** & **DehuTech**





# Index

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■ Introduction	P4
■ GLUS Set-Up and Partners	P4
■ GLUS Lay-Up Sites	P5
■ Class and Certification	P8
■ Protection and Indemnity (P&I)	P8
■ Hull and Machinery (H&M) Insurance	P8
■ Lay-Up Options	P9
■ Preparation for Lay-Up	P10
■ Preservation and Maintenance	P12
■ Underwater Services	P18
■ Documentation and Record Keeping	P19
■ Safety and Security	P20
■ Crewing and Inspections	P21
■ GAC Marine Logistics	P22
■ GAC Ship Agency	P23
■ Re-Commissioning and Start-Up	P23

## Introduction

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Laying-up ships makes good business sense during tough times. Not only does it allow ship owners and operators to avoid non-profitable journeys and over supply, it also reduces wear and tear, crew costs, fuel consumption and insurance premiums during the idle period.

GAC Ship Lay-Up Services (GLUS) has prepared these guidelines as support for customers that opt to lay-up their vessels – whether it be for shorter or longer periods – and to provide a clear overview of the lay-up methods and services available.

## GLUS Set-Up and Partners

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GAC Ship Lay-Up Solutions (GLUS) works with “best in class” partners under a single umbrella to provide the broad range of skills and experience required for the comprehensive care of a ship being laid-up.

Part of the GAC Solutions stable, GLUS is a strategic partnership with Bibby Ship Management Ltd and DehuTech AB. It aims to assist customers at a range of lay-up locations around the world with a range of services and products including: identification of lay-up locations, ship agency, logistics support, technical management, crewing, dehumidification, surveillance and preparation for reactivation.

### GAC Solutions

GAC Ship Lay-Up Solutions – Powered by Bibby Ship Management and DehuTech is a unit under GAC Solutions, a special business area of the GAC Group, set up to provide value-added products to the shipping and marine industries. It combines GAC’s knowledge and long standing relationships with its shipping, logistics and marine customers with the products from world-leading suppliers. Other services range from class-approved fire, rescue & safety systems / services, onboard and office based weather routing solutions, protective solutions (anti-piracy), workwear and the list is growing.

### Bibby Ship Management

Bibby Ship Management’s dedication to quality brings economic advantages to its clients. In particular, the company’s adherence to stringent quality management systems, industry foresight and professional integrity means that the long term interests of clients are prioritised. Bibby Ship Management has a global presence and is part of Bibby Line Group, with over 200 years of marine heritage.

### DehuTech AB

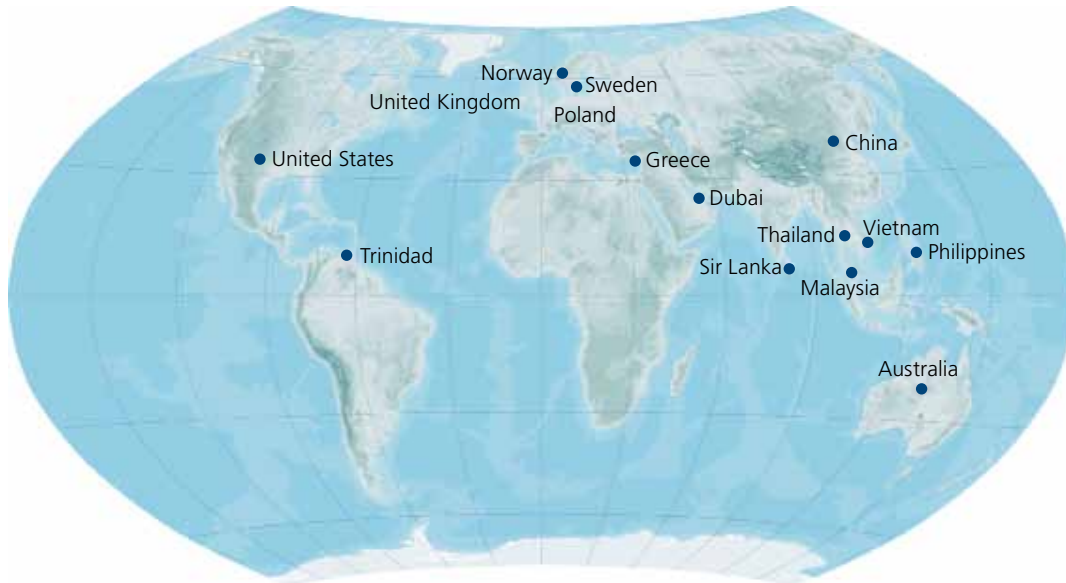
DehuTech is a Swedish company that exports desiccant dehumidifiers to countries outside Sweden. The dehumidifiers are developed, designed and manufactured in Sweden and are used for a vast number of different industrial applications. DehuTech AB is a subsidiary of Fuktonroll AB, Sweden which has been active in the domestic Swedish market since 1980.



GAC Ship- Lay-Up Solutions helps safe-keep your business with our comprehensive range of services delivered by professionals.

## GLUS Lay-Up Sites

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Thanks to the GAC Group's global network of offices and agencies, GAC Ship Lay-Up Solutions has the local experience, expertise and resources to offer informed advice on the best lay-up locations, as well as a wide range of secure, safe and cost-effective solutions for vessels laying-up wherever you go, including:

- Australia
- Malaysia
- Sri Lanka
- Thailand
- Vietnam
- Philippines
- China
- Dubai
- Greece
- Poland
- Sweden
- Norway
- United Kingdom
- United States
- Trinidad

## GLUS Lay-Up Sites

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Sites may differ widely, depending upon the type of vessel, so the following should be considered when choosing a suitable site:

- Shelter provided from open seas, winds, waves, swells etc.
- Mooring method including ships berthed alongside, at buoys, anchors, stern moorings, anchored rafts of several vessels, etc.
- Security of location.
- Proximity to preferred trading routes after reactivation.
- Detailed local weather conditions, such as:
  - ▶ wind, waves and swell, direction and force;
  - ▶ cyclones, hurricanes, ice, local currents and tides;
  - ▶ reliability of local weather forecasting services.
- Shelter provided from open seas, winds, waves, swells etc.
- Anchorage depth and type of holding ground, with diver or sonar surveys as appropriate.
- Water depth to be sufficient for the vessel to remain afloat with sufficient under keel clearance at all tide conditions.
- Proximity to any obstructions, wrecks, underwater cables or pipes, etc.
- Proximity to passing traffic and other moored vessels.
- Proximity of any commercial aquaculture including fish farms, oyster beds, water intakes etc.
- Details of local authorities and availability of tugs, fire fighting, medical and safety services.
- Availability of services such as fresh water, waste disposal, shore power and repairers
- Available space or number of designated lay-up positions
- Suitable access and egress channels, pilotage, tug assistance during mooring, etc.
- Likely hull fouling due to marine growth
- Location of any effluent or corrosive discharges
- Availability of spare or replacement mooring equipment
- Potential windage of vessels, containers on deck, etc.
- Facilities for shore monitoring of vessel position, remote GPS monitoring etc.

## GLUS Lay-Up Sites

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### Approval of lay-up arrangements

Approval by Flag State, Port State, harbour authorities, classification societies, hull & machinery insurers and their surveyors are handled by GLUS when making lay-up arrangements, tailor-made for each vessel and its location.

### Mooring arrangements

Initial checks are made to ensure that the ship is safely positioned at its designated mooring. Mooring arrangements may vary depending upon the location, wind / sea conditions and local regulations. For example in fjords, ships are moored with anchors forward and wires to the shore aft. In sheltered bays they are laid together in rafts, bow to stern, with anchors at both ends. In some benign areas, they are laid on a running mooring with both anchors laid out. Vessels may also be laid up alongside a suitable berth.

GLUS assesses specific requirements of each vessel and liaises with the local authorities to ensure the safest arrangements, taking into consideration the following:

- The mooring must be sufficient to hold in the most extreme wind conditions.
- Assessment of water depth compared to vessel draft and freeboard.
- Frequent anchor checks to ensure that anchors are well pulled in, and chains are as straight as possible and at optimum tension. If in doubt regarding anchor holding efficiency, the whole mooring operation is carried out again. Anchor positions should be marked with buoys to show locations and to facilitate recovery if slipped.
- When wires are used astern, they must be under even tension and taut.
- Position of anchor chains and mooring lines to be varied at regular intervals to prevent uneven wear at contact points with hawse pipes, fairleads, winches, etc.
- If the vessel is laid up against a quay, suitable fenders and safe gangways with adequate lighting must be used.
- To minimise windage and improve anchor holding, tankers should take about 30% deadweight ballast, and bulk carriers should have maximum ballast.
- Except in special circumstances, mooring for lay-up on a single anchor is not considered unless the lay up is a very short "Hot" type.
- Allowances are made for high profile vessels with a large side windage - such as car carriers, passenger/cruise ships and container vessels with container stacks - when assessing the strength of the mooring system.
- To easily ascertain any change in draft, final lay-up draft marks forward and aft are marked conspicuously with white lines on port and starboard sides.
- Depending on the location, emergency towing lines should be deployed fore and aft, ready for use, without adjustment, in case the vessel needs to be towed off the berth or anchorage.
- Multiple vessels are laid up together, either alongside or in anchored or moored groups or 'rafts', should be of a similar size.
- Vessels alongside should normally be not more than three abreast and all facing in the same direction.
- When moored in rafts, vessels should normally not be more than six abreast, anchored to face in alternate directions and secured bow to stern.

## Class and Certification

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### Class Certification

#### Flag, Class and Insurance requirements

Laid-up ships are subject to all relevant national, port and other statutory requirements. These may vary extensively depending upon the lay-up location as well as the Flag and Class of vessel.

#### Period of Class

Depending on the vessel's Classification, its class period may continue unchanged throughout the lay-up period. In such cases, periodical surveys will be performed, although dry-dock surveys that fall due while the ship is laid-up may be deferred until reactivation.

#### Class renewal

Where the class of a vessel has expired, renewal is conditional on the performance of a substitute survey. Special surveys are designed and set up for laid-up vessels.

#### Safety certificate

Ship's equipment is subjected to inspections required for the issue of a safety equipment certificate.

Depending on the period of lay-up, Flag States or recognised organisations acting on behalf of Flag States may suspend or withdraw certificates required under International Safety Management (ISM) Code and International Ship and Port Security (ISPS) Code. When the vessel is reactivated, appropriate surveys will be required before the certificates can be re-issued.

## Protection and Indemnity (P&I)

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The vessel's P&I club must be advised of the intention to lay-up the vessel, and whether any crew will remain on board for the duration of the lay-up period.

## Hull and Machinery (H&M) Insurance

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H&M insurers must be advised of the intention to lay up the vessel and their approval obtained of the lay-up site. Insurers' requirements must be complied with. Relevant documentation, including insurance agreements and certificates, should be available and a folio of documents maintained throughout the lay-up period.



All insurance documentation must be readily available through the lay-up period.

## Lay-Up Options

Laying-up a ship is designed to:

- maintain the security, safety and protection of the vessel, crew and environment;
- preserve and maintain the vessel structure and machinery by protecting against corrosion and static seizure.

The extent to which a vessel will be laid-up depends on several factors, including: anticipated lay-up period duration; the need to reduce running costs; time required for reactivation; and the age and value of the ship.

GLUS offers four different modes of lay-up:

- Hot up to 3 months (H)
- Warm up to 12 months (W)
- Cold up to 5 years (C)
- Long term 5 plus years (L)



### Modes of Lay-Ups:

Hot	1-3 mths	(H)
Warm	4-12 mths	(W)
Cold	1-5 years	(C)
Long Term	-5 years	(L)

### Hot lay-up (24-hour reactivation)

This lay-up condition is suitable for up to a month out of service. In this condition, the vessel is held within Classification and Flag State requirements, although crew numbers may be reduced to certified minimum safety crewing limits. Machinery is kept operational but economies are made. The vessel is located in an area close to potential cargo trade routes.

### Warm lay-up (one-week reactivation)

Suitable for up to 12 months out of service. In this condition, vessel crewing is reduced to below the trading limit and in agreement with the Flag State, Classification Society, insurers and local authorities. Most ports will only grant a temporary permit to lay-up a vessel in this condition in port, provided that Class and Flag surveys are conducted. There may be local restrictions on vessels operations such as restrictions on the transfer of oily bilge water.

### Cold lay-up (three-week reactivation)

Suitable for up to five years out of service. In this condition, vessel crewing is in line with emergency requirements to deal with fire, flooding, mooring and security watch. Cold ship lay-up locations are generally remote so access to the vessel can be limited. Upon reactivation, the vessel may need to go direct to dry dock before trading, depending on the extent of any hull marine growth. It is imperative that all preparations and processes during cold lay-up are well documented as crew changes may be significant.

### Long-term lay-up (three-month reactivation)

Suitable for up to more than five years out of service. In this extended condition, preparations are comprehensive as original manufacturers are consulted for critical equipment, Any remedial work done on reactivation is likely to be extensive and unpredictable, such as renewal of alarm systems that may have become obsolete. For long-term lay-ups, several vessel are laid up side-by-side to minimise supervision costs.

GLUS is aware of all these potential problems involved in lay-ups and has the experience, expertise and resources to avoid the pitfalls.

## Preparation for Lay-Up

### General

To ensure that the ship may be re-commissioned without delay if required, any necessary repairs or servicing should be performed prior to lay-up. This requires close liaison with the vessel owners to reach agreement sought on what work need to be carried out before lay-up. When machinery is shut down, the following should remain ready for use.

### Safety equipment

- All safety equipment must be in good working order and fully tested prior to lay-up. The amount of safety equipment onboard may be reduced in certain circumstances, such as removal of BA escape sets that would normally be used by substantive crew and which are not required onboard during lay-up.
- Lighting, fire fighting and lifesaving equipment must be maintained in operational condition during lay-up. Depending upon available power sources, lighting may have to be run from a portable generator placed onboard.
- All consumables and flammable material must be removed prior to lay-up, including chemicals, paint, gases.

### Security

To ensure security during the lay-up period the Company Security Officer in co-operation with the Ship's Security Officer must arrange security measures and procedures with the administration responsible for the lay-up facility.

### Safety management

GLUS, through Bibby Ship Management, prepares all the respective procedures for the laid-up operation mode, to ensure satisfactory control. All respective documentation containing emergency procedures and means of communication, must be on board the vessel.

### Fire alarm and fire-fighting systems

- The onboard fire alarm system must remain operative during lay-up. Where no fire alarm system is installed on board and provision is not made for a permanent watch, a temporary fire alarm system should be fitted in the engine room and other relevant spaces.
- The electricity supply must be sufficient to enable a one-main fire pump to be operated.
- The emergency fire pump should be kept ready for use and the fire-fighting system should be tested at weekly intervals.
- Fire hoses, equipment items, international shore connections and other fire fighting appliances such as hand extinguishers or CO2 systems must be kept ready for use at all times.
- Readily ignitable articles which increase the risk of fire should be removed. Bilges should be dried and kept free from oil. Where there is a risk of frost, fire mains are to be drained.



Onboard fire alarm and fire-fighting systems must remain operative during lay-up.

## Preparation for Lay-Up

The following GLUS activities generally apply to “Cold” and “Long-Term” Lay-ups, but in some circumstances may also apply to the “Hot” or “Warm” Lay-up modes.

General criteria for lay-up:

- Apertures / inspection openings where covers have been removed for air circulation should be covered with fine mesh wire gauze to prevent ingress of foreign matter.
- External equipment moved to dehumidified spaces should be properly stowed, the storage location carefully recorded and the normal location site labelled.
- All machinery and equipment components removed from their normal location should be properly labelled and stowed adjacent to the parent unit within dehumidified spaces. The parent unit should be marked with appropriate labels indicating the location of such components.
- Fuel oil lines should be isolated, and injectors removed, cleaned, coated with oil and stowed.
- Internal combustion engine cylinders must be lubricated with lube oil while engine is turned by hand.
- Cooling systems should be drained of water and left open to dehumidified atmosphere. Where neoprene sealing rings are fitted, system should be left charged to prevent dry-out and corrosion inhibitors added.
- Sea water systems should be drained and opened to dehumidified atmosphere.
- Selected inspection covers should be removed to allow free circulation of dry air throughout the machine.
- Exhaust lines should be blanked.
- Underwater areas must be adequately protected with sacrificial anodes and hull potential to a satisfactory level.
- During lay-up, ballast tanks should be maintained either full or empty. Full tanks may be protected by means of corrosion inhibitors or sacrificial anodes. Empty tanks should be dried out to minimise corrosion. All sludge and mud should be removed prior to lay-up.
- All sea valves should be fitted with internal blank flanges. External sea suction should be closed off by divers using fibreglass blanks fitted with neoprene seals. Blanks should have a pocket to allow a biocide brick to be inserted to prevent marine growth in the grids.
- The stern seal should be checked externally by divers to ensure there are no ropes or lines penetrating the seal assembly that could result in leakage.
- Safe access to the vessel must be provided for watchmen and maintenance crews.



Special preparation is required before a vessel can be laid up.

## Preservation and Maintenance

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The nature and extent of preservation required for each laid-up vessel is determined by:

- lay-up duration.
- lay-up location and corresponding climatic conditions.
- general condition of the vessel (to be assessed and corrective maintenance performed in liaison with the owners prior to lay-up).
- conditions governing re-commissioning.

Corrosion is a major problem when laying-up a vessel and all measures should be made to reduce and even eradicate the risk. Any measures taken must be recorded for reference as a check list when the ship is re-commissioned. The following methods are used to reduce corrosion:

- Total and effective sealing of major accommodation and machinery spaces from external atmospheric conditions, particularly where high humidity levels exist.
- Controlled dehumidification of internal air spaces (including void spaces within machinery and pipelines) to prevent sweating and humidity corrosion damage, as well as moisture absorption into electrical cables and fittings.
- Application of preservatives and suitable lubricants to external equipment and machinery not within the dehumidified spaces.
- Hull cathodic protection to be maintained, and for long term lay-up ballast tanks to be suitably protected. This could mean that they are totally emptied, cleaned and dried out or fully ballasted to remove air pockets and corrosion inhibitor added.
- Regular turning of rotating machinery to prevent corrosion damage to bearings, seizure and component distortion. Equipment would be identified and highlighted on the check lists for this purpose.

### Controlled humidity space sealing and dehumidification

Humidity can present risks for laid-up vessels. Corrosion and other moisture damage can be costly and cause serious delays when the time comes to re-activate. GLUS provides a range of dehumidifying services to reduce the risk of such damage.

The atmosphere within designated spaces should be kept within certain set limits to ensure preservation of equipment. In some geographical location or during certain seasons, some may consider this to be unnecessary. However, this is a fallacy and dehumidification requirements should never be underestimated.

Main Machinery spaces should be maintained at 30 – 50% RH  
Accommodation spaces should be maintained at 45 – 55% RH

All openings – including doors, windows, port holes, vent/extraction apertures, sanitary outlets, scuppers, drains and air intake grids – should be secured and sealed using proven methods. Limited means of access to be retained.

Dehumidification units of adequate capacity need to be sited and installed, together with associated distribution trunking to achieve sufficient air circulation both within the 'controlled' spaces as a whole and through major individual items of machinery, equipment and systems within those spaces. The circulation of dry air will be arranged such that desired levels of relative humidity will be achieved throughout. All water / steam systems and tanks within the controlled spaces, except those required for the lay-up operation will be drained free of water (including bilge areas), dried and left open to dehumidified atmosphere. Non-return valve internals will be removed where necessary to improve air circulation within the systems.

## Preservation and Maintenance

### Dehumidifiers

DehuTech AB, GAC's strategic partner in GLUS, develops, designs and manufactures dehumidifiers and can provide a range of services to reduce the risk of such humidity damages.

Dehumidifiers are used for different areas onboard, including:

- Accommodation areas.
- Engine rooms.
- Bridge and control rooms.
- Specific objects.

There are basically two types of dehumidifiers:

- Condensing dehumidifiers.
- Desiccant dehumidifiers.

For laid-up ships, desiccant dehumidifiers are most widely used. However, in certain climates and for certain compartments, condensing dehumidifiers could also be used.



### Desiccant dehumidifier

- The air that should be dehumidified (process air) enters the rotor. The water molecules are absorbed in the silica gel rotor.
- The rotor is reactivated through another air stream which is heated to 80-100 °C. The moisture leaves as warm, wet air.

Dehumidifiers are either installed outside the area to be dehumidified with ducts or hoses for dry air - sometimes also processing air connected to the dry space - or inside the dehumidified area. Desiccant dehumidifiers also have ducts for wet air and, sometimes, reactivation air to the exterior. For specific objects, such as the crankcase of an engine, dry air is introduced to the interior in a so-called "open system".

Dehumidifiers are normally installed indoors or outdoors with separate weather protection. Specially designed outdoor dehumidifiers that do not need any separate weather protection are also available.

Desiccant dehumidifiers may be installed in ambient temperatures from -30°C to +40°C, while condensing type dehumidifiers are restricted to use in medium or high ambient temperatures. In tropical climates, a dehumidifier must be protected against radiated heat from the sun.

A dehumidifier can either be in continuous operation or controlled by humidistat to a desired level of relative humidity.

Monitoring and recording of relative humidity can either be done using simple instruments for visual reading, or with more sophisticated digital instruments which can in some cases with the option to connect to a remote computer.

For laid-up ships, the principle of installation must be decided for each and every compartment or object to be dehumidified, taking into consideration many different parameters such as the desired level of relative humidity (RH) and climatic conditions at the mooring place. The type and size of each dehumidifier must also be determined and several other practical questions resolved.

GLUS has the experience, expertise and resources to provide informed advice on the best option for each individual laid-up vessel.



## Preservation and Maintenance

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### Diesel engines

Engines that have been run on heavy fuel oil should operate on diesel fuel for a sufficient time before shut down to ensure that the fuel lines and the injection system are free from heavy fuel oil.

#### Engine shut-down up to 3 months

Preservation measures are usually unnecessary for shut-down periods of up to 3 months. Only during cold times of the year is it necessary either to keep the engine room temperature above freezing point or add antifreeze to the fresh cooling water. The mixing ratio depends on anticipated temperatures and should be determined in accordance with manufacturer's instructions. Lubricating oil should be subjected to thorough separation. The moisture content must not exceed a maximum limit of 0.1%. Any decision regarding the further use of old oil should be preceded by an analysis.

Approximately every two weeks, the engine should be lubricated and turned through at least two revolutions, taking care to ensure that on each occasion the crankshaft comes to rest in a different position. Where engines are fitted with cylinder lubricators, it is recommended that these should also be turned by hand during the rotation of the engine. After turning, the indicator cocks should be re-closed.

#### Engine shut-down for longer periods

##### Protection of the combustion chambers and fuel injection systems

The following preservation procedure should be applied in the interests of internal protection: A mixture of gas oil and 20% by volume anti-corrosion oil should be fed into the fuel system. While the engine is running at reduced revolutions with an increased lubricating oil pressure, the air intake apertures should be closed, causing the engine to come to a stop without ignition. Another possibility is to use an atomiser to spray in anti-corrosion oil through the openings in the combustion chamber (injection valve or inspection parts). The compatibility of the anti-corrosion oil with the circulating oil is to be confirmed by the manufacturers.

##### Engine casing

For smaller engine casings it is recommended that the crankcase vents and all apertures provided on the engine are sealed to prevent any air. Information about the condition of the oil can also be obtained by analysis. The limit values specified by the engine manufacturers must not be exceeded. Where an oil change has been carried out, the engine should have run with the new oil for at least 15 minutes. If the shut-down period exceeds 6 months, the oil filter and casing require special attention. They should be cleaned and filled with anticorrosion oil.

The engine entablature of large engines must be ventilated. Relative humidity of no more than 35% should be maintained. This can be achieved by means of an air-drier. According to type, air-driers with a closed circuit (air recycled to the drier) or an open circuit (air discharged into the engine room) may be used. Care must be taken to ensure adequate air circulation in the engine casing. Where an air-drier is also used to keep the engine room dry, separate ventilation of the engine casing is essential. If closed circuit air-driers are used in the engine room, all apertures are to be closed. Gears, camshaft and all control elements should be protected with anticorrosion oil.

##### Turbocharger and exhaust line uptakes

The exhaust line outlet should be sealed. Drain cocks should be opened. Ideally, in the engine room, air should be able to circulate inside the exhaust line, with the air outlet located as close as possible to the end to the exhaust line. The turbocharger intake filters must be cleaned and protected according to their design requirements. Internal parts of the turbocharger should also be protected against corrosion. The rotor should be arrested and all openings closed. Charging air coolers should be drained. Attachments made of materials which are not resistant to seawater must be protected.

##### General - Cooling water spaces

Anticorrosion oil should be added to the fresh cooling water before lay-up. After the ship has been taken out of service, fresh water systems should be drained. Where complete drainage is not feasible; antifreeze should be added prior to shut-down. Confirmation should be obtained from the manufactures that the anticorrosion oil and the antifreeze are compatible with each other and with other cooling water additives as well as with seals and hoses.

##### Starting air system

The entire starting air system, including air cylinders, should be protected and depressurised wherever possible. Air cylinders should be opened. Pneumatic control systems should also be depressurised. All drainage devices should be left open. The condition of the protection must be checked regularly.

## Preservation and Maintenance

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### [Boilers \(measures for combustion gas spaces\)](#)

Boilers run on heavy fuel oil should be changed over to diesel oil prior to shut-down. The fuel piping system should be free from heavy fuel oil completely.

The boiler should be cleaned on the furnace side of all soot and combustion residues which can absorb moisture and lead to corrosion. Any defects, such as leakages, must be repaired. After cleaning, the boiler should be dried by heating (for example, by briefly firing the burner(s) on diesel oil).

Exposed external parts of the boiler should be protected as necessary. Exhaust pipes are to be covered and protected from the elements. Silica gel should be placed within the furnace to maintain a dry atmosphere. To maintain dry air within the boiler, dried air may be circulated within a closed cycle around the furnace / tubes and uptakes. Alternatively, dried air may be passed through an open circuit with the exhaust air leaving the top of the boiler and directed back into the engine room.

### [Seawater cooling systems](#)

Seawater systems which are not in operation should be drained. It is advisable to flush out lines and heat exchangers with fresh water and then dry. All drain cocks should be left open. Valve spindles should be tested from time to time to ensure that they can move freely. As far as possible, all bottom and shipside valves should be closed. Valve spindles should be greased.

It must be remembered that systems or parts of systems may be opened for the purposes of preservation. All strainers should be drained, mopped dry and left open together with selected valves, thus permitting the circulation of dry air.

### [Fresh water cooling systems](#)

Fresh water cooling systems should be drained and dried. All drain cocks should be left open. Expansion tanks should be cleaned and protected. Interiors should be drained and dried out. Inspection covers and drain plugs should be removed for air circulation, and suction strainers drained and left open.

### [Refrigerating equipment](#)

Before refrigerating plant is shut down, care must be taken to ensure that there are no leaks in the coolant circuit. Coolant should be drawn off into the condenser or collector. Condensers should be opened on the water side and dried. Refrigerating spaces should be ventilated.

### [Deck machinery](#)

Deck machinery should be regularly activated and should, wherever possible, be preserved internally and externally and covered over. Where the laying-up conditions make this necessary, anchor and mooring winches should be kept ready for use. Steam-powered winches may, if necessary, be operated by compressed air, and in this case at least one air receiver of appropriate size should be held in readiness.

### [Air compressors and systems](#)

Lube oil should be drained from sumps whilst warm, system recharged with clean oil and the machine run for 5 minutes before final shut-down. Unless the compressor is required for use during lay-up routines, covers and valves on all stages should be removed and cylinders lubricated. Air filters and inspection covers should be removed and header drains left open to allow free circulation of air. Receivers should be drained and mopped dry and drains and inspection doors left open.

### [Fuel oil purifiers](#)

Internals should be removed, cleaned, coated with grease and stowed. Bowl and crankcase should be left open to atmosphere. The crankcase should be drained, cleaned and charged with new oil of owners' supply.

### [Steering gear](#)

The entire steering gear should be subjected to a service test once a week. Provision should be made for the adequate lubrication of the rudder carrier bearings. Exposed parts must be protected.

### [Bilge level alarms](#)

The bilge level alarm system should be kept operative. Where such a system is not installed, a temporary alarm system should be fitted. Valves in seawater systems which are not in operation should be closed. The bilge pump should be kept ready for use.

## Preservation and Maintenance

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### Accommodation

If the vessel is laid-up unmanned:

- In addition to external sealing arrangements described in controlled humidity space sealing and dehumidification, all sanitary fittings should have openings sealed and water supply systems isolated.
- All provisions stores and dry stores should be emptied, cleaned and doors secured in open position.
- All cabin linen should be stowed in a central locker in clean condition, mattresses stood on edge and all cupboard and cabin doors secured in open position.
- All access alleyway decks should be covered with H/D polythene. If carpets are fitted these should be cleaned then covered with a breathable fabric for protection.
- All navigation and communication systems should be isolated (except local VHF Trans/receiver) and room doors left open to ensure good air circulation.
- Accommodation spaces should be sprayed with insecticide to prevent infestations of cockroaches, etc.

### Electrical Installation & Equipment

- All electrical equipment and cables must be in good condition, particularly those required during lay-up such as engine room and accommodation lighting systems and main auxiliary switchboards. Electrical power may be provided by a portable diesel generator or shore power when available. This will minimise utilisation of the vessel's own emergency generator which can then be laid-up. Temporary cables should be supplied and safely installed as necessary.
- Lead batteries should be regularly recharged. Automatic chargers should be kept in operation. The acid level of batteries must be checked every month.
- Electric motors and generators should be heated; low-voltage heating via the windings is recommended. Small motors, switch boxes, electronics cabinets and switchboards should be kept dry and, where necessary, sealed using moisture absorbent materials.
- Full insulation tests should be carried out on all distribution systems and motors prior to lay-up, and readings recorded and submitted to owner on a regular basis.
- The condition of external motors should be monitored by taking regular insulation readings. If the condition deteriorates to a point where it would be detrimental to the motor, where possible, it should be removed and stowed in a dehumidified area.
- All starters, control panels and distribution boards within dehumidified spaces, where safe to do so, should have access doors partially opened to allow free circulation of dry air.

### Main Boilers

#### ■ Gas side

Boilers run on heavy fuel oil should be converted to diesel oil prior to shut-down. Steps should be taken to ensure that the entire fuel piping system is free from heavy fuel oil. The shut-down boiler should be cleaned on the furnace side and any leaks repaired. After cleaning, the boiler should be dried by firing briefly with diesel oil. Exposed external parts of the boiler are to be protected as necessary. Accumulations of soot and dust should be removed. Exhaust pipes should be covered. The furnace may be kept dry with silica gel. Another possibility, as in preservation method III applied to turbines, is to introduce dried air into the boiler furnace and recycle it to the drier in a closed circuit.

In the case of auxiliary and exhaust gas boilers, the dried air may be passed through an open circuit with the exhaust air leaving the top of the boiler and directed back in to the engine room.

#### ▶ Water Space – Dry protection

Dry conditions may only be maintained in steam generators if they can be completely drained. Preferably, the boiler should be drained and opened while hot. To dry thoroughly, pipes, corners, recesses, receivers, etc. should be scavenged with compressed air. The drying operation may be performed much more effectively if the water space is evacuated. Silica gel is then suspended at suitably distributed points to absorb the moisture in the boiler. For boilers with natural water circulation a rough guide is of silica gel per tonne of boiler capacity. Silica gel and other drying agents are preferable to calcium chloride as they can be regenerated by heat. After the moisture absorbent has been placed inside, the boiler should be sealed. The condition of the drying agent should be checked after about 14 days. The target relative humidity should be about 30%. Nitrogen offers another means of protection. Nitrogen is introduced at the highest point of the dried boiler. By maintaining a slight excess pressure and replenishing automatically during the period protection, oxygen in the air is prevented from re-entering.

## Preservation and Maintenance

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▶ **Water space - Wet protection**

This method is to be preferred to other means of protection, particularly where the boiler is soon to be returned to service. Where there is a danger of sub-zero temperatures, suitable counter-measures are required. Oxygen in the air can be prevented from penetrating by a blanket of nitrogen at an excess pressure of about 0.1bar.

Steam lines which may be filled with water as part of the wet protection procedure should be suitably secured to take the additional weight, i.e. anchoring spans and providing supports where necessary. The treatment of the boiler water should be agreed with the boiler manufacturer and the chemical supplier, as appropriate.

Stern tube, tail shaft and engine shafting

The level in the stern tube oil top tank should be checked. Where pressure feed lubrication is used, the pumps shall be operated at a regular intervals. Additional lubrication should be supplied to the intermediate shaft bearing to prevent wear when the equipment is turned, for example in the form of molybdenum sulphite as dry lubricant.

External equipment

All moving and working parts of deck fittings should be proved free and thoroughly coated with preservative grease. Crane cabs should be secured and sealed and control positions covered and secured.

Arrangements should be made for the regular turning of steam / hydraulic deck machinery on air. Engine interioris and all working parts should be regularly lubricated. Lifeboats and davits must be kept in good working order, regularly lowered and the engines run on test.

Cranes

At least one stores crane should be in good working order for use during the lay-up period, and have valid load test certificates issued.

Stores and provisions

All excess or unnecessary equipment, stores and provisions should be off-loaded, particularly in long term lay-up situations.



## Underwater Services

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GLUS can provide a range of specialist underwater maintenance, servicing and repair work on vessels as lay-up starts, throughout the lay-up period and at reactivation, including:

### Hull cleaning

Ongoing research and development of new-generation hull cleaning equipment ensures understanding of how to successfully clean the latest low surface energy coatings currently in service.

### Propeller polishing

A propeller-polishing tool can produce an industry standard surface finish of 0.5µ Ra. The cost of a quality underwater polish represents only a small proportion of the fuel savings it achieves.

### Worldwide inwater surveys

Major Classification Approval ensure equipment is optimised to match the prevailing underwater conditions by using CCTV and high resolution cameras that are sensitive to low light levels. GLUS can also provide CAD generated drawings.

### Other services include

#### [Afloat Shell Plating Repairs](#)

Allowing defective areas of shell plating beneath the waterline to be cut out and replacement insert plates be welded into position whilst the vessel is afloat.

#### [Afloat Stern Seal Repairs](#)

Capabilities to provide underwater stern seal replacement and repair services strategically situated at key global sites.

#### [Afloat Propeller Repairs](#)

Technically sophisticated solutions to propeller damage and associated performance problems in cooperation with Subsea Propeller Incorporated (SPI).

#### [Underwater Welding Typical Applications](#)

Sacrificial and impressed anode replacement, Rope guard and rudder repairs, External doubler plates, Sealing up disused inlet and outlet.

Specific services that may be required before, during and after lay-up include the following:

### At Lay-Up commencement

- In-water inspection of underwater hull and fittings prior to lay-up, with particular attention to the condition of the coating and the sacrificial anodes;
- Reinstatement of coatings underwater, such as epoxy anticorrosive coatings and (if required) tin free underwater applicable anti-fouling;
- Replacement of depleted sacrificial anodes and attachment of additional of sacrificial anodes for protection during lay-up (essential if impressed current systems are to be switched off).
- Design, manufacture and fitting of pressure blanks to sealing sea chest openings and discharge pipes while ship side valves are inspected internally, repaired or replaced. These pressure blanks are a sandwich of aluminium and marine plywood and thus unsuitable for long-term immersion. Information from ship's drawings or a detailed inspection by divers is required to ensure the correct fit on the hull.
- For long-term lay-ups, removal of valves to prevent corrosion and isolation of internal pipe work from sea water by fitting temporary steel spade blanks. Valve removal relieves the need for movement of the valves at regular intervals. Removal of valves and sealing the hull opening also removes the flooding risk where manhole doors are removed from salt water cooled coolers and equipment within the engine room;
- Fitting of lay-up sea chest covers to seal the sea chest against water flow and sunlight to limit fouling growth within the sealed sea chest. A capped port can be fitted for injection of biocide to kill off any existing fouling inside the sea chest, but full local permission is required before using biocides. Covers would not be applied to fire pump sea chests as they must be kept operational throughout lay-up.

## Underwater Services

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### During Lay-Up

- Periodic underwater inspections in line with class or owner requirements to monitor the hull condition and rectify emergent work;
- Monitoring of oil leakage and temporary sealing arrangements made where leakage found;
- Monitoring of bow and stern thrusters for leakage, as well as removal for repair ashore and reinstatement prior to re-commissioning;
- Regular hull cleaning. Vessels with biocide free low energy antifouling hull coating will foul rapidly while stationary. Unchecked, this may permanently damage;
- Sealing of emergent leakage problems caused by hull corrosion;
- Fitting pressure blanks to sea valves to allow repair and replacement;
- Underwater inspection of mooring / anchoring systems;
- Full Class inspection surveys, if required, depending on lay-up duration;
- Periodic checks on the hull electrical potential along the underwater side area to assess the effectiveness of the anode hull protection system.

### Reactivation

- Hull cleaning prior to vessel leaving under her own power or being towed to a dry dock/breakers' yard;
- Removal of sea chest covers;
- Cleaning of fouling choked sea chests;
- Application of pressure blanks for reinstatement or inspection of hull side valves;
- Inspection of rudders and stabilisers prior to and during re-commissioning of the systems to ensure correct operation and rectification of any defects;
- Propeller polishing to remove fouling and calcareous deposits and peak efficiency of the propulsion system once the vessel gets under way;
- Underwater inspection by competent diver, as required by Class if lay-up period is more than 12 months.

## Documentation and Record Keeping

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All work carried out during lay-up preparation must be carefully recorded, documented and photographed. Copies of records should be retained on board (or ashore in designated office) during the lay-up period for use during reactivation. Any spares or equipment subsequently removed for operational purposes, such as transfer to other operational vessels, must be duly recorded. A daily routines log book must be kept to record all activities carried out by the lay-up team.

## Safety and Security

Safety, security and protective measures are essential for laid-up vessels, and they vary according to the type and location of the lay-up.

### Hot/Warm lay-ups:

While crew numbers may be reduced from the normal full operational complement during hot lay-ups, there must be sufficient manpower onboard at all times – including qualified officers and crew – to maintain the vessel in a safe and secure position. Stand-by crew / watchmen are required to maintain a full-time fire, leakage, mooring, safety and security watch of the vessel.

### Cold/long-term lay-ups:

For cold lay-ups, alarm functions must be in place including independently powered fire and flooding alarms. If these cannot be run from the vessel's main system, temporary systems may need to be fitted to cover machinery space, bilges and other spaces as deemed appropriate. These services include:

- Fire fighting capability sustained through either the emergency fore pump or retrofitted equipment.
- Removal of all unnecessary flammable material as well as gas freeing and cleaning of various tanks /compartments.
- Arrangements for the safe containment and frequent removal of garbage and sewage produced by crew or watch personnel onboard.
- Suitable evacuation facilities of watchmen living onboard, to include either gangways or lifeboats / rafts, and evacuation equipment such as breathing apparatus and associated equipment.
- Sealing of all air intake and exhaust openings not required to protect compartments and machinery, such as the generator and main engine uptakes funnel exhausts.
- Onboard security by limiting access by boarding, securing and sealing of doors to the accommodation and other spaces. Provision of suitable alarm systems with remote monitoring.
- Provision of a safe working environment for onboard crew, watchmen and maintenance workers.
- Minimisation of the risk of air pollution.
- Enclosed spaces to have the facility to be ventilated prior to entry (in the cold lay-ups, this takes the form of portable blowers rather than the vessel's own equipment).
- Oil tanks to be drained of fuel oil, then cleaned and maintained in gas-free condition and tested at regular intervals. Oil pipelines, including main engine pressure pipes, to be drained and cleaned prior to long term lay-up.



Safety, security and protective measures are essential during a vessel's laid-up period.

## Crewing and Inspections

GLUS provides sufficient manpower to carry out the lay-up preparation, with the assistance of the existing crew. After initial lay-up has been achieved, then as soon as possible the crew can be reduced until the vessel is finally de-manned or reduced to an agreed level. If unmanned, GLUS provides watchmen to ensure the security for the vessel, and staff to carry out maintenance routines. Reductions below minimum crewing levels should be agreed with the relevant Flag State and any necessary dispensation obtained. GLUS can carry these discussions on behalf of the owner as required.

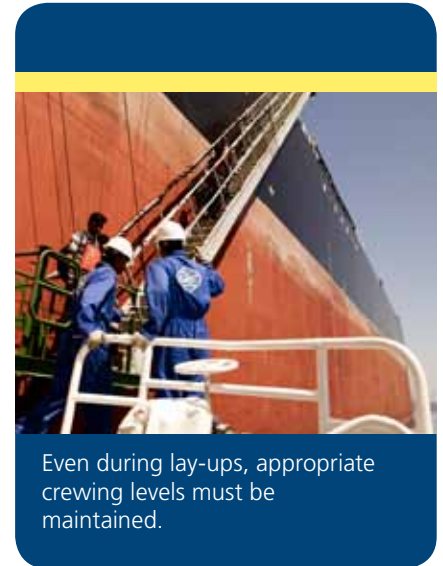
For all lay-ups – hot, warm, cold or long-term – an inspection regime must be established onboard. Most lay-up locations require the maintenance of a skeleton crew either onboard or at a shore-based location close to the vessel.

The Lay-up team's main objective is to conduct regular inspections of the vessel's spaces, machinery and equipment through designed maintenance procedures recognised by makers of the equipment, and to ensure that the standard of preservation is maintained.

Inspection regimes must be fully documented in advance of lay-up and may include daily, weekly, monthly and annual activities. Full procedures and necessary records must be maintained. Inspection routines should be specific to the vessel type and the machinery onboard, and is drawn up after consultation with the owners.

GLUS conducts the following checks as a minimum:

- Regular checks of operation of emergency equipment apparatus, fire, leakage, and security systems and alarms (see Safety and Security)
- Visual checks on 'controlled' space sealing arrangements being fed the dehumidified air supply. This will include regular measurement checks on relative humidity levels within these 'controlled' spaces
- Visual checks on protective coatings which have been applied to all external machinery and equipment. It may be necessary to increase the protective coatings depending upon the fabric condition at the time of lay-up
- Periodic visual examination of all opened machinery and equipment within dehumidified spaces.
- Visual checks on all 'filled' systems for leaks, such as hydraulics, fuel, lubrication oil, air conditioning and water. This includes oil sump levels where it has been necessary to maintain oil levels.
- Visual and measurement checks of battery systems.
- Live test of emergency fire pump and system - a prerequisite in most lay-up locations.
- Measurement checks of electrical circuit insulation continuity.
- Visual regular checks on all occupied storage tank levels.
- Periodic underwater survey by qualified diving contractor.
- Measurement checks on hull potential (cathodic protection system)
- Frequent checks on communication systems. This will necessitate keeping a power supply to the equipment, probably via the vessels emergency batteries or a portable emergency power supply.



## GAC Marine Logistics

GAC Marine Logistics (GML) is a specialised logistics service which covers the entire supply chain management of ship spares and marine parts. It aims to provide ship owners, ship management companies, ship builders and manufacturers with an integrated and seamless end-to-end solution which is time and cost efficient – even during times of ship lay-ups, emergency or crisis.

The GML service operates in conjunction with GLUS by offering logistics services which cover demobilization of equipment from vessels entering lay up periods. Whether that involves local storage, re export, transfer to other vessels in the fleet or local delivery, GML provides the logistics solutions as an integral part of GAC's innovative service to the shipping industry.

### How you benefit

- Highly specialised door-to-deck delivery service for ship spares and marine parts, ensuring cost and time efficiency
- Worldwide coverage
- Special focus on landed items otherwise known as reverse logistics
- 24/7 operation
- Full control of physical operation and communication throughout supply chain
- Single point of contact
- Competitive rates by leveraging global buying power
- Purpose designed web tracking system

GAC Marine Logistics offers time-definite, door-to-deck delivery of ship spares worldwide



## GAC Ship Agency

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Through its global ships agency network, GAC has identified a range of locations around the world suitable for laying up ships. Thanks to decades of extended relations, GAC's local offices maintain excellent rapport with port authorities to ensure that your vessels, superintendents, officers and crew get the best possible support at all times for your cleared in, laid-up and/or cleared out ships. Years of experience at most locations means clients can benefit directly from GAC's considerable tacit knowledge and buying power.

GAC's Hub in Dubai acts as the main focal point for Ship Lay-Ups, providing you with a single convenient point of contact for quotations and invoices, and enabling you to deal with best-in-class agents, logistics providers, technical managers, dehumidification manufacturers and other specialists for specific detailed matters. That centralised coordination means that the GAC team dealing with your laid-up vessels is always synchronised and well placed to provide you with the best possible advice.

For lay-ups, GAC's specialist have created a comprehensive list of information required from each client, enabling GAC to identify the specific needs and best solutions for every individual vessel to be laid-up.

## Re-Commissioning and Start-Up

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When a vessel is re-commissioned, any outstanding surveys must be performed together with a full check of the entire machinery installation. Depending on the duration of the lay-up, a trial that may be performed after consultation with the respective Classification society. A reactivation or complete audit of the vessel's Safety Management System must also be performed, depending on how long the vessel has been inactive.

**Disclaimer:**

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