
No. 74 A GUIDE TO MANAGING MAINTENANCE IN ACCORDANCE WITH THE REQUIREMENTS OF THE ISM CODE

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INTRODUCTION

The ISM Code makes it clear that the ship operator (the “Company”) is responsible for ensuring the safe and pollution-free operation of the ship. In particular, the Company is required to ensure that the ship’s hull, machinery and equipment are maintained and operated in accordance with the applicable rules and regulations and any additional requirements that may be established by the Company.

This will be achieved only if the Company’s senior management is committed to applying the necessary resources, including appropriately qualified and competent crews.

A well designed and effectively implemented maintenance management system not only helps the Company to meet the safety and pollution-prevention objectives established by the ISM Code, but is also a sensible investment in the protection of a very valuable asset.

The management of shipboard maintenance is often regarded as an entirely technical matter, somehow unrelated to safety and pollution prevention, and the exclusive responsibility of the technical staff. As a result, shipboard maintenance is the least-developed and weakest element in many management systems. This increases the risks to personnel, property and the environment, and can result in substantial costs arising from repairs and operational delays. It not only threatens ISM certification, but also increases the risk of port state control detentions. (Of all the port state control detentions attributed to failures in shipboard safety management systems, more have referred to maintenance than to any other clause of the ISM Code.)

The purpose of this document is to assist ship operators in meeting the requirements of the ISM Code with respect to shipboard maintenance and to provide guidance on the development and improvement of maintenance management systems by establishing the principles on which they should be based, and by identifying their fundamental elements.

Although it provides useful guidance on what external auditors will be looking for, companies should avoid the temptation to create systems with the sole aim of keeping the auditor happy. The objective must be to ensure the safe and reliable operation of the ship and its equipment, and compliance with all the applicable regulations. How this is achieved will depend on the size and complexity of the company and the types of ships that it operates. The system may be entirely electronic, entirely paper-based, or a combination of the two, and the level of shore-based supervision will vary from one organization to another. All that matters is that the system works, and that it works in a way that best suits the company. If it does, it can pose no threat to the company’s ISM certification.

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1. WHAT THE CODE SAYS ABOUT MAINTENANCE

Paragraph 10.1 of the ISM Code states, *“The Company should establish procedures to ensure that the ship is maintained in conformity with the provisions of the relevant rules and regulations and with any additional requirements which may be established by the Company”*.

The procedures should be documented, and should ensure that applicable statutory, class, international (e.g. SOLAS, MARPOL) and port state requirements are met, and that compliance is maintained in the intervals between third-party surveys and audits.

The maintenance procedures should also include any additional requirements established by the Company. These may arise, for example, from an analysis of the maintenance histories of machinery and equipment, from the particular demands of a ship's operations, or from a manufacturer's recommendations.

It is important to remember that these requirements apply as much to the maintenance of the hull, the deck machinery and the life-saving and fire-fighting equipment as they do to engine room items.

Compliance with the requirements of the ISM Code with respect to the maintenance of the ship and its equipment involves more than meeting the specific requirements of clause 10.

Several other clauses also apply to this activity, as they do to all others. Examples are:

1.2 OBJECTIVES

What are the company's objectives with respect to safety and pollution prevention?
How successful are the maintenance procedures in contributing to the achievement of those objectives?

4 DESIGNATED PERSON(S)

How effective is the designated person in verifying an efficient flow of maintenance-related information between the office and the ships, and in securing adequate resources to support shipboard maintenance, (in particular, the prompt provision of spares and consumables)?

6 RESOURCES AND PERSONNEL

Is the company's management committed to the provision of adequate resources to enable prompt and satisfactory maintenance to be carried out? Have inspection and maintenance responsibilities been assigned to adequately qualified and trained members of staff?

9 REPORTS AND ANALYSIS OF NON-CONFORMITIES, ACCIDENTS AND HAZARDOUS OCCURRENCES

Are system non-conformities, accidents and hazardous occurrences being properly reported and investigated? Is appropriate corrective action being implemented? The Company should be concerned not only with responding to the immediate consequences of an accident or removing the hazard, but also with identifying the underlying causes of the incident and making the technical and management system changes that are necessary to prevent recurrence. Terms such as 'defect', 'non-conformity', 'incident' and 'hazardous occurrence' should be carefully defined to ensure that the appropriate type and grade of event will be reported.

11 DOCUMENTATION

Are the publication, amendment and distribution of maintenance procedures and other essential documents properly controlled?

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12 COMPANY VERIFICATION, REVIEW AND EVALUATION

Is appropriately analyzed and summarized vessel performance and maintenance information being included in the shipboard and company reviews of the effectiveness of the management system? Are these reviews beneficial in terms of generating improvements in the management of maintenance?

Compliance with relevant rules and regulations

Clause 1.2.3 states,

“The safety-management system should ensure:

- .1 compliance with mandatory rules and regulations; and*
- .2 that applicable codes, guidelines and standards recommended by the Organization, Administrations, classification societies and marine industry organizations are taken into account.”*

Procedures should be in place to control such documents. In other words, the appropriate rules, regulations, codes, guidelines and standards must be made available to those departments and people whose activities are governed by them. They should be of the appropriate edition or revision, and significant changes should be identified and distributed accordingly. The procedures should contain provision for ensuring that obsolete documents do not come into use inadvertently.

Reporting and investigation of technical deficiencies and non-conformities

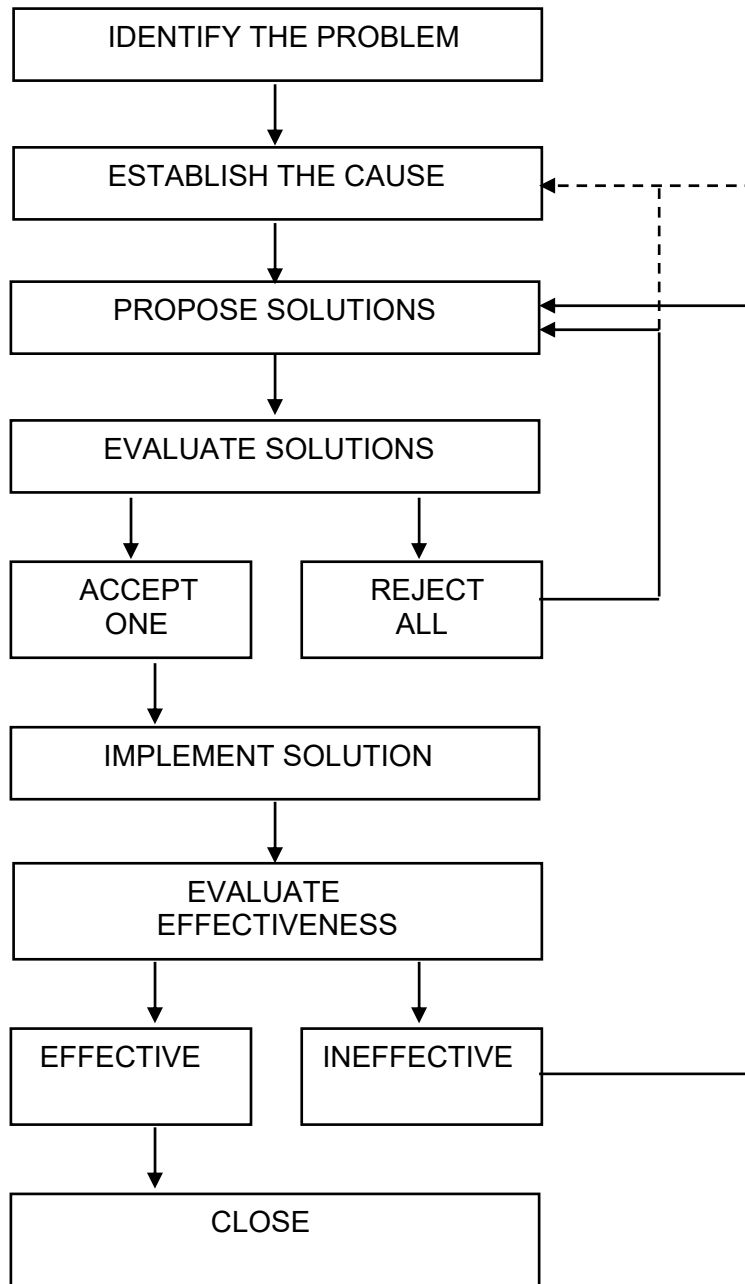
Clause 10.2 of the ISM Code states that the company should ensure that any non-conformity is reported, with its possible cause, if known, and that appropriate corrective action is taken.

(In this context, "non-conformity" should be taken to mean a technical deficiency which is a defect in, or failure in the operation of, a part of the ship's structure or its machinery, equipment or fittings. See also clause 9 of the ISM Code.)

Problems reported may be discovered during routine technical inspections or maintenance, following a breakdown or an accident, or at any other time.

The Company's responses should be aimed not only at the rectification of the immediate technical deficiency, but also at addressing the underlying maintenance management system failures (non-conformities) that led to the problem in the first place. ***Any lessons learned from the investigation of these failures should be examined for their applicability to other ships in the fleet, and the resulting trends and patterns should be used to identify opportunities for continual improvement.***

The fundamental elements of an effective defect- or non-conformity investigation process are shown in the following diagram. Note that it is not enough simply to take corrective action. The effectiveness of such action must be verified.

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(cont)**The Corrective Action Process**

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An effective maintenance management system will be the result of an assessment by the Company of the associated risks. In undertaking such an assessment, the Company should take into account the following:

- i) the maintenance recommendations and specifications of the equipment manufacturer;
- ii) the history of the equipment, including failures, defects and damage, and the corresponding remedial action;
- iii) the results of third-party inspections;
- iv) the age of the ship;
- v) identified critical equipment or systems;
- vi) the consequences of the failure of the equipment on the safe operation of the ship.

2. A SYSTEMATIC APPROACH TO MAINTENANCE

A systematic approach to maintenance will begin with the establishment of a comprehensive asset register or a database of machinery, equipment and fittings. It will be based on the risk assessment described above, and will include:

- i) the establishment of maintenance intervals;
- ii) the definition of the methods and frequency of inspection;
- iii) the specification of the type of inspection and measuring equipment to be used, and the accuracy required of it;
- iv) the establishment of appropriate acceptance criteria (pass/fail);
- v) the assignment of responsibility for inspection activities to appropriately qualified personnel;
- vi) the assignment of responsibility for maintenance activities to appropriately qualified personnel;
- vii) the clear definition of reporting requirements and mechanisms.

Maintenance intervals

Maintenance intervals should be established based on the following:

- i) manufacturers' recommendations and specifications;
- ii) condition monitoring techniques (i.e. lube oil analysis, vibration analysis), where used as part of an approved condition monitoring or condition based maintenance scheme.
- iii) practical experience in the operation and maintenance of the ship and its machinery, including historical trends in the results of routine inspections, and in the nature and rates of failures;
- iv) the use to which the equipment is put - continuous, intermittent, stand-by, or emergency;
- v) practical or operational restrictions, e.g. maintenance that can be performed only in dry-dock;
- vi) intervals specified as part of class, convention, administration and company requirements;
- vii) the need for regular testing of standby arrangements.

Inspections

Procedures for planned inspection routines should be written to include the following:

- i) acceptance criteria (e.g. pass/fail, tolerances);
- ii) the use of suitable measuring and testing equipment of the required accuracy;
- iii) the calibration of the measuring and testing equipment to the appropriate standards.

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The following are examples of the types of inspection and test that may be employed:

- i) visual
- ii) vibration
- iii) pressure
- iv) temperature
- v) electrical
- vi) load
- vii) water tightness

Inspection methods

Where appropriate, checklists should be developed to ensure that inspection, test, measurements and maintenance activities are performed in accordance with the procedures, and at the specified intervals. These checklists may be developed from manufacturers' recommendations or specifications.

Permit-to-work systems

Where appropriate, permit-to-work systems should be employed to ensure that inspections and maintenance activities are carried out safely. A well designed permit-to-work procedure will amount to a risk assessment, carried out before any hazardous activity is undertaken. As a result of the assessment, controls will be imposed to eliminate or reduce the risks involved. These may include, among other things, an assessment of the environment in which the work will take place and adjacent areas and compartments (especially for hot work), the isolation of electrical circuits or the draining of pipes and tanks, the provision of appropriate and well maintained tools and equipment, the assignment of qualified and experienced personnel, stand-by and emergency arrangements.

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3. WHAT RECORDS SHOULD BE KEPT (and what use can we make of them?)

Records kept to demonstrate compliance with the company's maintenance procedures, and their effectiveness, may be divided into two broad categories:

A. Externally-generated records

- Class records, reports and certificates
- Statutory records, reports and certificates
- Port State Control reports
- Reports of vetting organizations
- Condition monitoring reports, where applicable

B. Internally-generated records

- Records of routine shipboard inspections
- Records of maintenance work carried out
- Records of the testing of stand-by and other critical equipment
- Records of the testing of alarms and emergency shut-downs
- Condition monitoring reports, where applicable
- Superintendents' visit and inspection reports
- Internal and third party audit reports
- Reports of non-conformities, accidents and hazardous occurrences
- Records of the implementation and verification of corrective action
- Spare part requests, acknowledgements, delivery notes etc.

As well as providing evidence of compliance with procedures, the records generated by shipboard maintenance activities may also be seen as a database from which to extract valuable management information.

For example, the appropriate analysis of records of inspections, defects, non-conformities and corrective actions may yield information that could lead to changes in inspection and planned maintenance intervals, thereby reducing unnecessary work and the frequency of failures. The same analysis could permit the identification of trends or repetitive problems that require further investigation and longer-term solutions.

The proper filing and review of non-conformities, reports of accidents and hazardous occurrences, defect reports and spare-part requests permit the efficient control of follow-up and verification activities.

4. THE IDENTIFICATION AND TESTING OF 'CRITICAL' EQUIPMENT

Clause 10.3 of the ISM Code states, *"The Company should establish procedures in its SMS to identify equipment and technical systems the sudden operational failure of which may result in hazardous situations. The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems. These measures should include the regular testing of stand-by arrangements and equipment or technical systems that are not in continuous use"*.

The list of 'critical' equipment and systems will vary according to the type of ship and the operations in which it is engaged. When the equipment has been identified, appropriate tests and other procedures should be developed to ensure its reliability.

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On board any ship there may be equipment and systems the sudden operational failure of which may result in hazardous situations, and for which there may be no mandatory requirements. Measures aimed at promoting the reliability of such equipment or systems should be provided.

The testing and maintenance of stand-by and infrequently used equipment should be part of the company's maintenance plan. The following are examples of items to be subjected to inspection and test:

- i) alarms and emergency shutdowns,
- ii) fuel oil system integrity,
- iii) cargo system integrity,
- iv) emergency equipment (EPIRB, portable VHF, emergency steering gear, emergency generator, emergency fire pump, etc.),
- v) safety equipment (portable gas and CO2 detectors, etc.),
- vi) fire-fighting equipment and life-saving equipment,
- vii) generators and batteries,
- viii) (pre-arrival and pre-departure tests of) steering gear, main propulsion, telegraphs, etc.

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Checklist of Principal Maintenance System Management Controls

	Control	Yes	No
1	Do we receive prompt and reliable information about new and amended statutory, class, international and port state regulations, and about industry codes and guidelines?		
2	Do we have controls in place to ensure compliance with all applicable mandatory regulations, and to ensure that appropriate codes, guidelines and standards are taken into account?		
3	Have the responsibilities and authority of shipboard and office staff involved in inspection and maintenance activities been clearly defined?		
4	Have inspection and maintenance activities been assigned to adequately qualified, trained and experienced staff?		
5	Are controls in place to ensure that all applicable procedural and technical documents, of the appropriate editions, are available where they are needed?		
6	Have steps been taken to ensure that obsolete documents cannot be brought inadvertently into use?		
7	Do we have in place a system for the reporting and analysis of defects, accidents and hazardous occurrences?		
8	Have the types and seriousness of the defects and incidents to be reported been clearly defined?		
9	Do procedures exist for the implementation of corrective action and the verification of its effectiveness?		
10	Do the inspection and maintenance records enable us to monitor adequately the maintenance history of the ship, its machinery and its equipment?		
11	Have we established all appropriate inspection intervals?		
12	Have we defined inspection methods and the type and accuracy of the inspection and measuring equipment to be used?		
13	Have we established appropriate acceptance criteria?		
14	Have we established all appropriate maintenance intervals?		
15	Are sufficient inspection and maintenance records being kept to demonstrate compliance with company requirements and mandatory regulations?		
16	Have we identified all equipment and technical systems, including stand-by and infrequently used items, the sudden operational failure of which may result in hazardous situations?		
17	Are appropriate permit-to-work procedures in place to assess the risks involved in the inspection and maintenance activities, and to ensure that adequate controls are applied?		
18	Is appropriately analysed and summarized maintenance information being provided for inclusion in the masters' and the company's reviews of the effectiveness of the management system?		
19	Where condition monitoring and condition based maintenance are being used to influence maintenance, is the monitoring system effective and being operated appropriately?		

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