

MARINE SAFETY MANUAL

Chapter 25: MANNING REQUIREMENTS FOR AUTOMATED VESSELS

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CHAPTER 25: MANNING REQUIREMENTS FOR AUTOMATED VESSELS

A. Manning Requirements.

1. General.

Coast Guard acceptance of automated systems to replace specific personnel or to reduce overall crew requirements is predicated upon the capabilities of the system, its demonstrated and continuing reliability, and a planned maintenance program that ensures continued safe operation. The automated systems and arrangements must provide that under all sailing conditions, including maneuvering, a level of safety at least equal to that of the same vessel with a fully manned engine room. The Officer in Charge, Marine Inspection (OCMI) should review all manning proposals objectively. Reductions in manning scales shall only be granted when they do not detract from the safe navigation or operation of the vessel and are consistent with statutory or regulatory requirements. The following general features shall be addressed in reduced manning proposals:

a. Fire Equipment.

Installed fire protection equipment shall be adequate for the reduced complement to deal effectively with a fire emergency.

b. Station Bill.

The station bill shall provide for the effective use of personnel during emergency situations.

c. Lifesaving Equipment.

The design and installation of lifesaving equipment shall be adequate for effective operation by the complement.

d. Vital Systems.

Redundancy of vital systems or machinery shall be required (as in duplicate fuel pumps, secondary ship's service generator(s) with independent prime movers, etc.).

e. Operational Limit.

Scenarios of the vessel's contemplated operation (unlimited or limited service, possible support by shoreside personnel) shall be provided.

f. Accommodations.

Quarters shall be sufficient to accommodate the designated complement and any additional personnel needed during initial operation or during periods when additional manning is required, such as a result of an automation failure. These accommodations need not be in the form of additional staterooms, but their size and furnishings shall be adequate to meet the needs of the additional personnel.

Manning proposals for new construction or existing vessels that are altered to incorporate automated features should be requested from the owner/operator early in the work. Experience has shown an occasional lack of awareness or understanding of the legal requirements concerning the Coast Guard's assignment of manning scales. In some cases, delay in obtaining such information may result in completion of the vessel to designed standards that will not physically accommodate the required crew.

2. Deck Department.

Reductions in the deck department normally involve elimination of the ordinary seamen, resulting in a deck crew of 6 able seamen (ABs). In addition, requests are received to man vessel's with 4 ABs and 2 ordinary seamen. This manning will normally be considered only if the 2 ordinary seamen meet the criteria set forth in Navigation and Vessel Inspection Circular (NVIC) 3-83. The vessel's Certificate of Inspection (COI) will require 6 ABs, but will be endorsed to allow substitution of up to 2 specially trained ordinary seamen for 2 ABs. The decision to allow substitution of specially trained ordinary seaman for ABs rests with the OCMI. On vessels subject to STCW, members of the navigation watch must meet the qualification as "rating forming part of a navigational watch", and must hold the appropriate STCW certificate. The basic features permitting a lesser requirement for unlicensed deck personnel are as follows:

a. Messing.

Coffee service, drinking water, and sanitary facilities in the immediate bridge area are necessary for the functioning of the bridge watch without the relief service traditionally provided by an ordinary seaman.

b. Call System(s) From The Bridge.

These systems, running to each mate and AB's quarters, general spaces, such as the messroom and recreation areas, and line-handling stations, enable the summoning of crewmembers for the oncoming watch and in emergencies, and allow better coordination in the mooring/unmooring of the vessel.

c. Constant Tension (Self-Adjusting) Mooring Winches.

These devices enable the reduced deck force to moor/unmoor the vessel safely, without unreasonable physical effort.

d. Automated Hatch Cover Securing Equipment.

These devices enable the reduced deck force to open and secure the vessel's hatches without unreasonable physical effort (this is particularly important aboard dry bulk and container cargo vessels). [NOTE: These features are not all-inclusive. Consideration will be given to alternate proposals that accomplish the same goals more practically, when applied to a particular vessel.]

3. Engine Department.

Automation of the engine department is the most common method of reducing manning levels. A review of automated vessel experiences show varying degrees of reliability in engineering automation. Accordingly, manning reductions in the engine department shall be made only after a system has been operated for a sufficient period of time to demonstrate its reliability.

a. Reduction in Engine Room Manning Requests.

The Officer in Charge, Marine Inspection (OCMI) shall review and approve all requests for reductions in engine room manning. The examination shall include a detailed analysis of the following: (1) the capabilities of the automated system; (2) the combination of the personnel, equipment, and systems necessary to ensure the safety of the vessel, personnel and environment in all sailing conditions; (3) the ability of the crew to perform all evolutions including emergencies and during control or

monitoring system failure; (4) a planned maintenance program with regular testing and inspection procedures; and (5) the automated system's demonstrated reliability during its initial trial period and its continued reliability. Critical consideration shall be given to the degree of vital system automation, status of automation approval by the Marine Safety Center (MSC) and status of testing required by 46 CFR 61.40. 46 CFR 62.50 provides additional details on the specific equipment and operational requirements for minimally attended or periodically unattended machinery arrangements. The OCMI shall consider all relevant information in determining a reduction in crew size to ensure there is no adverse effect on safety. Any follow-up requests for alteration of the vessel's manning shall be documented and reviewed in a similar manner. Commandant (G-MOC) shall be provided a copy of the final approval letter whenever a manning reduction is permitted.

b. New Construction.

There are generally four stages in the approval process of new vessels with automated vital systems that may ultimately lead to a request for a reduction in crew size. This process occurs between the vessel owner and the cognizant OCMI.

(1) Conceptual Approval.

This is normally given in response to a request to evaluate a proposed ship and its crew size before construction and, in some instances, may be based on only the broadest description of the vessel and its intended operations. Conceptual approval is always based on the condition that the cognizant OCMI finds the vessel's proposed manning is sufficient for safe operation. The manning levels in the conceptual approval are the design goals for the owner, which are subject to change if the situation warrants. Also, the owner may want to design the automation so that the engine room is suitable for periodically unattended operation, even though no request for reduced manning is made during initial certification.

(2) Technical Review and System Testing.

In accordance with 46 CFR 61.40, design verification and periodic safety testing of automated vital systems verifies system design, construction and operation according to applicable Part 62 requirements. These include general and specific requirements for vessels described in 46 CFR 62.01-5(a) covering systems and equipment described or omitted in 62.01-5(b) and (c) respectively. There are additional requirements when automation is intended to replace watchstanders for minimally attended or periodically unattended machinery spaces (see 46 CFR 62.50-20 and 62.50-30, respectively). Design verification testing proves the fail-safe character of the vital systems automation design, and is the only effective method to verify functional independence of required systems that use advanced microprocessors. This testing must be performed according to an MSC approved design verification test procedure and witnessed by the cognizant OCMI before vessel certification, or immediately after installation of the automation, as applicable. The approved design verification test (DVT) procedure is the final product of the completed vital systems automation plan approval and satisfactory review of the failure mode and effects analysis (FMEA) required by 46 CFR 62.20-3(b). A staff engineer from MSC will, under normal circumstances, accompany the OCMI to witness the DVT. This critical testing

should never be started until plan review of the FMEA and DVT is complete. Periodic safety testing must also be completed to demonstrate required instrumentation and alarms and proper operation of the automation. This testing is done in accordance with the periodic safety test procedure that is reviewed by MSC and then forwarded with recommendations to the cognizant OCMI for approval. Again, this testing should not begin until vital systems automation plan review is complete.

(3) Initial Certification.

When a vessel is initially certificated, the manning level specified in the manning block on the certificate of inspection will generally be that of a fully manned engine room. This level is determined based upon the minimum personnel necessary to stand the engine room watch should complete automation failure occur. However, the vessel's master has the authority to decide if watches are necessary, the required complement of the watch, and how watches are actually stood. If for some reason the automation fails, the necessary watchstanders will be onboard and will be assigned a watch schedule in accordance with the requirements of 46 U.S.C. 8104. No reference to watches or periodic unattended engine room operation is to appear on the COI. However, the COI should indicate the MSC automation system approval letter by serial number and date. Owners should be encouraged to submit their proposed manning scales early in the construction process.

(4) Final Approval.

A vessel owner may ask the cognizant OCMI for a reduction in the minimum crew size before, at, or sometime after, initial certification. The request for reduction in crew size must precede the trial period discussed below and must be consistent with the technical approval of the vessel's automation features. In making a final approval determination the OCMI should: (1) ensure satisfactory completion of the trial period; (2) review the vessel's records; and (3) conduct an onboard observation trip to witness the system's reliability and the ability of the reduced crew to maintain and perform all evolutions safely.

(a) Trial Periods.

The trial period is a period of operating the plant at the desired watchstanding level (however, a complete engineering crew, as specified in the manning block on the vessel's COI, must be onboard). The trial period validates the proper design and installation of the automation intended to replace engine room personnel and allows the vessel personnel to correct minor system problems and fine tune the automated systems. The trial period also demonstrates the reliability of the automation hardware and software. The duration of trial periods for new construction when the vessel is first in a class of vessels is based on underway time and will be 3000 hours. Follow up vessels in the same class may have a reduced trial period depending upon the successful completion of the trial period by the first in class and other circumstances considered by the OCMI. On the other hand, evidence of repeated major problems and systems failures may be cause for the OCMI to lengthen trial periods and in some cases reevaluate previously accepted manning levels on vessels of the same class.

(b) Review of Vessel Records.

Whenever possible, the inspector should review the engineering logs, maintenance records and crew overtime logs prior to the observation trip. This will assist in developing a plan for conducting the inspection and to identify possible problem areas with the automation. The OCMI should prompt the vessel owner to submit these logs for review whenever they are not attached with the observation trip request. Identification of problems can be a formidable task. Many of the sophisticated computer logging systems prevalent today tend to log all events. For example, equipment secured by the ship's crew as a matter of routine generate alarms and logged events. It is difficult to differentiate such normal occurrences from evidence of significant automation problems (e.g., repeated problems that significantly degrade system reliability or automation system/equipment failures). Interviews with the engineering crew should help the inspector make these distinctions. It is also important to determine whether maintenance is preventive or in response to a casualty. Interviews will also assist here. The inspector shall document all significant automation problems, including excessive maintenance, in the inspection report.

(c) Observation Trip.

Onboard observation trips should be of sufficient length to adequately assess the reliability of the systems. A trip of one to seven days is recommended depending upon the complexity of the plant and the crew reduction requirements. If possible, the inspector assigned should be one who is familiar with the vessel. The vessel should be operated as it would with reduced manning and the inspector should witness the crew's ability to respond to emergencies and system failures. The crew's response should be demonstrated through their performance of a reasonable number of randomly selected tests taken from the vessel's approved periodic safety test procedure. Interviews with the vessels engineering officers and crew should be conducted to discuss plant operation, the frequency and character of

assistance-needed alarms, event logging methods, and maintenance policies. The inspector should submit a report that is sufficiently detailed to allow for an adequate review of all evolutions and/or problems witnessed, and should document all significant automation problems and any excessive maintenance needed. The OCMI may, after reviewing the results of the observation period, require an increase in engine room watch personnel until any problems are corrected, lengthen the trial period, or consider an increase in engine room watchstanders onboard other vessels of the same class previously approved for reduced manning levels.

(d) Issuance of COI.

Once the request for reduced manning is approved, the COI may be amended. The following entry in the "Conditions of Operation" section shall be made identifying the mode of operation for which the propulsion plant is approved:

"Approved for [**periodically unattended**] or [**minimally attended**] machinery space operation. This approval and the minimum manning level specified on this Certificate of Inspection are contingent upon the proper operation of the automated control/automated monitoring/automated machinery management system(s). Any major alteration or failure must be reported immediately to the nearest OCMI."

(e) Reflagged Vessels.

Reflags will be processed as new vessels, except allowance for a reduced trial period can be considered if prior records (in English or with certified English translation) can be provided showing a history of safe operation, and that no major system changes are contemplated during reflagging. In no case will an initial manning level less than that required by the former flag state be considered.

4. Periodic Inspections.

Marine inspection personnel shall ascertain the performance of installed systems of those vessels that have reduced manning levels during periodic inspections. In addition to the review of the vessel's logs, maintenance records and overtime sheets, licensed and unlicensed personnel should be interviewed. When vessels are required to carry engine maintenance personnel, any periods in which they are placed in a watch status must be noted.

5. Increased Manning Levels.

Vessel manning levels that have been reduced due to the installation of automated systems or controls will be restored to conventional levels if the automated system develops a pattern of unreliable performance; isolated instances of "downtime" will not be bases for increased manning. The manning level will be adjusted only in the department affected by the malfunctioning system, and an appropriate amendment will be made to the COI. The increased manning level will remain in effect until corrective action has been taken and the system has been tested to the OCMI's satisfaction.

The OCMI should take appropriate action to validate any complaints or reports detailing specific instances of repeated equipment failures, excessive overtime, or concerns

regarding unsatisfactory performance of crews during emergency and operational evolutions onboard vessels having reduced manning. If the reports are found factual, a reevaluation of the manning may be justified. The COI required manning must reflect the minimum safe manning level to comply with statutes and regulations. The OCMI should increase the required manning whenever a review of the work records indicates excessive workloads, or when statutory workhour limits are being exceeded, or in situations when the limits are met by the virtue of the vessel owner assigning a sufficient number of "other persons in the crew" to augment the required crew. Manning increases deemed necessary by the OCMI due to automation system failures or inability to safely operate and maintain the vessel for any reason should be reported to Commandant (G-MOC). Automated machinery control and management system failures, design or component related, which may affect a class of vessels should also be reported to Commandant (G-MSR).

