

PART B

CHAPTER 11

CONSTRUCTION AND MAINTENANCE OF SHIPS

11.1 Construction Standards

11.1.1 There are no regulatory requirements for ships to be classed with a Classification Society. However, for ships falling within the scope of certain international conventions (eg. SOLAS, Load Line, MARPOL) and for fishing vessels greater than 24 metres in length there is a requirement for approved standards of construction and maintenance relating to hull, machinery, electrical installations and control installations. The approved standards are listed in MSN 1672, as amended, and further guidance is provided in MGN 322(M+F). The standards quoted are the rules of the Class Societies which are UK Recognised Organisations under Regulation (EC) No 391/2009 and Directive 2009/15/EC.

11.1.2 These standards apply to vessels which fall within the scope of the relevant convention. For example, a vessel falling within the scope of the Load Line convention (but not SOLAS or MARPOL) would need to comply with Class Society rules regarding construction and maintenance related to the conditions of assignment only as this is the scope of Load Line.

11.1.3 The requirements for non-convention vessels depend on the vessel type, age, operational area etc. In all cases, if the vessel is built and maintained in accordance with appropriate Class Society rules, the certifying authority will accept this as being of an adequate standard. The following UK regulations also require a vessel to be constructed and maintained to the approved standards in MSN 1672:

- The Merchant Shipping (Passenger Ship Construction: Ships of Classes III to VI(A)) Regulations 1998, as amended;
- The Merchant Shipping (Passenger Ships on Domestic Voyages) Regulations 2000, as amended;
- The Fishing Vessels (EC Directive on Harmonised Safety Regime) Regulations 1999, as amended.

11.1.4 The policy on survey of unclassified vessels is contained in MGN 322(M+F). The standards adopted where surveys are undertaken by MCA will be those of Lloyds Register appropriate to the type, size and operation of the vessel.

11.1.5 *Acceptance of alternative standards*

11.1.5.1 Where recognised standards are in place for a specific type, size, age and operation of vessel these must be used as the required standard. If the recognised

standards are thought to be not appropriate for a particular vessel, including where a vessel embodies features of a novel kind, advice should be sought from Vessel Policy Branch as to alternative standards that may be accepted.

11.1.5.2 The construction standards of SEAFISH are acceptable for the following vessel types:

- Fishing vessels of up to 24 metres in length;
- Passenger ships complying with the Safety Code for Passenger Ships Operating Solely in UK Categorised Waters (MSN 1823) of under 24 metres in length, with a single passenger accommodation deck and carrying not more than 70 passengers
- Passenger ships complying with the Small Seagoing Passenger Ships Code (MGN 535) with a single passenger accommodation deck and carrying not more than 60 passengers.

11.1.6 Class notations

11.1.6.1 Surveyors should make note of any class notation applied to a vessel and understand the requirements and limitations of such notations. There is a myriad of notations involved and these vary from Class Society to Class Society. If any doubts arise the surveyor should ascertain from the Class Society what the notations mean. The standard required shall be agreed before MCA commence survey of the vessel and before any certificate is issued. Where a vessel is to be built to a standard less than full Class requirements agreement should be sought from Survey Operations Branch.

11.1.7 Novel craft

11.1.7.1 Interpretation of Class rules is more difficult in the case of novel craft eg. DUKWs. For passenger ships the relevant Instructions to Surveyors require submission of plans to Vessel Policy Branch. In the case of non-passenger ships advice from Vessel Policy Branch should be sought if in any doubt as to how to interpret the rules.

11.1.8 Hull thickness

11.1.8.1 Unless justified by the use of special materials with supporting information to the satisfaction of Vessel Policy Branch, hull thickness of less than 3 mm will not be accepted.

11.1.9 New builds and flag-ins

11.1.9.1 Refer to MGN 322 on Ship Survey Standards.

11.2 Maintenance

11.2.1 Where there are no specific standards for maintenance mentioned in UK legislation, reference should be made to the relevant Class Rules. If the vessel is not classed then MCA will adopt the standards of Lloyds Register appropriate to the type, size and operation of the vessel.

11.2.2 Thickness Measurement – Unclassed Vessels

11.2.2.1 Where thickness measurement is required, the following measures should be taken:

- a. Where non-destructive testing is being engaged, the measurements must be obtained by skilled and experienced operators of the apparatus. It is recommended that, where possible, a class approved service supplier is used;
- b. The calibration of any measuring equipment must be checked prior to the measurements being taken. It should be verified as to whether the equipment is of a type that can measure through coating films, or whether any coatings will need to be removed;
- c. An MCA or Classification Society^{1,2} surveyor should be present whilst the measurements are taken. It is recommended that prior to the commencement of testing it is agreed with the thickness measurement technician and the owner the positions to be measured - Annexes 1 and 2 provide minimum requirements on the areas to be considered for measurement³. Where it is not practicable for a surveyor to be in attendance, agreement must be sought between the surveyor, the owner and the thickness measurement technician as to the positions to be tested, noting that the use of a simple grid pattern across the hull is not acceptable;
- d. A signed copy of the results should be obtained from the thickness measurement technician and placed on the ship's file for record purposes, together with the surveyor's report on any action which may have been taken as a result of the readings.

¹ A Classification Society surveyor must be an exclusive surveyor of one of the six UK recognised organisations: American Bureau of Shipping, Bureau Veritas, Class NK, DNV GL, Lloyds Register, Registro Italiano Navale.

² For Small Commercial Vessels under survey by one of the MCA Certifying Authorities, the Certifying Authority surveyor or a Classification Society surveyor should be present.

³ Annex 1 is based on Lloyd's Register Rules and Regulations for Special Service Craft (LR SSC Rules) and should be used for ships which come under the scope of those Rules and in addition for passenger ships operating solely in categorised waters.

Annex 2 is based on the International Association of Classification Societies (IACS) Unified Requirement Z7 and should be used for all ships to which Annex 1 is not applicable, including fishing vessels.

11.2.2.2 In preparation for thickness measurements, all spaces are to be sufficiently cleaned to allow for a proper assessment of the structure, including removal from surfaces of all loose accumulated corrosion scale. Spaces are to be sufficiently clean and free from water, scale, dirt, oil residues etc. to reveal corrosion, deformation, fractures, damages, or other structural deterioration. However, those areas of structure whose renewal has already been decided by the owner need only be cleaned and de-scaled to the extent necessary to determine the limits of the areas to be renewed.

11.2.2.3 Adequate access and lighting arrangements must be provided to allow the surveyor and thickness measurement technician to be able to safely reach and examine all parts of the structure under examination. In assessing an area prior to thickness measurement, the surveyor must be able to safely get within arms length of the structure.

11.2.2.4 Owners/managers should be made aware in advance of surveys that may require thickness measurement and the level of cooperation that is required between owner, surveyor, yard and thickness measurement technician. Where measurements have been taken without consultation with the surveyor, it is at the surveyor's discretion as to whether the measurements can be accepted; in such cases sample measurements may be required for verification, or a complete re-measurement.

11.2.2.5 Where a thickness gauge is available to the surveyor, sample readings may be taken to verify the measurements recorded by the thickness measurement technician. In such cases, the gauge must be calibrated and measurements should only be taken by a surveyor that is familiar with the use of the equipment.

11.2.2.6 Areas that may warrant particular attention ("suspect areas" in Annexes 1 and 2) during thickness measurement include, but are not limited to:

- a. Wind and water strakes;
- b. Areas subjected to the effects of cavitation;
- c. Plating surrounding overboard discharges (see 11.2.6.3);
- d. Plating below bilge suctions (note that the bell mouth may need to be partially or fully removed to allow inspection/measurement);
- e. Areas where pitting has been identified during visual inspection (see 11.2.4);
- f. Salt water tanks (where the coating is found to be other than in a good⁴ condition);
- g. Fish room bilge wells;
- h. Pipework susceptible to deterioration, e.g. engine room pipes, soil pipes (see 11.2.6.5);
- i. Air receivers;

⁴ "Good" condition means with only minor spot rusting affecting not more than 20 per cent of areas under consideration

- j. Collision bulkhead (where any coating is found to be other than in a good⁴ condition) (see 11.2.6.2);
- k. Plating in way of sounding pipes;
- l. Plating in areas where oil/water sludge is accumulated (where the coating is found to be other than in a good⁴ condition);
- m. Plating below machinery and sanitary areas.

11.2.2.7 Guidance on acceptable diminution limits are provided at 11.2.3 below. Detailed guidance can be obtained from the rules of one of the UK Classification Societies.

11.2.2.8 Where areas of concern are identified, the surveyor should request for further measurements to be taken as necessary to identify the extent of diminution.

11.2.3 Corrosion

11.2.3.1 For guidance, if a vessel was built to one of the UK authorised Class Society Rules the following rule of thumb may be useful for corrosion limits.

		Within L/2 midships		Elsewhere	
		Length >100m	Length <100m	Length >100m	Length <100m
Plating:	Bottom	10%	15%	20%	30%
	Topsides	10%	15%	25%	30%
Stiffeners	Bottom	10%	20%	20%	30%
	Topsides	15%	20%	25%	30%

NB: For tankers and bulk carriers of 15 years of age or more, the maximum permitted reductions are determined for the Enhanced Survey Programme (IMO Resolution A.744(18), as amended,) for minimum longitudinal strength requirements (e.g. 10% on midship section modulus - MSC 108(73) recommends compliance with IACS Unified Requirements S7 and S11).

11.2.3.2 Local plating strength for steel may be assessed according to the following formula:

$$t = 0.004 \times s \times \sqrt{h} + c$$

t = minimum plate thickness (mm)

s = stiffener spacing (mm)

h = pressure head (m) (taken to 1 metre above deck)

c = corrosion allowance (e.g. for coated steel allow min. 2 mm when period between surveys is > 4 years)

The formula is based on a maximum yield stress in steel of 235 N/mm².

Formula applicable to plating subject to hydrostatic pressures only i.e. not high speed craft.

11.2.4 Local Pitting

11.2.4.1 If in isolated areas and provided the depth does not exceed 50% plate thickness the pit may be repaired by welding, subject to the use of approved procedures, qualified welders and approved materials. (e.g. approved by a Class Society surveyor, or suitable material specialist). In general, plate areas in the hull of below 3 mm in thickness should be renewed. Renewed plates should be of sufficient size to reduce problems of excessive stress being locked in due to shrinkage on cooling. Where the extent of pitting is considered excessive in area (e.g. more than 10% of area of plate) or due to the depth, the risk of heat distortion or cracking will increase and the defective plate should be cropped out and renewed. Such repairs may require non-destructive testing on completion by a qualified person to the surveyor's satisfaction.

11.2.5 Doubling Plates

11.2.5.1 **Doubling plates** may be acceptable but normally only as a temporary repair in certain circumstances. For example, to increase the strength of plating and stiffeners but not on bottom plating (excluding temporary repairs) and only if there is sufficient material in the parent plate to effect a good weld. Special attention is needed to welding details and only surveyors with the required competence should survey such repairs.

11.2.6 Flooding

11.2.6.1 Casualty investigations by the Marine Accident Investigation Branch have reported a significant number of vessels, particularly fishing vessels, which have been flooded and foundered due to lack of maintenance. Many of these casualties could have been avoided if the vessels had been properly maintained and all the safety features were in proper working order. Because of this MCA wishes to draw surveyors' special attention to specific areas:

11.2.6.2 **Watertight bulkheads:** - (e.g. engine room boundaries, forepeak etc). Check bulkheads for corrosion, unapproved openings and pipe penetrations, which could lead to progressive flooding (e.g. a bilge line from one compartment to another without non-return or shut off valves). Investigate below floor plates and around bilge wells. If practical carry out hose testing (e.g. from forward and aft of engine room bulkheads).

11.2.6.3 **Ship side valves:** - Ship side valves and their attachments are important and are provided primarily as a means of maintaining the watertight integrity of the hull should a leak or other internal failure in pipework occur. Therefore attachments to the hull (stub pipe) should be hammer tested and the nuts/studs should be

renewed if corroded. Valves should be constructed of approved corrosion resistant material and be maintained in good working order. Every 4 or 5 years (depending on survey cycle), valves should be stripped down for proper examination. Valve closing devices must be in accessible positions and where valves are located below engine floor plate level, extended spindles (or equivalent remote closing) should be provided. Pressure testing can be useful to prove sealing arrangements.

11.2.6.4 Bilge alarms: - Many vessels would have had a better chance of survival, had leaks been detected early enough to locate the source. Early detection can be assisted by bilge alarms, and in many unmanned machinery spaces they are mandatory and if not they should be strongly recommended (e.g. mandatory in load line and fishing vessel regulations). They should be tested and where applicable owners should be encouraged to fit fail-safe systems or secondary independent alarms.

11.2.6.5 Pipework: -

11.2.6.5.1 Many flooding incidents have been attributed to failures of internal pipework, especially within engine rooms. This is often due to poor maintenance and because arrangements can be difficult to survey in entirety. Pipework is not always universally accessible and the surveyor should use sampling techniques and record what has and has not been seen so as to give a satisfactory level of confidence that the overall system remains in satisfactory condition. In cases where most important areas of pipework are judged inaccessible, then it is up to the owner to demonstrate to the attending surveyor that said pipework remains satisfactory. At all times, the owner retains the prime responsibility for the condition of the vessel and for presenting satisfactory evidence to the surveyor.

11.2.6.5.2 In recent years the major Class Societies have approved NDT/inspection companies specifically for work onboard ships, including small vessels. Owners may be encouraged to provide an inspection report from one of these companies who have the required competence to conduct this work. Alternatively, owners may adopt a replacement schedule over a 4 or 5 year period. Where there is no evidence of satisfactory condition, surveyors should require at least sample sections to be surveyed.

11.2.6.5.3 A combination of the following techniques may be useful to surveyors:

- Check accessible sections by hammering or ultrasonic measurement;
- Remove sections in inaccessible areas or pressure test in situ, if this is practical;
- Remove representative samples (e.g. bends in areas of high flow rate, areas where the pipe section narrows and flow increases, areas which act

as a sump where an oxygen, salt and other deposit mixture can accelerate corrosion).

11.2.7 Bow doors

11.2.7.1 Areas of overlap in responsibilities can lead to problems being not adequately addressed by either Class Society or MCA. Special attention should be given to bow door arrangements on ferries as outlined below:

11.2.7.1.1 **PC renewal:-** Bow door hinges and closing arrangements should be thoroughly examined at PC renewal and where appropriate crack detection procedures put in place for the closing arrangements (hinge brackets, cleats etc). Although surveys of these items are authorised to the Class Society, MCA should have oversight to check they are examined during PC renewal.

11.2.7.1.2 **Ships in service:-** Owners must inform Class and MCA should any issues arise relating to the bow door arrangement.

- If a casualty is reported or the failure of a major component, MCA should arrange for an immediate inspection to determine the cause and that appropriate corrective measures have been taken, regardless of whether MAIB or others are investigating.
- Defects should be examined by the Class Society and MCA before the vessel continues operation.
- Have the causes for the defect been identified and rectified? Has the company recorded the non-compliance and carried out a full investigation and rectification in accordance with section 10.2 of the ISM Code?
- Is there a previous history of defects in the area concerned? Are there any anomalies, such as parts requiring replacement at more regular intervals than manufacturer's recommendations? (ISM Code reporting system should be used). Surveyors should ask for a log of all bow door defects (e.g. replacement of parts, cracks, electrical or hydraulic problems etc) to be recorded together, so that they may be easily identified if there are particular anomalies and surveyors can review these at routine surveys or inspections. Regular problems can give an overview and an indication of an underlying cause which has not previously been identified.
- If the cause has not yet been established the ship should not be permitted to continue in service unless all appropriate precautions

and safe guards have been taken and an appropriate condition of class imposed. The burden of proof that the vessel is safe rests with the owner.

- Have owners consulted all the appropriate experts? (Designers, manufacturers, consultants, Class Society etc). (There could be an unacceptable risk in allowing the ship to continue in operation if the cause has not been established.)

Where the cause has not yet been confirmed, consideration should be given to the following:

- Can temporary repairs be effected immediately, together with close monitoring (every operation) to determine if there is any recurrence?
- Have appropriate weather restrictions been applied?
- Can the defect area be continually monitored at sea (at the bow door or by CCTV), by dedicated watch?
- Can appropriate permanent repairs be effected within a short timescale (say within a few days or a week). Do permanent repairs include suitable approved modification taking account of the cause, rather than simple replacement?
- Temporary and permanent repairs/modifications to be approved by Class Society and MCA and suitable tests to be conducted to surveyor's satisfaction.

Because of the particularly sensitive nature of defects on bow doors, any conditions of class imposed relating to them should be referred to Survey Operations Branch, with an explanation of the actions taken.

If in doubt, lead surveyors / CSMs may wish to check for conditions of class using either Class Society databases or Equasis which should contain this information.

11.3 Planned Maintenance & Condition Monitoring **Systems – Machinery Surveys**

11.3.1 Background

11.3.1.1 Class Societies are moving away from the philosophy of dismantling machinery for survey. Increasingly, chief engineer's maintenance and / or condition monitoring records are accepted in lieu of strip-down for survey. For

survey purposes these machinery maintenance and condition monitoring records are scrutinised by the class surveyor on a regular basis. These ‘confirmatory’ surveys are conducted at intervals commensurate with prevailing circumstances and consist of an examination of the proffered machinery maintenance and condition monitoring records. At **their** discretion, the surveyor may request a test run of any item of machinery offered for survey in this way or even insist on strip-down if considered necessary. In order to avoid the imposition of machinery strip-down for statutory surveys the MCA will accept records of maintenance and condition monitoring for this purpose. It is expected that the MCA confirmatory surveys will coincide with those of the incumbent class society.

11.3.2 Application

11.3.2.1 The foregoing applies to all UK ships which undergo MCA surveys, including passenger ships.

11.3.3 Standards

11.3.3.1 Each of the Class Societies recognised by the MCA have different requirements and specifications for both the approval of these planned maintenance/ condition monitoring systems and the machinery running parameters the chief engineers are required to record. In order to guarantee the consistency of machinery surveys conducted by them on MCA’s behalf, each societies approvals procedures and machinery parameter records requirements should generally meet the base-line MCA requirements set out in Annex 3.

11.4 Electrical Installations

11.4.1 Electrical installations must comply with the approved standards as detailed in MSN 1672. Sections 11.1 and 11.2 of this chapter apply as for hull and machinery.

For survey of fishing vessels, reference should also be made to MSIS 27 Chapter 6 (Electrical Equipment and Installations).

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Annex 1 - Minimum Requirements for Thickness Measurements at Renewal Survey⁵ for Unclassed Vessels within the scope of the LR SSC Rules³

1st Renewal Survey Age ≤ 5	2nd Renewal Survey 5 < Age ≤ 10	3rd Renewal Survey 10 < Age ≤ 15	4th+ Renewal Survey Age > 15
1) Suspect areas throughout the vessel, as required by the surveyor.	1) Suspect areas throughout the vessel, as required by the surveyor.	1) Suspect areas throughout the vessel, as required by the surveyor.	1) Suspect areas throughout the vessel, as required by the surveyor and to include as applicable:
		2) Any exposed plating throughout the main deck.	a) Areas where any coatings are found to be other than in a good ⁴ condition.
		3) Shell plating in way of wind- and water strakes throughout the length of the vessel.	b) Shell and tank top plating immediately adjacent to tank top margins.
			c) Bottom shell in way of any cement, asphalt or other composition.
			d) Shell plating below portlights and windows.
			e) Tank top plating below ceiling or cabin soles.
			f) Deck plating and side shell plating in way of galleys, washrooms and refrigerated store spaces.
			g) Structure in way of integral sanitary tanks.
			2) All main deck plating outside deckhouses or superstructures and including plating in way of wood deck planking or sheathing.
			3) Shell plating in way of, and below, the waterline throughout the length of the craft.
			4) Two transverse sections of deck and shell plating within 0.5L amidships

⁵ Or as deemed necessary by the surveyor. For passenger ships, this should be taken as every five-year period, or as deemed necessary by the surveyor

Annex 2 – Minimum Requirements for Thickness Measurements at Renewal Survey⁶ for Unclassed Vessels not under the scope of the LR SSC Rules³

1st Renewal Survey Age ≤ 5	2nd Renewal Survey 5 < Age ≤ 10	3rd Renewal Survey 10 < Age ≤ 15	4th+ Renewal Survey Age > 15
1) Suspect areas throughout the vessel, as required by the surveyor.	1) Suspect areas throughout the vessel, as required by the surveyor.	1) Suspect areas throughout the vessel, as required by the surveyor.	1) Suspect areas throughout the vessel, as required by the surveyor
	2) One transverse section of deck plating in way of a cargo space within the amidships 0.5L	2) Two transverse sections within the amidships 0.5L in way of two different cargo spaces	2) A minimum of three transverse sections in way of cargo spaces within the amidships 0.5L
		3) All cargo hold hatch covers and coamings (plating and stiffeners)	3) All cargo hold hatch covers and coamings (plating and stiffeners)
		4) Internals in forepeak and afterpeak tanks	4) Internals in forepeak and afterpeak tanks
			5) All exposed main deck plating full length
			6) Representative exposed superstructure deck plating (poop, bridge, and forecastle deck)
			7) Lowest strake and strakes in way of 'tween decks of all transverse bulkheads in cargo spaces together with internals in way
			8) All wind- and water strakes, port and starboard, full length
			9) All keel plates full length. Also, additional bottom plates in way of cofferdams, machinery space, and aft end of tanks.
			10) Plating of seachests. Shell plating in way of overboard discharges as considered

⁶ Or as deemed necessary by the surveyor. For fishing vessels, this should be taken as every four-year period (i.e. in conjunction with International Fishing Vessel Certificate renewal survey – see **MGN 439**), or as deemed necessary by the surveyor. For passenger ships, this should be taken as every five-year period, or as deemed necessary by the surveyor

			necessary by the attending surveyor
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Note: For ships less than 100 metres in length, the number of transverse sections required at 3rd Renewal Survey may be reduced to one, and the number of transverse sections required at subsequent Renewal Surveys may be reduced to two.

Annex 3 - APPROVAL OF A PLANNED MAINTENANCE OR CONDITION MONITORING SYSTEM

Planned Maintenance (PM) systems must meet the following minimum requirements: -

- a) A numbered index of all items to be included in the system. This index is to consist of items included on the Continuous Survey of Machinery cycle (CSM) and which appear on the master list (howsoever named).
- b) The system is to be fully documented with control and reporting procedures including means of dealing with unscheduled repairs and damage.
- c) The system must clearly indicate which items are to be dealt with by PM, CM, both or neither, ie. some items (such as air reservoirs) must be surveyed by a society surveyor only
- d) The system must clearly indicate the maintenance interval as based on either running hours or calendar months.
- e) Existing ships with inherent faults must not be entered into the system
- f) Novel designs are not to be included in the system

The following must be specified for PM systems:-

- Maintenance intervals
- Maintenance window
- Maintenance instructions
- Reference documentation
- History
- Measurement records
- Test records
- Spare gear used, remaining on board and on order
- Definition of responsibilities
- Work tracing procedure
- Documentation in English language

System monitoring:-

- The system must be subject to annual audit by the society.
- The MCA reserve the right to supervise the audit
- The chief engineer authorisation to satisfy the societies rules and to meet the following minimal requirements:-
 - Adequate sea service in a senior rank (e.g. as chief/2nd engineer)
 - Relevant national certification
 - Relevant endorsements

Exclusions:-

The following items are to be surveyed/ assessed by Flag/ Class Society only:-

- Main and auxiliary steam boilers
- Main propulsion turbines
- Main engine crankshafts & bearings in single engine installations
- Pressure relief and safety devices
- Pressure vessels
- Steering gears and pumps
- Tailshaft
- Sterntube bearing
- Quick closing valves
- Remote stops
- Fire detection/alarm system
- Fixed fire extinguishing systems
- First start arrangement
- Inert gas systems

The following must be specified for Condition Monitoring (CM) systems:-

- Monitoring staff training requirements
- Monitoring intervals
- Monitoring window
- Monitoring Instructions
- Reference documentation
- Equipment with a reliable service history only to be included (no novel designs)

Records to include:-

- Performance results
- Trend analysis

The following additional records must be maintained (where applicable)

Steam turbines (main & auxiliary):-

- Rotor axial displacement
- Bearing wear-down measurements
- Power output
- Pressures (steam, lube oil, etc)
- Temperatures
- Steam flow velocity
- Steam flow volume
- Vibration measurements
- Lube oil analysis on specified basis
- Visual examination and on-line test (where practicable) by Class surveyor

Diesel engines (main & auxiliary):-

- Bearing wear down readings/crankshaft deflections
- Power output
- Individual cylinder power balance (where possible)
- Pressures (cooling water, lube oil etc)
- Temperatures
- Vibration analysis
- Lube oil analysis on specified basis
- Visual examination and on-line test (where practicable) by Class surveyor

Pumps:-

- Amperage
- Discharge pressure
- Suction vacuum
- Pumping rate (where possible)
- Vibration analysis
- Visual examination and on-line test (where practicable) by Class surveyor

Other auxiliary machinery i.e. air compressors:-

- Running parameters as appropriate (motor amperage, cooling water temperature etc)
- Vibration analysis

Tailshafts & sterntubes, where applicable:-

Tail shafts and sterntube bearings must be equipped as follows:-

- At least two temperature sensors are to be installed in the aft stern tube bearing in direct contact with the bearing metal or in the oil near the area where the maximum heat can be expected. Alternatively one sensor may be fitted where it may be easily replaced at sea and a spare is carried on board.
- High stern tube bearing temperature alarm
- Lube oil header tank low level alarm
- Arrangement of checking the stern tube bearing wear-down at sea
- Stern tube inner oil seals to be replaceable with the shaft in situ

Records to include:-

- Regular check of lube oil condition by ships staff
- Regular laboratory analysis of lube oil to include:-
 - Water content
 - Chloride content (when applicable)
 - Presence of bearing material
 - Statement of fitness of oil for next running period
 - The sample to be taken under running conditions, at service temperature, from the same clearly identified sampling point and be representative of the system oil charge

To be verified at survey;-

The annual verification survey must include at least the following:-

- Verification of alarm set points
- Alarm system function test
- Verification of remote temperature readings
- Lube oil consumption
- General sighting of sealing arrangement
- Check of records including wear down readings
- Check of lube oil analysis records