Sunshine Act Meetings

Federal Register
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Wednesday, May 18, 1988

This section of the FEDERAL REGISTER contains notices of meetings published under the "Government in the Sunshine Act" (Pub. L. 94-409) 5 U.S.C. 552b(e)(3).

FEDERAL DEPOSIT INSURANCE CORPORATION

Notice of agency meeting

Pursuant to the provisions of the "Government in the Sunshine Act" (5 U.S.C. 552b), notice is hereby given that at 12:04 p.m. on Friday, May 13, 1988, the Board of Directors of the Federal Deposit Insurance Corporation met in closed session to consider matters relating to an assistance agreement pursuant to section 13(c) of the Federal Deposit Insurance Act.

In calling the meeting, the Board determined, on motion of Director C.C. Hope, Jr. (Appointive), seconded by Mr. Dean S. Marriott, acting in the place and stead of Director Robert L. Clarke (Comptroller of the Currency), concurred in by Chairman L. William Seidman, that Corporation business required its consideration of the matters on less than seven days' notice to the public; that no earlier notice of the meeting was practicable; that the public interest did not require consideration of the matters in a meeting open to public observation; and that the matters could be considered in a closed meeting by authority of subsections (c)(4), (c)(6), (c)(8), (c)(9)(A)(ii), and (c)(9)(B) of the "Government in the Sunshine Act" (5 U.S.C. 552b(c)(4), (c)(6), (c)(8), (c)(9)(A)(ii), (c)(9)(B)).

The meeting was held in the Board Room of the FDIC Building located at 550—17th Street NW., Washington, DC.

Dated: May 16, 1988.

Federal Deposit Insurance Corporation.

Robert E. Feldman,

Deputy Executive Secretary.

[FR Doc. 88-11193 Filed 5-16-88; 11:24 am]

BILLING CODE 6714-01-M

FEDERAL RESERVE SYSTEM BOARD OF GOVERNORS

TIME AND DATE: 11:00 a.m., Monday, May 23, 1988.

PLACE: Marriner S. Eccles Federal Reserve Board Building, C Street entrance between 20th and 21st Streets, NW., Washington, DC 20551.

STATUS: Closed.

MATTERS TO BE CONSIDERED:

1. Personnel actions (appointments, promotions, assignments, reassignments, and salary actions) involving individual Federal Reserve System employees.
2. Any items carried forward from a previously announced meeting.

CONTACT PERSON FOR MORE INFORMATION: Mr. Joseph R. Coyne, Assistant to the Board; (202) 452-3204. You may call (202) 452-3207, beginning at approximately 5 p.m. two business days before this meeting, for a recorded announcement of bank and bank holding company applications scheduled for the meeting.

Date: May 13, 1988.

James McAfee,

Associate Secretary of the Board.

[FR Doc. 88-11152 Filed 5-16-88; 8:45 am]

BILLING CODE 6210-01-M

INTERNATIONAL TRADE COMMISSION

USITC SE-88-13

TIME AND DATE: Thursday, June 2, 1988 at 10:00 a.m.

PLACE: Room 101, 500 E Street, SW., Washington, DC 20436.

STATUS: Open to the public.

MATTERS TO BE CONSIDERED:

1. Agenda
2. Minutes
3. Ratifications
4. Petitions and Complaints
5. Inv. No. 731-TA-384 (Final) (Nitrile Rubber from Japan)—briefing and vote.
6. Any items left over from previous agenda.

CONTACT PERSON FOR MORE INFORMATION: Kenneth R. Mason, Secretary (202) 252-1000.

Kenneth R. Mason,

Secretary.

May 10, 1988.

[FR Doc. 88-11153 Filed 5-16-88; 8:45 am]

BILLING CODE 7020-02-M

INTERNATIONAL TRADE COMMISSION

USITC SE-88-12

TIME AND DATE: Tuesday, May 24, 1988 at 2:00 p.m.

PLACE: Room 101, 500 E. Street, SW., Washington, DC 20436.

STATUS: Open to the public.

MATTERS TO BE CONSIDERED:

1. Agenda
2. Minutes
3. Ratifications
4. Petitions and Complaints: Certain Venetian Blind Components (Docket Number 1442).
5. Inv. Nos. 701-TA-290-292 (P) and 731-TA-400-404 (P) (Thermostatically Controlled Appliance Plugs & Probe Thermostats Therefor from Canada, Hong Kong, Japan, Malaysia, and Taiwan)—briefing and vote.
6. Any items left over from previous agenda.

CONTACT PERSON FOR MORE INFORMATION: Kenneth R. Mason, Secretary (202) 252-1000.

Kenneth R. Mason,

Secretary.

May 10, 1988.

[FR Doc. 88-11154 Filed 5-16-88; 9:12 am]

BILLING CODE 7020-02-M

SECURITIES AND EXCHANGE COMMISSION

"FEDERAL REGISTER" CITATION OF PREVIOUS ANNOUNCEMENT: (53 FR 16614 May 10, 1988).

STATUS: Closed meeting.

PLACE: 450 5th Street, NW., Washington, DC.

DATE PREVIOUSLY ANNOUNCED: Thursday, May 5, 1988.

CHANGES IN THE MEETING: Additional item.

The following additional item was considered a closed meeting on Wednesday, May 11, 1988, at 2:30 p.m.

Regulatory matter regarding financial institutions.

Commissioner Cox, as duty officer, determined that Commission business required the above change.

At times changes in Commission priorities require alterations in the scheduling of meeting items. For further information and to ascertain what, if any, matters have been added, deleted or postponed, please contact: Brent Taylor at (202) 272-2014.

Jonathan G. Katz,

Secretary.

May 12, 1988.

[FR Doc. 88-11241 Filed 5-16-88; 3:45 am]

BILLING CODE 8010-01-M

Federal Register

Wednesday
May 18, 1988

Part II

Department of Transportation

Coast Guard

46 CFR Part 50 et al.
Vital System Automation; Final Rule

DEPARTMENT OF TRANSPORTATION

46 CFR Parts 50, 52, 56, 58, 61, 62, 110, 111, 113

[CGD 81-030]

Vital System Automation

AGENCY: Coast Guard, DOT.

ACTION: Final rule.

SUMMARY: The Coast Guard is adding regulations for automated vital systems on self-propelled commercial vessels to the Marine Engineering Regulations contained in various subchapters of Title 46 of the Code of Federal Regulations. Since the early 1960's, technological advances have caused an ever-growing dependence on automation to provide for the safe operation of vessels while reducing operating costs. Domestically, the Coast Guard has published a series of Navigation and Vessel Inspection Circulars (NVIC's) to promulgate its policy and guidance regarding the safe design, testing, maintenance, and manning of automated vessels. These circulars are inadequate and outdated. Internationally, the need for safe automation on vessels has resulted in the inclusion of automation regulations in the first set of amendments to the International Convention on the Safety of Life at Sea, 1974 (SOLAS '74). These amendments entered into force internationally on September 1, 1984. To ensure that safety is not compromised by automation or reduced manning, uniform safety regulations are needed to replace the NVIC's currently in effect, and to conform to and interpret the provisions of the recent SOLAS amendments. The Coast Guard intends these rules to provide minimum performance and testing standards that do not restrict use of technological developments or alternative arrangements that provide an equivalent degree of safety. Additionally, these rules detail the configuration and degree of automation the Coast Guard deems necessary when authorization for minimally attended or periodically unattended machinery plant operation is requested by the owner or operator of a vessel.

DATES: This regulation is effective August 16, 1988. The Incorporation by Reference of certain publications listed in the regulations is approved by the Director of the Federal Register as of August 16, 1988.

ADDRESSES: A final regulatory evaluation has been prepared for this rulemaking and may be inspected and copies at the Marine Safety Council (G-CMC/21) at Room 2110, U.S. Coast Guard, 2100 Second Street SW., Washington, DC 20593-0001, between the hours of 8:00 a.m. and 4:00 p.m., Monday through Friday.

FOR FURTHER INFORMATION CONTACT: LCDR Peter L. Randall, Office of Marine Safety, Security and Environmental Protection, (202) 267-2206.

SUPPLEMENTARY INFORMATION: A notice of proposed rulemaking (NPRM) was published in the **Federal Register** on September 23, 1985 (50 FR 38608). Interested persons were requested to submit comments and fifty-two letters were received, each containing numerous comments. These comments are discussed in detail below.

Drafting Information

The principal persons involved in drafting this rulemaking are: LCDR Peter L. Randall, Project Manager, and Mr. W.R. Register, Project Counsel, Office of the Chief Counsel.

Discussion of Regulations

a. Background

(1) The vital machinery and engineering spaces of commercial vessels are automated for a variety of reasons, including operator convenience, increased efficiency, reduction or elimination of the need for operators to be continuously present, and detection and control of unsafe conditions. Most automation is provided at the option of the owner of the vessel to reduce necessary manning and increase operating efficiency, thereby reducing operating costs. Over the life of a vessel, the savings as a result of these reduced operating costs usually exceed the capital investment cost of the automation.

(2) The Code of Federal Regulations does not address technical criteria for the safe and reliable automation of vital systems on commercial vessels. For more than 20 years, the Coast Guard has issued a series of NVIC's to express its policy and provide guidance for the cognizant Officer in Charge, Marine Inspection in an effort to ensure a general level of safety on automated vessels at least equal to that experienced on vessels that are not automated. The primary circular for self-propelled vessels other than small passenger vessels and offshore supply vessels has been NVIC 1-69, "Automated Main and Auxiliary Machinery." This NVIC was issued in January 1969 as a result of Coast Guard and industry experience with the automation technology and steam propulsion systems prevalent in the 1960's. Worded as the "judgment of the Coast Guard" in the context of 46 U.S.C. 222 (now 46 U.S.C. 8101), it provided guidelines for equipment design, maintenance, and testing. It also specified the equipment and procedures deemed necessary to qualify for reduced engineroom manning and emphasized that safety must not be compromised as a result of either automation or associated reductions in manning. While many of the underlying concepts of this NVIC have stood the test of time and are consistent with the international views on safe and reliable automation, it lacks guidance and flexibility applicable to new technologies, configurations, and propulsion systems, particularly diesel engines and electronics. The Coast Guard has used internal policy statements and interpretations to address these deficiencies. The existence of these numerous guidelines and interpretations in nonregulatory form has at times caused confusion in the marine industry and resulted in nonuniform application, misinterpretation, and unnecessary additional costs to the industry.

(3) In 1970, the United States submitted NVIC 1-69 the Intergovernmental Maritime Consultative Organization (IMCO) for consideration in the development of international automation standards. (In 1982, IMCO changes its name to International Maritime Organization, IMO.) In 1974, the United States participated in the development of the International Convention for the Safety of Life at Sea (SOLAS '74), which was developed under the auspices of IMCO. SOLAS '74 was ratified by the United States on September 7, 1978, and entered into force internationally on May 25, 1980. The first set of amendments to SOLAS '74, including automation regulations, were adopted at the Forty-fifth session of the Maritime Safety Committee (MSC) of IMCO in November, 1981. Under the amendment procedures of SOLAS '74, the contracting governments, including the United States, accepted the amendments on March 1, 1984. These amendments entered into force internationally on September 1, 1984. The United States actively participated at all levels of development of the SOLAS '74 amendments and the document that comprised the automation requirements.

Resolution A.325(IX). Public comment was invited and the marine industry participated in all aspects of the development of the United States' position. The SOLAS '74 amendments are generally consistent with the U.S. position; however, they require substantial interpretation and augmentation by the Coast Guard and affected members of the public if they are to be applied in a uniform and fair manner to the U.S. commercial fleet.

(4) In 1981, the Coast Guard initiated this regulatory project, CGD 81-030, to update and replace NVIC 1-69, to incorporate IMCO Resolution A.325(IX), and to solicit public comment before publishing regulations. In 1983, difficulties in evaluating foreign flag vessels being brought under the U.S. flag further accentuated the need for revised Coast Guard automation requirements. NVIC 6-84, "Automated Main and Auxiliary Machinery, Interim Guidance On," was published on June 25, 1984, to provide immediate interim guidance on the application of the SOLAS amendments and NVIC 1-69 pending publication of final rules in this rulemaking. Since its publication, NVIC 6-84 has served its purpose of clarifying how the Coast Guard intends to apply SOLAS to U.S. flag vessels, informing the public, reinforcing certain general concepts found in both NVIC 1-69 and SOLAS, and de-emphasizing certain obsolete or conflicting guidelines in NVIC 1-69.

(5) On September 23, 1985, the Coast Guard published the NPRM for this rulemaking with a comment period set to close December 23, 1985. Shortly before the end of the comment period, however, requests for additional time to prepare and submit comments were received from the American Bureau of Shipping (ABS) and others. The requests cited the extensive and comprehensive nature of the proposed rule as the reason additional time was needed. Due to the significance of this rulemaking, the Coast Guard considered it important to allow parties with relevant comments additional time to evaluate the proposal. An extension of the comment period to February 21, 1986, was published in the Federal Register (51 FR 3352).

Shortly before the end of the extended comment period, the National Marine Engineers' Beneficial Association (NMEBA) requested that a public hearing be held on the proposed rules, citing perceived significant changes in Coast Guard technical and manning policies and the need for fullest possible public participation. The Coast Guard carefully considered the points raised in the request and noted that they reflected a misunderstanding of Coast Guard policy and the intent of the proposal. The Coast Guard also considered the extended length of the comment period, the public hearings on vessel manning held in a related rulemaking discussed later in this preamble (Licensing of Maritime Personnel Rulemaking, CGD 81-059), and the written comments received from the affected public, and concluded that a public hearing at that stage in the rulemaking was not necessary. All points raised in the request, and the Coast Guard's detailed response, have been included in the public docket and are addressed in detail elsewhere in this rulemaking.

b. Issues Addressed.

(1) *Safety.* The marine industry, the Coast Guard, and the member nations of IMO recognize that automated vital system failures are a hazard to navigation and personnel. Coast Guard records for casualties on U.S. flag vessels during 1985 and 1986 include at least 78 marine casualties involving automation addressed by this rulemaking, at a known total cost of at least $3.2M in damages. These casualties are discussed at length in the Final Evaluation referenced above under ADDRESSES. As an example, Coast Guard casualty records include several cases where remote propulsion controls have failed, resulting in loss of control of the vessel and ensuing damage. These propulsion control casualties alone have directly or indirectly accounted for $1.3M in damages in 1985 and 1986.

(2) *Vessel manning.* Automation is a vessel manning issue as much as it is an issue of equipment safety and reliability. The Coast Guard is charged by 46 U.S.C. 8101 with determining the complement of licensed officers and crew necessary for safe operation of a vessel. The Coast Guard recently published revised manning requirements in the Federal Register of October 16, 1987 (52 FR 38614) which include manning provisions relating to vessel automation (see 46 CFR Part 15 entitled "Manning Requirements"). While these revised requirements in Part 15 state that the degree of automation is considered by the Officer in Charge, Marine Inspection (OCMI) in determining the manning requirements for a particular vessel, the technical criteria for making this determination has been in NVIC's 1-69 and 6-84, which are now considered by the marine industry and the Coast Guard to be inadequate.

(3) *Lack of regulatory requirements.* The reason most commonly cited by all interested parties as the need for automation regulations is the lack of clear regulations, and the inadequacy of NVIC's 1-69 and 6-84. Both construction costs and operating costs have been unnecessarily incurred by the marine industry because of misinterpretation of requirements.

(4) *SOLAS.* The SOLAS amendments leave certain detailed requirements and interpretations to the discretion or satisfaction of the "Administration," *i.e.*, the Coast Guard. Certain SOLAS provisions are also more stringent than previous requirements for U.S. flag vessels. An example of this is SOLAS Regulation II-1/31.2.7, which requires propulsion control systems to fail to a preset speed and direction. This SOLAS requirement exceeds past requirements and leaves interpretation of "preset" and the failures to be considered to the individual Administrations.

(5) *Technological advances.* The state of the art of marine automation has advanced from steam plants and elementary controls and instrumentation to the diesel and hybrid plants, distributed automatic controls, and microprocessor control and monitoring technologies prevalent today. This developmental trend is expected to continue and must be taken into account by automation regulations.

(6) *Safety evaluation complexity.* The details of an automated machinery plant depend upon the design of the machinery, its arrangement, and the automation technology (electronic, electric relay, pneumatic, hydraulic, mechanical, etc.) employed. The combination of these factors often makes the details of an automation system unique to a given vessel or class of vessels. The trend toward greater automation of vessels as a result of economic pressure has resulted in large vessels with 1000-2000 monitoring points and sophisticated electrical plant management systems. This uniqueness and complexity in turn makes it difficult to evaluate the safety and reliability of automated vessels, and dictates the need for comprehensive performance standards as opposed to detailed design requirements.

(7) *Applicability.* SOLAS '74 and NVIC 1-69 were not developed to address certain systems or classes of vessels, such as mobile offshore drilling units (MODU's), non-self propelled vessels, dynamically supported craft, or

tanker overflow control systems. The applicability of standards derived from SOLAS and the NVIC to these vessels must be given further consideration. These rules do not apply to those vessels.

c. Intent of Rules.

(1) *General.* The Coast Guard intends the regulations to—

(i) provide flexible, performance-oriented rules to assure acceptable minimum levels of safety, regardless of an automated vessel's degree of automation, the type of automation technology, or the configuration employed;

(ii) assure compliance of automated U.S. flag vessels with the international standards of safety promulgated by the SOLAS convention and the applicahble IMO resolutions;

(iii) emphasize the role of the marine industry, particularly in the areas of design, construction, and maintenance, in providing safe and reliable vessels; and

(iv) closely integrate the specific automated vessel technical design and construction requirements of these rules with the vessel manning requirements of recently revised 46 CFR Part 15, to assure the safety and adequate manning of U.S. flag vessels.

(2) *Structure.* (i) The provision of a single set of automation regulations applicable to all vessels to which the Marine Engineering Regulations apply should promote a uniform set of standards that can be more easily understood and simplify the process of revising the regulations when necessary. It should also facilitate Coast Guard plans concerning possible future transfer of certain functions associated with the regulations to the American Bureau of Shipping or other non-government agencies.

(ii) The rules are broken into four major segments:

(A) An equivalency provision.

(B) General performance, reliability, and safety criteria for all automated systems.

(C) Specific criteria for specific types of systems, where provided.

(D) The minimum equipment and systems deemed necessary for minimally attended and periodically unattended machinery spaces on automated vessels.

Each of these segments is intended to build upon the prior, *i.e.*, systems listed under the specific provisions must also meet the general criteria, and systems required for minimally attended or periodically unattended machinery space manning must also meet applicable specific and general critiera.

(3) *Assumptions and objectives.* (i) In developing the safety performance standards in this rulemaking, the Coast Guard used several assumptions and basic objectives. These were derived from the Coast Guard's experience with automated vessels over the last 20 or more years and from input provided by the public. They are considered to be fundamental concepts that, in various degrees, are reflected in past and present Coast Guard, IMO/IMCO, SOLAS, and classification society policies and regulations for vessel safety. These basic assumptions were presented in the NPRM and are again listed below. Clarification of Assumption (B) has been made as a result of public comments, and the revision is shown in italics.

Assumption (A) Regardless of how well designed, constructed, or operated any automated equipment is, it can fail catastrophically. While extensive and detailed design, quality control, and maintenance regulations may reduce the likelihood of a failure, a finite probability remains that a failure can occur. Regulations that attempt to completely prevent failure might in fact be counter-productive to safety, expensive, and burdensome to all parties. Therefore, it is prudent to assume that failures will occur and consider the necessary safety contingencies.

Assumption (B) Localized flooding or fire can occur regardless of the precautions taken to prevent them. Such emergencies can disable vital system automation, make it inaccessible, and pose an immediate threat to the safety of the vessel and its crew. Therefore, it is prudent to provide alternative means of operation. *Further, the ability to counteract localized flooding or fires should not be diminished by the provision or location of automation.*

Assumption (C) The evaluation of the safety of any automated vessel in light of the events described in Assumptions (A) and (B) should be limited to any single, non-concurrent failure or event and its logical effects. In light of the large number of concurrent combinations possible and the relatively low probability of their occurrence, it is impractical and burdensome to consider such combinations. It is, however, prudent and reasonable to consider the logical chain of events that could occur as a result of a single failure or event, and to consider conditions that contribute to unsafe conditions.

Assumption (D) The safety of vessels with automated vital systems should be at least equal to that of a vessel with its vital systems under direct manual supervision.

(ii) Based on these assumptions, these regulations are intended to meet the following objectives:

Objective (A) To the greatest extent practicable, the failure of automation or automated equipment should be safe (failsafe) and the foreseeable unsafe effects minimized by design. In a similar manner, the effects of a localized fire or flooding on safe control and operation should be minimized and localized.

Objective (B) A responsible member of the crew must promptly become aware of a failure, fire, or flooding, either directly from personal observation or indirectly from reliable instrumentation or alarms.

Objective (C) Upon becoming aware of a failure, fire, or flooding, the crew must have an alternate, effective means available to operate the vessel safely and to counteract the effects of failure, fire, or flooding.

Objective (D) The crew should know how to operate both the automated system and the alternate controls in the event the automation fails. Similarly, the operation of the system must be clear and obvious to the crew.

Objective (E) There must be indication at operator control locations of the safe, or unsafe, state of operation of the equipment controlled from that location.

(iii) A failure scenario was developed that describes the intended sequence of events deemed desirable to attain the primary goal of this rulemaking, safety. The scenario includes options that depend upon the nature of the automation, manning of the vessel, and its operation. It is a development upon the aforementioned assumptions and objectives, and includes the following sequence of events:

Event (A) The vessel is underway in normal operation, with spaces and machinery status monitored by crewmembers or automation.

Event (B) A single vital system or vital system component fails, or localized fire or flooding occurs.

Event (C) In the case of a vital system failure, it fails to a pre-determined safe state and the effects of the failure are minimized.

Event (D) A crewmember on duty promptly becomes aware of the failure, fire, or flooding.

Event (E) In the case of a vital system failure, either—

(i) the failed unit is automatically removed from service and replaced with a reliable, effective backup; or

(ii) a crewmember manually removes the failed unit from service and manually transfers to a reliable and effective alternate means of operation.

In the case of localized fire or flooding, either—

(i) The crew takes action locally to counteract the effects of the hazard, if the space and equipment are accessible and operable; or

(ii) The crew takes action from an alternate, remote location to counteract the effects of the hazard, if the space or equipment are not accessible or operable.

Event (F) The failure scenario ends with the vessel in continued or restored safe operation, even if at a reduced operational capacity.

(4) Discussion of Specific Regulations—§ 58.01–35 Main propulsion auxiliary machinery. This rule is an interpretation of SOLAS Regulation II–1/26 and provides general performance criteria not found elsewhere in the Marine Engineering Regulations. It has been included because it is fundamental to compliance with the performance standards in Part 62.

Subpart 61.40 Design Verification and Periodic Tests

These tests are intended to make sure that automated systems initially operate in a safe and reliable manner and continue to do so during the service life of the vessel. The tests are similar to those described in NVIC 1–69. The Design Verification Tests in § 61.40–1 are intended to be more detailed and intensive than the Periodic Safety Tests of § 61.40–6, in that they must confirm that all systems, when initially installed, function as required by the performance standards of Part 62. Design Verification Tests are generally associated with yard trials and sea trials. Periodic tests are intended to confirm the continued operation of major safety systems and features annually. On vessels where the Coast Guard has accepted automated systems to replace specific personnel or reduce overall crew requirements, the periodic tests are also intended to determine, in part, the adequacy of the required planned maintenance program and the adequacy of the mainning with which the vessel has operated.

Section 62.01–5(d) Applicability, Central Control Rooms.

This paragraph is an interpretation of the SOLAS requirements referenced in Table I and is generally more stringent than past Coast Guard guidelines. Implicit in this interpretation is the assumption that a control room partially or completely isolates the operator from the machinery space environment. Certain essential monitoring and control functions, therefore, are required to be extended from the machinery space to the control room to provide a level of safety equivalent to that of an operator located in the machinery space itself.

Subpart 62.20 Plan Submittal. This subpart contains certain changes from past standards. Significant among these are a new requirement for a qualitative failure analysis of certain complex automated systems, deletion of the previous requirement for a maintenance program *approved* by the Coast Guard, and provisions for the self-certification of compliance with environmental design standards in lieu of plan review and laboratory testing.

Section 62.20–1 Plans for Approval. The plan submittal requirements in this section are similar to those of the past. Designers and manufacturers of automation equipment should also see 46 CFR 50.20–15, which outlines the requirements for the use of previously approved plans. Information necessary to confirm general compliance with the Marine Engineering and Electrical Regulations will continue to be required by those regulations, such as overcurrent protection, wiring and connection materials, and fluid piping.

Section 62.20–3 Plans for Information.

The *approval* of a planned maintenance program is no longer a prerequisite for reduced manning. The specific content of the program is up to the vessel's operator. The maintenance program will initially be used by the Coast Guard to aid in evaluation of requests for reduced manning. Once the vessel is in service, it is intended that re-inspection and the Periodic Safety Tests of Subpart 61.40 witnessed by the Coast Guard will determine the adequacy of the maintenance program.

This section also requires that a qualitive failure analysis be developed and submitted as an information document for certain complex systems. This document will aid in the evaluation of the system and will emphasize the role of the designer and manufacturer in evaluating the designed safety of vital system automation. Further discussion of the failure analysis requirements is included in the *Analysis of Comments* discussion below.

Subpart 62.25 General Requirements for All Automated Vital Systems

This subpart is intended to provide general performance and arrangement standards applicable to the control and monitoring of any vital shipboard system.

Section 62.25–25 Programmable Systems and Devices.

These requirements are intended to prevent either the intentional or unintentional modification of required safety parameters on systems or equipment that readily lend themselves to adjustment or loss of function, such as safety trip sensors and programmable controllers. The requirements are not intended to prohibit routine adjustments and calibration necessary for the normal and efficient operation of automatic controls or instrumentation.

Section 62.25–30 Environmental Design Standards.

These standards generally correspond to those of international technical bodies. Rather than require detailed and costly testing to these standards in an effort to confirm component suitability, the Coast Guard intends to emphasize the realiable and safe function of the overall system, testing after installation, and manufacturer and designer certification of component suitability.

Subpart 62.30 Reliability and Safety Criteria, All Automated Vital Systems

This subpart is intended to provide general performance standards applicable to any automated vital system.

Section 62.30–1 Failsafe.

The failsafe operation of vital systems has long been a Coast Guard policy. In some cases, such as failure of propulsion controls to a preset speed and direction, the failsafe state is internationally definable and recognizable. In other cases, such as a microprocessor based system, the complexity or nature of the system may preclude the statement of a single preferred failsafe state. It is the intent of this rule that each control and alarm system fail in a manner consistent with the overall safety of the vessel and personnel in light of the assumptions and failure scenario discussed in this rulemaking. For certain complex systems and in equivalency determinations, the failure analysis required by § 62.20–3(b) is intended to aid in the identification of a preferred failsafe state.

Section 62.30–5 Independence.

Independence of systems or equipment normally implies separate and discrete components in order to provide reliability. Complete duplication in this manner is costly, may not be necessary, or may be impractical. As the term independent is defined and used in these rules, however, common reliable components could be used provided the performance criteria are met. An example is a system that provides for disconnection of a failed subsystem while allowing continued operation of the required function. This definition is included to allow arrangements that do not provide complete duplication but do

provide a level of safety and reliability equivalent to complete duplication.

Subpart 62.35 Requirements for Specific Types or Automated Vital Systems

This subpart augments the general performance and configuration requirements of Subpart 62.25 and 62.30. It addresses safety criteria peculiar to specific systems of equipment that might be automated on a vessel.

Section 62.35–5(e)(3) Remote Propulsion Control System Details.

This rule has special significance in that it requires failsafe propulsion control operation. Failure of propulsion controls, particularly while manuevering, has caused numerous vessel casualties. This rule, in conjunction with the failure analysis required by § 62.20–3(b)(2), is intended to address known causes of propulsion control failures.

Section 62.35–20 Oil-Fired Main Boilers

These rules include automatic safety trip controls for all main boilers to prevent major boiler failures, greater emphasis on boiler air flow to prevent explosive conditions, and prohibition of certain automatic functions following boiler safety shutdowns.

Table 62.35–50 Minimum System Monitoring and Safety Control Requirements for Specific Systems. This table is intended to summarize in a single location the minimum instrumentation, alarms and safety controls deemed necessary by the Coast Guard for specific types and categories of automated equipment.

Subpart 62.50 Automated Self Propelled Vessel Manning

This subpart is intended to address the minimum systems, configurations, and maintenance programs necessary for the Coast Guard to accept automated systems to replace specific personnel or to reduce overall crew requirements in accordance with the new § 15.715 of the manning requirements mentioned above under *Issues Addressed.* The requirements of this subpart would be in addition to the rest of the technical requirements of Part 62. The references to specific levels of manning and watchstanders in NVIC 1–69 have been deleted, as they have resulted in misinterpretation and confusion. These rules are intended to establish technical criteria to be used by the Officer in Charge, Marine Inspection in determining the manning requirements for a particular vessel. Actual manning may exceed the Coast Guard's minimum required complement and is usually subject to agreement between a vessel's labor and management interests. Failure of automated equipment to perform in accordance with the provisions of the rules could result in the Coast Guard adjusting the minimum complement of officers and crew.

Section 62.50–20 Additional Requirements for Minimally Attended Machinery Plants

These requirements are intended to address vessel machinery plants and spaces that are automated, but not to a degree where the plant could safely be left unattended. Emphasis is placed on the centralized remote control and monitoring of the machinery plant and machinery spaces and the assumptions and failure scenario discussed in this rulemaking. The cognizant Officer in Charge, Marine Inspection (OCMI) may determine the need for more or less equipment depending on the vessel characteristics, route, or trade. For example, the personnel alarm may not be required if normal operation includes two crewmembers continuously in attendance.

Section 62.50–20(h) Maintenance Program

Where automation is provided to replace personnel or to reduce overall crew requirements, there may be a greater need for planned maintenance. This occurs because of a potential reduction in the maintenance work force, an increase in the sophistication and quantity of equipment to be maintained, and the reliance of the crew upon the automated equipment. The Coast Guard therefore considers it necessary to require automated vessels to have a planned maintenance program. As the content of such a program varies with vessel type, trade, route, manning and similar factors, the rules leave program content and implementation up to vessel management. The Coast Guard will evaluate the actual effectiveness of the program during the trial period and re-inspections and will then determine the adequacy of the program and manning.

Section 62.50–30 Additional Requirements for Periodically Unattended Machinery Plants

These requirements are intended to address machinery plants and spaces that are automated to the degree that they are self-regulating and self-monitoring and can safely be left periodically unattended. Emphasis is placed on providing systems that act automatically until the crew can take action in the event of a failure or emergency. As required by the Coast Guard in the past, the requirements for a periodically unattended machinery plant are in addition to those of a minimally attended machinery plant. This permits the crew to operate the plant directly should the arrangements for unattended operations prove unsatisfactory, for whatever reason.

Section 62.50–30(k) Continuity of Electrical Power

This rule, in consideration of SOLAS II–1/53.2, which requires automatic standby power for the main switchboard, and 46 CFR 112.05–3, which prohibits automatic feedback by the main-emergency bus-tie, no longer permits use of the emergency generator as the automatic standby source of electrical power.

Analysis of Comments and Changes Made

Need for Regulations. This rulemaking has presented a new and comprehensive set of safety regulations for vital system automation. Four comments on the proposed rules opposed the development of any new regulations, and stated a definite preference for NVIC's or comparable guidelines. The reasons given included: (1) the NVIC's are less rigid and less costly, (2) the maritime industry is in recession and cannot give the proposed rules the attention they deserve, and (3) there is no clear mandate, *i.e., need for regulation.* Twenty-nine comments supported the development of new regulations, with ten stating the rulemaking represents a marked improvement over the NVIC's, which should help eliminate confusion and which should be generally beneficial.

These rules have been developed as performance standards to allow the maximum possible flexibility in compliance consistent with safety. The costs related to these regulations are discussed under *Evaluation and Certification.* These rules, and the NVIC's and SOLAS regulations from which they are derived, have been developed with considerable public input over the last 25 years, and the public actively participated in the development of the final rules. Because of the ever present potential for casualties related to vital system automation, these safety regulations are considered to be essential.

Delegations to Classification Societies. The draft regulatory evaluation and the notice of proposed rulemaking (NPRM), at 50 FR 38615, stated that the proposed rules could potentially result in a cost savings to the Coast Guard as a result of further delegation of plan review and inspection functions to the American Bureau of Shipping (ABS). Automated vital system

functions are not presently delegated by the Coast Guard to any party. Although the NPRM did not propose any delegation of plan review and inspection functions to classification societies, four comments supported such a delegation. Specific delegations to the ABS or any other classification society are considered to be beyond the scope of these rules, and are being addressed in a separate rulemaking docket entitled "Delegation of Authority to United States Classification Societies" (CGD 85-019).

Clarifications. The final rules include various clarifications to provisions proposed in the NRPM which have been made principally in response to recommendations of commenters. Many of the clarifications address specific recommendations that certain text be revised to remove unclear or confusing concepts as noted in specific comments. With one or two exceptions, these clarifications have not been individually discussed below as the reasons for the clarification become self evident simply by comparing the text of the clarified rule with corresponding proposed rule text. Certain clarifications have also been made to make text consistent with the text of various substantive changes which are discussed below.

Sections 52.01-10(a) and 62.35-20(a)(1) Main Boiler Safety Trips

One comment recommended deleting the requirement to have automatic safety trips on manually fired main boilers because they are not required by SOLAS. This comment has not been adopted. Coast Guard casualty records show that numerous boiler casualties, particularly flarebacks, occur when boilers are manually fired and can be avoided by providing automatic safety trips. These same findings are supported by ANSI/NFPA 85D "Standards for Prevention of Furnace Explosions In Fuel Oil-Fired Multiple Burner Boiler-Furnaces." Automatic safety trips are considered essential and are normally provided on vessels as a matter of general industry practice.

Section 56.50-80(i) Lubricating Oil System

One comment recommended that the requirement in the proposed rules to have an emergency supply of oil for all propulsion turbines only be applied to steam turbines. This recommendation has been adopted. There was no intent to apply the requirement to propulsion machinery other than steam turbines and associated high speed gearing. The shorter coast down period of diesel propulsion machinery generally makes an emergency supply unnecessary.

Section 58.01-35 Duplication of Auxiliary Machinery

This regulation requires duplication of auxiliary machinery vital to the main propulsion system. One comment stated that the regulation should specify which auxiliaries must be duplicated. Another comment requested clarification regarding single propulsion boiler installations, piping, cabling, deadship starts, and the relation of this regulation to SOLAS II-1/26 and Subpart 56.50 of Subchapter F. Specific requirements for most auxiliaries required to be duplicated are contained in Subparts 56.50 and 111.10 of Title 46, CFR. Specific requirements for piping and cabling are also in Subpart 56.50, Subpart 111.10, and in § 111.60-9. This regulation is substantively the same as SOLAS Regulation II-1/26.3.

Two comments recommended that the note to § 58.01-35 concerning partial reduction of normal propulsion capability refer to a reduced navigating capability (after propulsion auxiliary failure) of 7 knots or half speed, whichever is *less* (rather than *greater*, as proposed in the proposed rule). This recommendation has been adopted. The proposed rule would have required slower vessels to have unnecessary additional equipment which is not needed when proceeding at half speed. The note as revised is comparable to the various recognized classification society rules which generally specify 7 knots or less.

One comment asked whether an automation feature of "automatic slowdown" would comply with § 58.01-35. Automatic slowdown upon loss of an auxiliary component is one means of compliance.

Section 61.40-1(b) Test Responsibility

This regulation specifies that testing must be done by persons designated by the owner. One comment recommended that a marine inspector, rather than the owner of a vessel, randomly select a crewmember to conduct the testing required by this section in order to evaluate crew familiarity with the vessel. This recommendation has not been adopted. The tests are intended to evaluate the equipment, not the capabilities of the crew. The Coast Guard's role with regard to automation test procedures is not to supervise or participate in the tests, but rather to inspect and witness testing of the vessel according to an approved procedure.

Section 61.40-3(a) Design Verification Testing

This rule requires design verification tests to be based on failure analysis, if required by § 62.20-3(b), and other criteria. One comment stated that it will be difficult to derive a design verification test procedure from a failure analysis, especially where a microprocessor or computer control system is concerned. Failure analysis is intended to evaluate the safety and reliability of the design and readily lends itself to identifying critical safety features that should be confirmed by testing. As an example, the failure analysis may show that a power outage to one section of a microprocessor or computer control system should not affect the operation of the rest of the system. This design feature is identified by the failure analysis and can then be confirmed by a one-time design verification test.

Section 61.40-6(b) Periodic Safety Tests

Two comments recommended that the typical period between tests be one year in lieu of at each inspection for certification (*i.e.*, every two years). This recommendation has been adopted. The Officer in Charge, Marine Inspection (OCMI) can specify test intervals longer or shorter than one year, depending on the particulars of the vessel's operation, maintenance program, and past performance of the automation. Normally, however, the interval between periodic safety tests witnessed by the Coast Guard has been one year.

Section 62.01-5(a) Vessel Applicability—MODUs

Several comments stated that the proposed rules should not be applied to mobile offshore drilling units (MODUs). The applicability of the rules to MODUs was addressed as issue b.7. above and made reference to the OCEAN RANGER casualty. As a result of this casualty, attention to MODU ballast systems and ballast control systems has significantly increased. Substantial effort has gone into developing international standards for these systems at various meetings of the International Maritime Organization, IMO. Pending the anticipated completion of international standards in 1988, the Coast Guard will continue to treat MODU automation as a vital system on a case-by-case basis. The requirements in this rulemaking (CGD 81-030) will not be applied to MODU's at this time. Applicable requirements of this rulemaking and the finalized IMO standards will be proposed for MODU's in Coast Guard rulemaking docket (CGD 83-071a) when the IMO standards become effective.

OSV's. Several comments questioned whether the proposed rules would apply to Offshore Supply Vessels (OSV's).

These rules do not apply to OSV's. Requirements for these vessels are addressed separately in NVIC 1–78 and have been incorporated into proposed rules being prepared for OSV's in a separate rulemaking docket, (CGD 82–004). See the advance notice of proposed rulemaking for planned OSV requirements, which was published in the **Federal Register** of February 14, 1983 (48 FR 6636).

Other Vessels. Two comments recommended limiting the applicability of these regulations to self-propelled vessels to which NVIC 1–69 and SOLAS apply, and a third comment recommended limiting applicability to self-propelled vessels over 1600 gross tons, with provisions for type and locale of operation. As in the case of OSV's, these rules were never intended to apply to self-propelled vessels under 500 gross tons certificated under Subchapters D, I or U, or to certificated passenger vessels under 100 gross tons. A new subsection 5(a) has been added to exclude the applicability of these regulations to these types and sizes of vessels. These limits are the same as SOLAS and the Coast Guard's application of NVIC 1–69 and NVIC 6–84. The recommended 1600 gross ton cutoff was not adopted. This cutoff would exclude vessels such as coastal tankers, coastal freighters, dredges, passenger ferries, passenger cruise vessels, and research vessels, all of which commonly use automation. There are approximately 130 such existing vessels above the 100/500 gross ton cutoffs of these rules and below 1600 gross tons, and NVIC 1–69 has been applied to most of them.

The limitations for type and locale of operation are inherent in the regulations. For example, if the only automation on a passenger ferry is remote propulsion control, only those requirements relevant to remote propulsion control will apply. However, if sufficient automation is provided to reduce manning, the cognizant OCMI will determine the need for more or less equipment depending on the vessel characteristics, route, or trade (see § 62.50–1(b), note). This approach represents a continuation of current Coast Guard policy.

One comment suggested that the proposal only apply to vessels that are automated to reduce manning, but not to vessels that automate vital systems, as an option, without reduced manning. This recommendation has not been adopted. Coast Guard casualty records show that automation can fail regardless of a vessel's manning, and that adequate safety precautions must be taken. This is one of the fundamental points discussed under *Assumptions and Objectives* in this document. Additionally, SOLAS Regulation II–1/31 also contains automation requirements for vessels that automate vital systems, as an option, without reduced manning.

Section 62.01–5 (b) and (c) System and Equipment Applicability

These rules apply to automated vital systems and equipment listed in § 62.01–5(b) except for certain exemptions listed in § 62.01–5(c). One comment said this applicability is too broad and appears to include simple systems for closing fuel valves, stopping ventilation, and automatically starting pumps. The comment recommended that the applicability be more specific and, in particular, be limited to propulsion control systems. This recommendation has not been adopted. The basic safety principles discussed in *Assumptions and Objectives* have been applied by the Coast Guard in developing these rules and are intended to apply to simple and complex systems alike. The proper location and failsafe operation of remote motor and valve controls, the provision of local manual alternate control, and the automatic starting of standby vital auxiliaries in unattended machinery spaces are important safety considerations for automated vessels. Fire protection systems, flooding safety systems, and electrical power generation systems are among the systems that are automated and essential to safety that would be excluded by adopting this recommendation.

One comment said the regulations should not apply to systems that are only being monitored and that are not automatically or remotely controlled. This recommendation has not been adopted. Instrumentation and alarms, from simple bilge level alarms to complex computerized video displays in control rooms, are relied upon by the crew as extensions of their own senses and as a source of information for making decisions. Reliable and clear presentation of this information is necessary for safe operation of the vessel and its machinery.

Proposed paragraph (b)(3) exempted optional control and monitoring systems from all of the proposed requirements. One comment recommended that this exemption be deleted, *i.e.*, that the requirements in this rulemaking be made applicable to optional control and monitoring systems which can effect vital systems. This recommendation has been adopted. The final rules (see § 62.01–5 (b) and (c)) have been made applicable to optional control and monitoring systems unless otherwise exempt as non-vital or industrial systems or other systems exempted under § 62.01–5(c). Non-vital exempt systems include performance monitoring and trending systems and similar non-required, non-vital systems whose failure would not degrade the safety and reliability of required systems.

Section 62.01–5(d) Central Control Rooms

This paragraph provides that the requirements of subpart 62.50 for automated self-propelled vessel manning only apply to vessels automated to replace specific personnel or to reduce overall crew requirements, with certain exceptions. The exceptions relate to vessels having main propulsion or ships service electrical generating plants which are automatically or remotely controlled from a control room. In this case, vessels must provide certain additional essential monitoring and control functions required in §§ 62.50–20(a)(3), (b)(3), (c), (e)(1), (e)(2), (e)(4) and (f)(2), including fire protection and flooding safety functions. As explained in the NPRM, this regulation was derived from SOLAS Regulations II–1/31.3 and assumes that a control room partially or completely isolates the crew from the machinery space environment.

One comment said that reference § 62.50–20(a)(3)(ii) (relating to control and monitoring of the electrical *generating and distribution* plant from the control room) should be deleted. This recommendation has been partially adopted. The provision in § 62.50–20(a)(3)(ii) for control and monitoring of the electrical *generating plant* from the control room has been retained in the final rules. Situations arise where the licensed engineer in a control room, without these capabilities, would be effectively isolated from the controls and instrumentation needed to restore power in the event of a blackout. Control of the entire electrical distribution was not intended, however, and the final rules have been modified to provide that compliance with the electrical distribution provision in § 62.50–20(a)(3)(ii) is not required. Compliance is also not required in the comparable SOLAS regulation, II–1/31.3, and the revision reflects contemporary industry practice.

The proposed rule included a reference to § 62.50–20(d) (relating to remote control of fire pumps). One comment recommended that this reference be deleted because it unnecessarily exceeds SOLAS Regulations II–2/4.3.4. This recommendation has been adopted. The

reference does exceed SOLAS and it refers only to vessels not having reduced manning, in which case sufficient crewmembers should be available to quickly respond to the required fire alarms regardless of the location of pump control.

One comment recommended that the reference to the requirement in § 62.50–20(e)(2) for remote control of a required bilge pump from the control room be deleted because it exceeds SOLAS. This recommendation has not been adopted. The intent of § 62.01–5(d) and SOLAS II–1/31.3 and 48 is to ensure the ability to take timely and effective action to counter flooding. Also the need for § 62.01–5(d) is supported by casualty information involving engineroom flooding. Remote control of a bilge pump from the control room is essential to carry out *this* intent and, accordingly, the provision has been retained in the final rule.

To comments expressed uncertainty as to whether the requirements in this paragraph apply to vessels with open control stations. These rules do not apply to vessels with open control stations where reduced manning is not desired; nor do the rules require enclosed control rooms.

Section 62.05–1 Incorporation by Reference

The proposed rules referenced the IEEE "Guide for General Principles of Reliability Analysis of Nuclear Power Generating Station Protection Systems" as the primary standard for the development of failure analysis required by this part. Four comments recommended deleting this reference because it is not a commercial maritime standard, the commercial maritime industry is generally unfamiliar with it, and because it could be applied in a manner that would be overly restrictive and impose a prohibitively high cost. This recommendation has been adopted. Failure analysis, and acceptable formats for failure analysis, are discussed below under *§ 62.20–3(b) Plans for Information, Failure Analysis.*

Three comments recommended comparing the proposed rules to those of the American Bureau of Shipping, and whenever the ABS rules will suffice, adopt them in lieu of the proposed rules. This recommendation has also been adopted, and the rules have been revised to incorporate by reference the ABS "Rules for Building and Classing Steel Vessels" where possible. More extensive incorporation by reference of ABS rules in this rulemaking has not been possible because of differences in requirements, scope, and application.

Two comments suggested that the Coast Guard work with the ABS to resolve differences and change ABS automation rules to facilitate additional incorporations by reference. The Coast Guard is actively working with ABS, ASTM, SNAME, and others to develop industry automation standards and guidelines suitable for future incorporation by reference.

Section 62.10–1(a) and 62.30–1(a) Definitions, Failsafe

Two comments noted the absence of a definition of what is failsafe for a given system and wanted specific failsafe states specified by the Coast Guard, if possible. Section 62.30–1(a) requires the evaluation of failsafe states on a case-by-case basis. Case-by-case evaluation is necessary because systems and vessels vary, and what is safe for one may not be safe for another. For example, shutdown of one of two propulsion engines on a vessel due to overheating may be safe because propulsion can be maintained without jeopardizing the vessel or personnel. On a single propulsion engine vessel, however, the same shutdown would result in loss of propulsion and should not be considered "failsafe" because a less critical alternative, *e.g.*, a reduction in power without shutdown, may be possible and preferable. Table 62.10–1(a) provides a listing of *typical* failsafe states for automated equipment specified in the rules.

One comment requested clarification of what is considered to be the failsafe state for remotely operated fuel tank valves. These valves should fail closed under fire conditions, but should fail open under other conditions to permit continued operation of engines. Table 62.10–1(a) has been revised to reference § 56.50–60(d) which specifies these valves must either fail closed or have a stored energy system to close them.

One comment said that some safety systems should be allowed to fail in an "as is and alarm" state rather than result in the shutdown of vital machinery. The table has been revised to include this option.

Section 62.20–1(a) Plans for Approval

One comment asked if automation plans, test procedures, and failure analysis can be submitted at any time for review and approval. Automation plans must apply to a specific vessel, and must be submitted for review in accordance with Subparts 50.20 and 62.20. However, § 50.20–15(a) provides that if a manufacturer wishes to fabricate equipment in accordance with plans previously approved, including work accomplished under a previous contract, resubmittal of plans is not required if the equipment is certified to be identical, that there are no changes in the applicable regulations, and that the same Coast Guard plan review office, *i.e.*, the Marine Safety Center, is the approving authority. The Coast Guard will review previously approved plans to determine if they are suitable for the specific vessel and system application. The industry is encouraged to take advantage of the provisions of § 50.20–15(a) as they are both time and cost effective for the Coast Guard and industry alike. A manufacturer or shipyard planning to use previously approved plans should contact the Marine Safety Center to discuss establishment of a design file, how plan modifications and contract-specific details are to be treated, how information plans are to be treated, and similar details.

Sections 62.20–3(a)(2), 62.50–20(h) and 62.50–30(j) Planned Maintenance Program

The final rules require a planned maintenance program on vessels automated to replace specific personnel or to reduce overall crew requirements. The rules also require that this program be submitted to the OCMI as an information document for use in evaluating automated vessels and the proposed manning. Two comments suggested that these requirements are unnecessary and recommended deleting them. These recommendations have not been adopted. Planned maintenance programs are necessary on these vessels because of a potential reduction in the maintenance work force, an increase in the sophistication and quantity of equipment that must be maintained, and the reliance of the crew on the automated equipment. The Coast Guard has required and approved maintenance programs under the provisions of NVIC 1–69. Section 62.50–20(h)(1) states that program content and detail are optional, provided it includes the necessary maintenance and repair manuals and checkoffs to help avoid errors of omission. Sections 62.50–1(b)(4) and the new § 15.715(a) of the recently adopted "Manning Requirements" state that Coast Guard acceptance of automated systems to replace specific personnel or to reduce overall crew requirements is predicated upon a planned maintenance program to ensure continued safe operation of the vessel. Maintenance programs vary from provision of scheduled shore-side maintenance personnel for vessels with a dedicated route, to the provision of a detailed

program carried out by a reduced shipboard engineering complement. The Coast Guard considers this information in evaluating automated vessel manning requests.

Section 62.20–3(b) Plans for Information, Failure Analysis

The proposed rules required submittal for approval of a qualitative, non-numeric failure analysis of *all* vital system automation. The proposed requirement for review and approval of a qualitative failure analysis of all automation was part of a multi-tiered safely scheme comprising failure analysis at the design stage, oversight of the analysis by the Coast Guard, review of safety requirements for overpressure, overcurrent, fire safety, shock, and similar material characteristics, design verification testing to confirm the accuracy of the failure analysis, a shipboard trial period, and follow-up periodic safety tests to confirm that the system continues to operate safely. In many respects, this scheme was more comprehensive than past criteria. The proposed requirement represented an expansion of Coast Guard policy in recent years of requiring a qualitative failure analysis for microprocessor-based vital system automation because of the complexity of these systems. It was also comparable to the requirements of various classification societies such as the American Bureau of Shipping (ABS).

Five comments opposed the use of qualitative failure analysis as the primary means to evaluate safe functioning and reliability of designs. The comments suggested that potential abuses and a decrease in safety could result along with uncertainty among designers as to application of the regulations, and they emphasized that the proposal would unnecessarily add to the overall costs of relatively uncomplicated systems on smaller vessels. In accordance with these comments, proposed § 62.20–1(a)(4) and § 62.30–10, which required failure analysis approval for *all* vital system automation, have been deleted. However, the final rules (§ 62.20–3(b)) retain a requirement for qualitative failure analysis for certain complex systems and particularly vital safety features. As recommended by the comments, detailed automation piping and wiring plans currently required by 46 CFR Subchapters F and J will continue to be required.

Qualitative failure analysis is a relatively new concept for many in the industry. Detailed plan review is adequate for simpler systems. The approach taken by the final rules minimizes the financial impact on the industry by requiring qualitative failure analysis only in those cases involving complex systems where experience shows that the analysis is necessary and the industry is generally familiar with the concept. Qualitative failure analysis will be used to *assist* in evaluating the safe functioning of complex systems represented by detailed piping and wiring plans. This approach is similar to the requirement for stability calculations required by 46 CFR 170.090 (which aid in the evaluation of vessel stability) and is similar to the requirement for calculation of short circuit currents (fault current analysis) required by 46 CFR Subpart 111.52 (which aids in the evaluation of vessel electrical systems).

As discussed above, experience has shown that analysis is necessary for certain complex systems. A brief discussion of the analysis requirements in the final rule and why they were retained follows.

(a) Section 62.20–3(b)(1) of the final rules requires a qualitative failure analysis for propulsion controls. As discussed in the NPRM, Coast Guard casualty records include several cases where these vital and often complex systems have failed, resulting in loss of control of the vessel and ensuing damage. Experience has shown that numerous casualties can be prevented by the use of failure analysis at the design stage to identify the design flaws that have resulted in many of these casualties.

(b) Section 62.20–3(b)(2) of the final rules requires a qualitative failure analysis of microprocessor based system hardware. This requirement has been a policy of the Coast Guard since 1983. It is necessary because of the complexity of these systems and their tendency to fail in indeterminate modes, making traditional evaluation by detailed plan review impractical and ineffective.

(c) Section 62.20–3(b)(3) of the final rules requires a qualitative failure analysis of safety controls. This requirement is necessary to aid in the evaluation of the required reliability, functional independence, and failsafe operation of these particularly important controls.

(d) Section 62.20–3(b)(4) of the final rules requires a qualitative failure analysis of electrical power management systems. Electrical power management systems have become increasingly complex in recent years in an effort to increase vessel efficiency. This requirement is necessary to evaluate the effect of electrical power management system failure on the continuity of ship service electrical power, the propulsion plant, and the overall reliability and safety of vessel systems that rely on electricity for power.

(e) Section 62.20–3(b)(5) of the final rule requires a qualitative failure analysis for automation equipment or functions that are required to be independent but that are not physically separate. This requirement is necessary to evaluate the safety of systems and equipment which share a common component or components, such as a control actuator, data bus, or uninterruptable power supply, but which must still be able to function independently in the event of failure in one of the systems. The failure analysis will typically only address the effect of failures to these common components on otherwise physically separate systems or functions.

(f) Section 62.20–3(b)(6) of the final rule requires a qualitative failure analysis of any other vital system automation that, in the judgment of the Commandant, constitutes a safety hazard to the vessel or personnel in case of failure. This requirement is necessary to address the safety and reliability of new or innovative automation designs or technologies, and to address automation that, as the result of future casualty experience, the Commandant considers particularly hazardous in the event of failure.

Section 62.20–3(b) includes a note explaining the intent, level of detail, procedures and content necessary for the required failure analysis. The note states that analysis need only be to a level of detail necessary to show compliance with the requirements of this rulemaking. One comment suggested that analysis should be conducted to a detailed component level in order to be of value because it is at that level that failures occur. This recommendation has not been adopted. The discussion in the NPRM said that it is not intended that the failure analysis be performed to the extremely detailed level. Normally, the level of analysis would be to the major subsystem or major replaceable component level, such as a remote control subsystem, power supply, or actuator. Once the analysis identifies that required safety provisions are met, *e.g.*, failsafe, functional independence, safety trips, operation, etc., additional analysis of the feature in greater detail is not needed to determine safe operation after failure.

Section 62.20–5(a) Self-Certification

The proposed rules required the designer and manufacturer of an

automated system to certify to the Coast Guard, in writing, that the system is designed to meet the environmental design standards of proposed § 62.25–30. The proposal also stated that plan review and independent testing to show compliance with the referenced standards was not necessary. Four comments said that self-certification is inadequate and recommended equipment testing to determine compliance with environmental design standards. This recommendation has not been adopted. With few exceptions, self-propelled vessels are classed by a classification society, and their automation equipment is therefore tested to environmental design standards of the classification society by the manufacturer. Additional environmental design testing by the manufacturer for the Coast Guard would be unnecessary duplication of effort and cost, particularly considering the assumptions of this rulemaking concerning equipment failure and the requirements for failsafe operation, alternate control, failure analysis, plan review, design verification testing, shipboard trial periods and follow-up periodic safety tests. On the occasional unclassed vessel, the accountability of the designers, the manufacturers, the owner, and the operator should avoid abuses in the self-certification process.

Section 62.25–1(b) Proposed Posted Operating Instructions

Proposed § 62.25–1(b) required operating instructions to be provided and emergency operating instructions to be posted at control stations when the operation is not common or readily apparent. Two comments said the required posting of emergency operating instructions is unnecessary because they would have to be voluminous and superfluous and would clutter the control station, would duplicate the technical manuals already required by § 62.20–1(a)(8), and because the licensed engineers should normally be aware of emergency procedures without reference to posted instructions. In accordance with these comments, proposed § 62.25–1(b) has been deleted. It should also be noted that Section 15.405 of the new manning rules requires each licensed engineer to become familiar with the relevant characteristics of the vessel, including emergency duties, controls, and main propulsion and auxiliary machinery, prior to assuming his or her duties on the vessel.

Section 62.25–1(b) of the final rule provides that automation which controls or monitors more than one safety control, interlock, or operating sequence must perform all assigned tasks continuously, *i.e.*, the detection of unsafe conditions must not prevent control or monitoring of other conditions. Three comments said this requirement should be revised to allow scanning type monitoring rather than continuous monitoring. This recommendation has not been adopted. The rule is intended to preclude systems that identify and process individual problems for an indeterminate length of time, to the exclusion of other, possible more important, assigned responsibilities. Such operation is not equivalent to manual control and monitoring by the crew. Automated systems that repeatedly scan inputs or conditions with sufficient speed to be equivalent to manual monitoring, however, would be acceptable.

Sections 62.25–5(a) and 62.35–5(d) Control Location

Proposed § 62.25–5(a) required control of propulsion systems, electric power generation systems and electric power distribution systems to be from only one location at a time, except for safety trips. One comment recommended deleting reference to electric power generation systems and electric power distribution systems because it would prevent pilothouse load and generator selection input to electric power management systems which are controlled in the engineroom with remote input from the pilothouse. This comment has been adopted in § 62.35–5(d), and proposed § 62.25–5(a) has been deleted.

Section 62.25–5(c) Control Systems, Inadvertent Grounding

The proposed rule said that inadvertent grounding of an electrical or electronic safety control system must not cause false signals or safety control bypassing. One comment recommended that the use of self-monitoring circuits which would automatically alarm if there is a ground should be allowed as an alternative. The recommendation has not been adopted. The intent of the rule is to preclude, by design, unsafe effects of grounds on control systems. The proposed alternative would not normally be acceptable because it does not preclude these effects; it only alarms them.

Section 62.25–20 Instrumentation, Alarms, and Centralized Control Locations

The rules in this section are performance standards that provide performance criteria for instrumentation and alarm displays. They do not provide specific requirements for any particular instrumentation technology, *e.g.*, analog gauge displays, digital displays, or cathode ray tube (CRT) displays. Three comments recommended that specific requirements for CRT displays be added. Reasons cited included CRT susceptibility to single failures, their inability to continuously display information during alarm conditions, and the limitations on the amount of information that can be displayed at one time. These recommendations have not been incorporated in the final rules. CRT displays can provide the same performance capabilities as conventional console displays and both are considered to be acceptable as long as they meet the standards in these rules. Depending on their configuration, both can be susceptible to single failures that can eliminate most or all of their display capability and, accordingly, both are evaluated to determine the effects of such failures. The limitation on the amount of information that can be displayed at one time by a CRT is comparable to the limitation on the amount of information that can be effectively observed at one time on a large conventional console display, *ie.*, the CRT screen display is comparable to the viewable portion of the conventional console. Also, both CRT's and conventional systems can be configured to simultaneously display both alarm and system information, *e.g.*, one CRT used to display only alarm conditions.

Paragraph 62.25–20(b)(2) requires systems with remote instrumentation to have provisions for the installation of instrumentation at the monitored system equipment. Two comments asked whether this rule requires permanently installed instruments. The answer is no. This paragraph does not require instruments to be permanently installed and it is identical to a longstanding guideline in NVIC 1–69 that was intended to make sure instruments can be utilized at the equipment location if the remote monitoring system fails.

Paragraph (b)(3) of the proposed rule required the status of automatic or remotely controlled vital auxiliaries, power sources, switches, and valves to be visually indicated in the machinery spaces and at the cognizant remote control location. The second sentence of the note to the proposed rule provided that if status was clearly indicated by other instrumentation, such as pump status indicated by pump output pressure indication, additional status indication would not be necessary. One comment recommended that this provision in the note be deleted because the distinct status indicators at the ECC for pumps provide valuable information in determining the cause of low pressure

alarms. The note in the final rule has been revised to incorporate this recommendation.

Paragraph (b)(5) of the proposed rule required that all data displays required to be alarmed must have continuous or demand instrumentation displays in the machinery spaces unless Table 62.35–50 specified otherwise. One comment said this requirement appeared to be a change in policy because NVIC 1–69 required the displays to be at the ECC, and recommended that the past policy be continued to aid the operator in monitoring the plant. There was no intent to modify the policy in NVIC 1–69. The final rule has been reworded to emphasize that instrumentation displays must be provided in the EEC or in the machinery ·space if an ECC is not provided.

Proposed paragraph (d)(1)(ii) required alarms to clearly distinguish between fire, general, CO_2/halon, machinery, flooding, and non-vital alarms. One comment said that the engineers' assistance-needed alarm of 46 CFR Subpart 113.37 should be added to the list because of its importance. The final rule has been changed to adopt this recommendation.

One comment said this rule should specify colors for alarm indicators. This recommendation has not been incorporated. The markings required for general alarms and fire safety alarms can be found in the individual vessel subchapters. The Coast Guard will continue its policy of accepting any consistent application of optional automation alarm color codes, pending the completion of the Code for Alarms presently being developed by the International Maritime Organization (IMO).

Paragraph (d)(2) of the rule says that required alarms in high ambient noise areas must be supplemented by visual means, such as rotating beacons. One comment recommended that if there are non-vital alarms in high ambient noise areas, they should consist of rotating beacons only to minimize confusion with the required alarms. This recommendation has not been adopted. A requirement for beacons on non-vital alarms, in addition to the beacons already necessary to draw attention to *required* alarms, will only add to confusion and difficulty in providing distinct alarm indication.

Paragraph (d)(6) of the proposed rule required failure of a control or alarm system to be alarmed at a manned control station. One comment said that for unattended plants, this would result in unnecessary alarms on the bridge. The comment said this rule appears to conflict with § 62.25–20(g)(3), which requires minimization of bridge alarms, and recommended that these alarms only be extended to the engineers' accommodations. The final rule has been changed to require the alarm in the machinery spaces and at the ECC, if provided. The rule was not intended to unnecessarily require alarms on the bridge.

Paragraph (e)(vii) of the final rule requires audible alarms to annunicate until manually acknowledged. One comment recommended that manual acknowledgment be required at the ECC in accordance with past Coast Guard policy. The final rule has not been changed. NVIC 1–69 and these rules do not require a central control station unless the vessel is automated to replace specific personnel or to reduce overall crew requirements. If an ECC is not provided or required, the alarms may be safely located and acknowledged at the equipment. If an ECC is required, then the rules require alarms and manual acknowledgment at the ECC, as recommended by the comment.

Section 62.25–25 Programmable and Adjustable Systems and Devices

Paragraph (a) of the rule prohibits programmable control or alarm system logic from being altered after design-verification testing without the approval of the OCMI. It also requires a means, acceptable to the OCMI, to make sure setpoints remain within the safe operating range of the equipment. Four comments said this requirement should not prohibit the normal practice of adjusting setpoints and tuning vital system automation. The rule has not been changed. It does not restrict the adjustment of setpoints within the safe operating range of the equipment. It requires a means to make sure that safety trip control, safety limit control, and alarm setpoints cannot be readily or inadvertently adjusted to the extent that they becom e meaningless and ineffective in ensuring safety and preventing equipment damage.

One comment said the rule would require numerous spare circuit boards to be carried, instead of allowing replaceable multiple-use boards that are typically carried and recalibrated on board. The rule has not been changed. It does not prohibit or make the use of multiple use boards impracticable. The *logic* of the calibrated board in a specific application cannot be changed without the approval of the OCMI because it can represent a re-design of the approved system.

Proposed paragraph 62.25–25(b) required operating programs for microprocessor-based or computer-based vital control, alarm, and monitoring systems to be stored in memory that did not rely on mechanical devices. One comment recommended that mechanical memory storage such as disk drives be permitted if provided in duplicate. The final rule has been changed in accordance with this comment to permit disk drives and similar mechanical devices. Analysis and experience with such installations since the NPRM have shown they can be safely applied. These devices are subject to failure analysis under the provisions of § 62.20–3(b)(2).

Paragraph (c) of the rule provides that if microprocessor-based or computer-based systems serve both vital and non-vital systems hardware and software priorities must favor the vital systems. One comment recommended that failures that cause incorrect priorities be alarmed. The rule has not been changed. These systems are subject to failure analysis to identify such malfunctions, and the rules require failure of all vital control and alarm systems, including microprocessor-based and computer-based systems, to be alarmed.

Section 62.25–30 Environmental Design Standards

Paragraph (a)(4) of the proposed rule required automation to be designed to be suitable for a relative humidity of 0 to 100%. Two comments recommended changing the requirement to 0 to 95% relative humidity because it is typical for industry design and because 100% relative humidity is unrealistic and will create unnecessary costs and design changes for previously acceptable equipment. The final rule has been changed in accordance with these comments to require automation to be suitable for 0 to 95% relative humidity.

Paragraph 62.25–30(b) of the final rule requires low voltage electronics to be designed with due consideration for static discharge, electromagnetic interference (EMI), fungal growth, and contact corrosion. One comment said that an EMI standard such as MIL–STD–461B should be referenced. This recommendation has not been adopted. Incorporation of a specific EMI standard such as MIL–STD–461B would unnecessarily eliminate other equally effective and less stringent performance criteria to prevent EMI.

Section 62.30–5(b) Independence

The proposed rule required the primary control, alternate control, and safety control systems for any vital system to be independent of each other, and required alarm and instrumentation systems to be independent of primary

and alternate control systems, including sensors. Four comments said that the rule should also require alarm and instrumentation systems to be independent of primary control, alternate controls, and safety controls because the classification societies require this type of independence and because this would make safety systems independent of alarm systems, thus enhancing their reliability. The final rule has been changed to adopt this recommendation. This change will prevent an unnecessary and costly conflict with the requirements of the classification societies while maintaining acceptable functional independence criteria.

Four comments recommended deleting the requirement for having independent sensors because they are expensive, preclude some safe parallel redundant control and monitoring schemes, and are impractical in many cases. Two comments supported having independent sensors for propulsion control speed or pitch feedback because sensor failure can result in system runaways but indicated that additional requirements concerning independent sensors are unnecessary. The final rule has been changed to require sensors for primary speed, pitch, and direction of rotation control in closed loop propulsion control systems to be independent and physically separate from required safety control, alarm, or instrumentation sensors. Coast Guard casualty records confirm that propulsion control feedback sensor failure can result in propulsion machinery runaway. The final rule has also been changed to delete the requirement for other alarm and instrumentation sensors to be independent for the reasons given in the comments and because any potential impact on safety is substantially offset by requiring alarm and instrumentation systems to be independent of primary controls, alternate controls, and safety controls.

One comment said that certain critical functions such as "stop" should not be processed by a computer and should be separate and independent because experience showed that a computer malfunction has resulted in a shutdown failure. The final rule has been changed to require the propulsion safety trip control of § 62.35–5(c)(1)(ii) to be independent and physically separate. This is consistent with past Coast Guard policy in NVIC 1–69 and the application of SOLAS requiring these safety trip controls to be independent and physically separate.

Section 62.30–5(c) Power Source Failure Alarm

The proposed rule required failure of either of the two required power sources to cause an alarm in the machinery spaces. One comment said that only the loss of the normal source should be alarmed because SOLAS only requires alarming of the normal source. This recommendation has been adopted for the reason given and because the visible indicator and test switch requirements for emergency power sources in 46 CFR Subpart 112.45 provide protection equivalent to alarming the failure of the emergency power source.

Section 62.30–15(b) Built-In Test Equipment

The proposed rule required built-in test equipment that failed to return the tested system to normal operation to cause an alarm at a manned control location. One comment recommended that the requirement for an alarm be deleted because it is unnecessary, expensive, and the required indicator at the control station provides sufficient information to the operator. The final rule has been changed to delete the requirement for an alarm. In addition to the reasons given, the criteria for causing the alarm, *e.g.*, operator not in attendance, time, etc., can be very subjective.

Section 62.35–5 Remote Propulsion Control Systems

This section addresses propulsion control in terms of speed and direction of thrust of the propeller. One comment said that this approach is too general and may allow interpretations deviating from the intent of SOLAS and Coast Guard policy. The comment recommended that the concept of propulsion control be addressed more specifically in terms of discrete engine speed control and propeller direction control. This recommendation has not been incorporated. The performance requirements in these rules and SOLAS are intended to address overall vessel propulsion control, regardless of whether it is attained by integrated or discrete engine speed control or propeller control.

Paragraph (c)(3) of the proposed rule required an indicator to be provided at the main pilothouse control location to annunicate when the shaft direction or the pitch of a controllable pitch propeller did not match that commanded by the navigating bridge operator control device. Two comments stated that this requirement is unnecessary because the required indication is provided by the shaft speed and thrust indicators required by Subpart 113.37 of this Chapter. This recommendation has been adopted, and proposed paragraph (c)(3), as well as the listing for an associated main propulsion remote control wrong direction alarm in Table 62.35–50, have been deleted from the final rules. The intent of the proposal was to indicate failure of the propulsion control system. The indications required by 46 CFR Subpart 113.37, in conjunction with the requirements for failure analysis, failsafe operation of propulsion controls, and alarming of propulsion control failure adequately meet the intent.

Paragraph (c)(1) of the rules navigating bridge propulsion control to include automatic performance of all associated services and not to allow overloading of the propulsion machinery during normal operation. One comment recommended extending the overload protection criteria to other control locations. This recommendation has not been adopted. The engineers in the ECC or at the local manual control station are generally more familiar with the limitations of the machinery and have more detailed instrumentation available to monitor possible overload. One comment said the rule should include protection during abnormal operation because overloads may be higher. This recommendation has been adopted. The intent of the requirement, as stated in NVIC 1–69 and SOLAS, is to prevent overload of the propulsion system as the result of movement of the bridge control device. The final rule has been changed to require the control system to prevent the rate of movement of the control device from causing overload of the propulsion machinery.

Paragraph (c)(3) of the final rule requires alarms on vessels propelled by internal combustion engines to indicate starting power of less than 50% of the required capability. It also requires that if automatic starting is provided, the number of automatic consecutive attempts that fail to produce a start must be limited to a reserve of 50% of the required starting capacity, which is required to be 12 starts for reversing engines, and 6 starts for non-reversing engines. Two comments recommended that the rule be changed to require limiting the number of automatic consecutive attempts to three, after which an alarm sounds and reset of the equipment by the operator is necessary prior to further automatic starting attempts. This recommendation has not been adopted. However, the recommendation represents an acceptable option that is consistent with

the rule and the requirements of SOLAS and the classification societies.

One comment said that there should be no limit on the number of automatic consecutive attempts because the low starting air alarms required by this section and the ability of the operator to override automatic starting attempts constitutes adequate protection against inadvertent depletion of starting capacity. This recommendation has not been incorporated. It is contrary to common industry practice and SOLAS requirements which limit automatic starting attempts to safeguard starting power.

Paragraph (d) of the rule incorporates ABS provisions which require automatic remote primary control systems to automatically prevent control location transfer from significantly altering propelling thrust. One comment said these requirements are unnecessary because it is normal practice for operators to manually align control levers before transfer to equalize signals at both stations and therefore prevent a change in thrust. The final rule has not been changed because it reflects NVIC 1–69 and SOLAS requirements. Many automation designs are arranged so that control transfer cannot occur unless the control levers are aligned as described by the comment.

Proposed paragraph (f)(2) required an automatic propulsion turbine safety trip to prevent inadvertent movement as a result of control system malfunction. One comment recommended that this requirement be deleted because the trip could itself malfunction and unnecessarily result in the loss of propulsion. This recommendation has been adopted. The proposed trip requirement has been deleted for the reason given and because the requirement in paragraph (e)(3) of the final rule for propulsion control systems to be failsafe provides the intended protection against inadvertent vessel movement resulting from control system malfunction.

Paragraph (e)(2) in the final rule permits a temporary override, located at the main navigating bridge control location, for propulsion machinery automatic safety trips. One comment said that these overrides should not be permitted because bridge personnel do not have the training or information necessary to make decisions concerning the propulsion machinery. The rule has not been changed. These optional overrides are permitted by SOLAS, are common industry practice, and have been accepted by the Coast Guard in the past. If an owner or operator does not feel the bridge personnel have the training or information necessary to make decisions concerning the propulsion machinery, they have the option not to install or permit use of the override. In other cases, the overrides permit the bridge personnel to reduce power settings or maintain steerage in emergency maneuvering situations.

Paragraph (e)(3) of the final rule requires remote propulsion control systems to be failsafe by maintaining the preset speed and direction of thrust until local manual or manual alternate control is in operation. Three comments suggested clarification of the term preset. One of these comments suggested that preset means "as is". Another suggested that preset means the setting of the mechanical speed governor. The final rule clarifies that preset means "as is," as the SOLAS regulation has been interpreted by the Coast Guard, classification societies, and manufacturers in the past. This permits the operator to either maintain plant status until local or alternate control is achieved, or to trip the plant using the manually activated safety trip required by § 62.35–5(b)(2). These options are superior to "trip" or "Zero" in a maneuvering situation. In some specific cases, where it does not result in a significant speed change, the preset setting of the mechanical speed governor is acceptable, but must be evaluated on a case-by-case basis.

One comment said that only loss of control power should be considered as a cause when evaluating failures of remote propulsion controls for compliance with this rule. This recommendation has not been adopted. Other causes in addition to control power failures, such as loss of feedback signal and computer malfunction, have resulted in casualties involving propulsion control failures.

Section 62.35–10 Flooding Safety

Paragraph (a)(1) of the proposal required automatic bilge pumps to be provided with an independent bilge high level alarm system. Three comments recommended that bilge high level alarms be permitted as part of the central alarm system because this has been permitted by NVIC 1–69. This recommendation has been adopted. The final rule has been changed to require bilge high level alarms to be independent of the automatic bilge pump controls. This is consistent with the requirements of NVIC 1–69 and there was no intent to modify that policy.

Paragraph (a)(2) of the rule requires automatic bilge pumps to be monitored to detect excessive operation in a specified time period. One comment recommended that the time period be specified. The final rule has not been changed. The intent is to detect excessive leakage which may be a prelude to a major casualty, and the time period for detection depends on variables that are different for each ship, such as size of the pump and size of the bilge wells. The operator usually establishes the time based on the particulars of the vessel, *e.g.*, the time it takes for the automatic bilge pump to drain the bilge well.

Section 62.35–20 Oil Fired Main Boilers

Proposed paragraph (c)(1) required automatic combustion control subsystems to provide the air/fuel ratio necessary for complete combustion and stable flame with the fuel in use, but in no case less than 10% excess air. Four comments recommended deleting the requirement for 10% excess air because it is inefficent and safe operation can be obtained with excess air of less than 5%. This recommendation has been adopted. The final rule as changed should allow flexibility in attaining a safe and efficient air/fuel ratio. This change essentially retains the air/fuel ratio provision in NVIC 1–69.

One comment recommended that automatic combustion controls be required to have a low fire interlock to prevent boiler damage during warn up, as required by NVIC 1–69. This recommendation has been adopted, and a new subparagraph (c)(3) has been added to require automatic combustion control subsystems to provide a low fire interlock to prevent high firing rate and superheater damage during boiler warm-up. This was an unintended omission from the NPRM.

Paragraph (d)(1) requires boilers to undergo a continuous purge of at least 5 changes of air volume. This is a change of policy from the minimum of four changes of air required by NVIC 1–69. One comment said the change from the past policy is unjustified. This recommendation has not been adopted. Boiler flareback casualties have been attributed to inadequate purging, and the National Fire Protection Association and the Society of Naval Architects and Marine Engineers both recommend more than 4 changes of air. There is no cost increase associated with this requirement.

Proposed paragraph (d)(2)(ii) required that boiler air flow during light off be at least 25 percent of boiler full load volumetric air flow. This was a change from past policy intended to preclude pocketting of combustible gases and ensure an air rich condition for safe light off. Three comments said this proposed requirement should be reconsidered because it is overly restrictive, the

airflow necessary for lightoff varies from installation to installation, and the proposal is contrary to the practice of closed register light off recommended by many manufacturers. The final rule has been revised by deleting the 25% airflow criteria and by requiring total boiler airflow during lightoff to be sufficient to prevent pocketting and explosive accumulations of combustible gases, *i.e.*, to provide an air rich furnace atmosphere. This change is consistent with the intent of the proposed rule, and permits necessary performance flexibility.

Proposed subparagraph (d)(2)(iv) required the burner trial for ignition period to be no longer than 5 seconds. This was a deliberate change from NVIC 1–69, which permitted trial for ignition periods of up to 15 seconds. The proposed rule was intended to minimize the amount of unburned fuel that enters the boiler. One comment said 5 seconds is too short because it won't allow settling of air flow after the purge that immediately precedes trial for ignition. One comment said it should be increased to 10 seconds, and two comments recommended that the NVIC 1–69 requirement of 15 seconds be continued. The final rule has been changed to require the trial for ignition period to be as short as practical for the specific installation, but in no case longer than 15 seconds. This will allow periods longer than 5 seconds, if necessary, while minimizing entry of unburned fuel into the boiler.

Subparagraph (d)(3)(ii) prohibits automatic increases in air flow to the boiler following boiler safety trip control operation. One comment said that the rule should be changed to require operation of the boiler safety trip control to cause immediate automatic post-purge of the boiler to clear the furnace of unburned oil vapors. This recommendation has not been adopted. Boiler safety trip occurs when there is a problem, such as flame failure. Automatically increasing airflow can result in an explosive atmosphere in a malfunctioning hot boiler. Following boiler safety trip, air flow changes should be gradual and under manual control, preferably after the cause of the trip has been determined and corrected.

Paragraph (i) lists the conditions that must result in closing the master and all burner fuel oil valves. One comment recommended that burner valve position feedback to the burner and boiler safety trip controls be required and that unsuccessful burner shutdown be an additional condition that causes valve closure. In support of the recommendation the comment said this would ensure that the commanded valve position actually occurred and would encourage proper maintenance of valves and valve actuators. This recommendation has not been adopted. It could result in tripping the boiler because of unsuccessful shutdown of a single burner, causing a loss of propulsion or loss of electric power to the vessel. Instead, a requirement for burner valve status instrumentation (open/closed) has been added to Table 62.35–50 to provide the recommended burner valve position feedback to the operator. This requirement is consistent with § 62.25–20(b)(3), which requires the status of automatically or remotely controlled vital valves to be visually indicated.

Section 62.35–35 Internal Combustion Engines

Proposed paragraph (b) required all controls and alarms for gas turbines to be provided at a centralized control location. This rule has been deleted because it unnecessarily duplicates the requirements of §§ 58.10–15 and 62.25–20(g).

Section 62.35–40(b)(1) Coal Fuels

The proposed rule provided that systems and equipment that operate on coal or two types of fuel, such as oil/gas, oil/coal, heated/unheated oil, and heavy/light oil require special consideration by the Commandant (G–MTH). Three comments said that, with the exception of coal, the rules are adequate for safety without special consideration by the Commandant, and recommended that the rule only require special consideration of coal systems. This recommendation has been adopted. There are sufficient requirements in Part 62 and elsewhere in Title 46 CFR to address the safety of oil-gas, heated/unheated oil, and heavy/light oil fuel systems. The final rule only requires controls and instrumentation for coal systems to be subject to special consideration by the Commandant (G–MTH).

Section 62.35–50 Tabulated Monitoring and Safety Control Requirements for Specific Systems

The rule includes a tabulation of automated system instrumentation, alarms, and safety control requirements that apply if the system listed is provided or required. The tabulation includes the requirements in Part 62 and provides clarifying notes. The table has been developed from NVIC 1–69, SOLAS, and experience gained with past and contemporary designs.

The table does not specify instrumentation location. One comment recommended that the table specify instrument location as local, remote, or both. This recommendation has not been adopted. The location requirements vary with vessel configuration and degree of automation, *e.g.*, if an ECC is provided or required, or if the vessel is designed for minimally attended or periodically unattended machinery spaces, etc. Location requirements can be found in § 62.25–20(b) (Instrumentation Location), § 62.25.20(g) (Central Control Locations), § 62.01–5(d) (Central Control Rooms), Subpart 62.35 (Requirements for Specific Types of Automated Vital Systems), and §§ 62.50–20 and 62.50–30 (Additional Requirements for Minimally Attended and Periodically Unattended Machinery Spaces).

The proposal included requirements for engine coolant tank level instrumentation. One comment recommended deleting this requirement because it was excessive, exceeded the requirements of classification societies, and the low level alarm provided adequate safety. This recommendation has been adopted for these reasons.

The proposal included a requirement to monitor main propulsion diesel engine fuel oil pressure to injectors. Two comments recommended changing this requirement to monitoring of fuel oil booster pressure because the high pressure of fuel oil to injectors is impractical and dangerous to monitor. This recommendation has been adopted for the reason stated.

One comment recommended that an alarm to indicate standby generator failure should be added to the table. This recommendation has not been adopted. The lack of ship service power will be obvious and the other ship service and emergency generator alarms provide adequate indication.

One comment recommended that pitch indication be included in the table requirement for main propulsion remote control shaft thrust instrumentation. This recommendation has been adopted. Pitch indication is required by § 113.37–5.

One comment recommended adding auxiliary boiler alarms to the table. This recommendation has been adopted, and the rule has been changed to require running indication and a trip alarm for vital auxiliary boilers, with reference to the detailed control and alarm requirements in Part 63, Control Systems for Automatic Auxiliary Heating Equipment. The reason for this change is to provide operators with summary status information and failure information for auxiliary boilers that are vital; *e.g.*, they provide steam for ship service turbo-generators or for heating

fuel used in propulsion engines. This requirement is similar to the instrumentation and alarm requirements for other vital auxiliaries listed in the table.

One comment recommended that the table require an exhaust gas temperature deviation alarm for each exhaust belt of diesel main propulsion engines and diesel generator engines, where more than one exhaust belt is provided, because it would alarm failure of a fuel pump. This recommendation has not been adopted. The individual cylinder deviation alarms required by the table provide adequate indication of fuel pump failure.

Note 18 in the proposed Table required fire detection systems to use flame or smoke detectors, or a combination of these. Two comments recommended changing this requirement becuase SOLAS does not permit the use of flame detectors alone. This recommendation has been adopted and the rule has been changed to agree with SOLAS and current Coast Guard policy. The note now says that the use of thermal detectors alone is subject to special consideration by the Commandant (G–MTH), and flame detectors may only be used in conjunction with smoke or thermal detectors.

Subpart 62.50 Automated Self-propelled Vessel Manning

Sections 62.50–20 and 62.50–30 specify additional requirements for minimally attended machinery plants and periodically unattended machinery plants. Two comments recommended defining the terms minimally attended machinery plants and periodically unattended machinery plants. The preamble to the NPRM included descriptions of these terms. These descriptions have been included as notes to §§ 62.50–20 and 62.50–30 in the final rules to provide clarification of the terms.

The rules do not specify engineering manning or watchstander levels on automated vessels. NVIC 1–69 provided general guidelines for the reduction of manning in machinery spaces on automated vessels, and also referred to the elimination of specific watchstanders by the installation of specific automation. These rules, NVIC 1–69, and the manning rules in Part 15 of this chapter refer to the OCMI as the authority who specifies an automated vessel's minimum manning based upon the evaluation of the vessel's equipment, automation reliability, planned maintenance program, crew organizational structure, trade, route, and other factors listed in §§ 62.50–1, 15.501(b), 15.705(a), and 15.715. Three comments recommended that the rule specify standard minimum manning levels for automated enginerooms. Two of these comments said that without specific standard manning levels, the OCMI might be subject to pressure to reduce manning below levels necessary for safety, and that manning levels for similar vessels would vary from OCMI to OCMI and port to port. The third comment said that arbitrary judgments by OCMI's would be disastrous to commercial eocnomics and labor/management relations. A fourth comment entirely supported the proposed approach taken.

The recommendation to specify standard manning levels has not been adopted. The OCMI has the authority and responsibility to issue the Certificate of Inspection which specifies the vessel's complement. The OCMI determines the minimum complement consistent with safety based upon evaluation of the crew and vessel to meet the criteria described above. There is no change from NVIC 1–69 to the final rule regarding the OCMI's role. Coast Guard Headquarters has been involved for several years in evaluating the safe manning of each and every automated vessel and in administering a Coast Guard wide uniform manning policy. This Headquarters involvement should prevent inconsistencies or arbitrary judgments by OCMI's referred to in the comments.

As stated in the NPRM, the references to specific levels of manning and watchstanders in NVIC 1–69 have misled people into believing that if specific automation is provided, specific manning is assured, without regard to the other essential criteria in these rules and the manning rules and in the new Part 15. The Coast Guard's policy has been, and continues to be, the emphasis of these latter considerations. The lack of reference to specific manning levels and watchstander levels in the rule is intended to eliminate the misconception that specific manning is assured if specific equipment is provided.

One comment recommended that the rules require a licensed engineer and an unlicensed rating to be on watch in automated enginerooms. The comment said it would afford the crew and vessel a reasonable degree of safety, allow simultaneous monitoring and maintenance of automated equipment, provide additional help and a back-up crewmember if necessary, and provide sufficient personnel to cope with emergencies. This recommendation has not been incorporated. The setting of watches is the responsibility of the master of the vessel. The comment's reasons for requiring watchstanders are among the considerations in determining the crew complement necessary for the safe operation of the vessel, including evaluation of the complement necessary to allow the master to set appropriate watches.

Section 62.50–1 General

Section 62.50–1(b)(3) requires the engineering manning of vessels incorporating automated vital systems to be conditioned by the proven performance of the plant during an initial trial period. Two comments requested clarification as to whether builder's sea trials are suitable for this purpose. A third comment recommended that successful builder's sea trials be accepted as the trial period for determining crew complement because this is common practice for some foreign flags and it would place U.S. flag vessels in a more competitive economic position. Sea trials are not considered to be adequate to evaluate the reliability of the vessel's automated systems. It is longstanding Coast Guard policy, as expressed in NVIC 1–69 and in section 15.715 of the Title 46 CFR, to require a period of proven operation and reliability of the automation following initial testing and de-bugging (*i.e,* after builder's sea trials) before establishing the final crew complement. SOLAS II–1/31.3 and 46.2 also require measures to be taken to ensure that the equipment is functioning in a reliable manner.

Experience has shown that the safety precaution of a trial period not only helps identify possible ship design and automation problem areas, but it also helps identify problems with the crew organization and complement in responding to emergencies, automation failures, and in maintaining and operating the vessel. The length of the trial period varies, with 6 months being typical for the first in a class of vessels. Subsequent vessels in a class having no major system changes typically undergo shorter trial periods, depending on the circumstances. The complete elimination of the trial period and acceptance of the builder's sea trials may provide some economic benefit to some U.S. flag operators, depending on the labor/management collective bargaining agreement. However, any benefit is more than offset by the potential inadequacy of the automation, crew complement, or crew organization, as demonstrated by some U.S. flag vessels which have had their trial periods extended because of problems encountered with unsafe or unreliable

automation during the required trial period.

Paragraph (c) of the rule states that equipment provided to replace specific crewmembers or to reduce overall crew requirements that proves unsafe or unreliable in the judgment of the cognizant OCMI must be immediately replaced or repaired or vessel manning will be modified to compensate for the equipment inadequacy. One comment said that this rule's provision regarding modifications in manning should be deleted because subjecting vessel manning to re-evaluation introduces unacceptable economic uncertainty for vessel operators. This recommendation has not been adopted. It would permit vessels whose automation proved unsafe or unreliable subsequent to the initial trial period, or whose maintenance requirements increased as the vessel aged, to operate in the unsafe condition of having an inadequate crew complement. The operator has the option, instead of increasing the vessel complement to compensate for equipment inadequacy, of replacing or repairing the equipment that proves unsafe or unreliable. Both of these options have been used in the past.

Section 62.50–20 Additional Requirements for Minimally Attended Machinery Plants

Paragraph (d) of the rules requires ECC control of the main machinery space fire pumps. One comment recommended deleting this requirement because it exceeds SOLAS, which only requires fire pump control from the navigating bridge. This recommendation has not been adopted. The fire pump controlled from the navigating bridge is not always located in the main machinery space, and remote control of the main machinery space fire pumps from the ECC under minimally attended conditions compensates for the crewmembers that would otherwise be present to start machinery space fire pumps. Also, remote control permits those in attendance to perform such tasks as bringing additional electrical generating capacity into play. This requirement is consistent with longstanding requirements in NVIC's 1–69 and 6–72, Guide to Fixed Fire Fighting Equipment Aboard Merchant Vessels. The intent of this rule is to ensure that the firemain can be charged as quickly as possible in the event of a fire.

Paragraph (e) of the proposed rules required the controls for machinery space fixed gas fire extinguishing systems to be operable from the ECC, except for systems that protect the ECC, which must have controls outside the ECC exit that is independent of the machinery space. Two comments recommended deleting the requirement for control from the ECC because it does not increase safety and it unnecessarily exceeds SOLAS requirements. This recommendation has been adopted for the reasons given and because the crew actions involving operation of fixed gas fire extinguishing systems should be the same regardless of manning: evacuate the space, secure the ventilation, and operate the fire extinguishing system from outside the space. Additional control location requirements in the ECC for minimally attended machinery spaces are not considered necessary.

Paragraph (e)(2) of the proposed rule required that either automatic bilge pumps be provided to dewater machinery space locations where liquid might accumulate, or that the ECC be required to include the controls necessary to bring at least one of the bilge pumps required by Subpart 56.50 of this chapter into operation to dewater these locations. Two comments said that control from the ECC of the bilge pumps required by Subpart 56.50 should be mandatory, instead of an option, to allow timely action to counter flooding in an emergency. This recommendation has been adopted and the required alternative of providing automatic bilge pumps has been deleted from paragraph (e)(2) of the final rules. The provision of control of a bilge pump from the ECC has long been one of the required alternatives in NVIC 1–69. Also, it is the intent of SOLAS II–1/31.3 and 48 to ensure the ability to take timely and effective action to counter flooding. Automatic bilge pumps are typically small pumps intended for the removal of routine accumulations that are ineffective to counter flooding.

One comment said that the proposed rule did not adequately address the requirements in SOLAS II–1/48.3 for the location of valve controls for protection against flooding. This was an oversight and a new paragraph (e)(4) has been added to include the provisions of the SOLAS rule, which are essentially the same as the corresponding provision in NVIC 1–69. The new paragraph (e)(4) requires controls for the sea inlet and discharge valves and emergency bilge suction valves to be provided and be so arranged to allow time for operation in the event of flooding with the vessel in the fully loaded condition. Section 62.01–5(d), *Central Control Rooms*, has also been amended to include this provision because it is required by SOLAS II–1/31.3, regardless of manning.

Paragraph (g)(1) requires the ECC to include controls and instrumentation necessary to place the ship service and propulsion generators in service in 30 seconds. Two comments said that NVIC 1–69 did not have a time criteria of 30 seconds and recommended that the time criteria be deleted. Reasons given were that (1) it is impractical for vessels with two steam turbogenerators to meet the time criteria, (2) the criteria exceed the baseline *Assumption* of the rulemaking that the safety of vessels with automated vital systems must be at least equal to that of a vessel with its vital systems under direct manual supervision, and (3) it would make it difficult for existing vessels with two steam turbo-generators to be automated for the purpose of reducing the crew complement. The 30 second criteria has been retained in the final rules. It is essential to the safety of the vessel to restore ship service and propulsion electrical power as quickly as possible, and this criteria is readily attained by contemporary new-construction to which this rule applies. Existing vessels with steam turbo-generators should be able to comply with the 30 second criteria if they provide a level of safety and electrical power continuity to vital loads equivalent to that required by this rule. It will not apply to existing vessels that do not undergo modification or do not request a change in manning indicated on the certificate of inspection, *e.g.*, vessels previously evaluated under the provisions of NVIC's 1–69 or 6–84.

Proposed paragraph (h)(3) required remote starting and connection from the ECC of manually started or controlled electrical power sources required by Subpart 112.05. This proposal has been deleted because it duplicated the requirements of Subpart 112.35.

Section 62.50–30 Additional Requirements for Periodically Unattended Machinery Plants

Paragraph (a) requires compliance with this section to be met in addition to the requirements in § 62.50–20 (Minimally Attended Machinery Spaces). One comment said that the personnel alarm of § 62.50–20(b)(1) incorporated by this rule should not be required on vessels designed for periodically unattended machinery plant operation because it is an expensive nuisance that serves no purpose on these vessels. The final rule has not been changed. The requirement for the personnel alarm in § 62.50–20(b)(1) is a longstanding requirement of NVIC 1–69 that is intended to monitor crew well-being in the event that an automation failure in a plant designed for periodically unattended operation results in minimally attended operation.

This alarm also permits the master the option of operating the machinery plant in a minimally attended mode, as opposed to a periodically unattended mode.

Proposed paragraph (f) included a note that the requirement for certain ECC alarms to be extended to the engineers' accommodations could be met by operation of the engineers' assistance-needed alarm. One comment recommended deleting this option because one function of the engineers' assistance-needed alarm is to indicate the non-response of the duty engineers to an alarm condition, and if the engineers' assistance-needed alarm fails for any reason, neither the original alarm nor the duty engineers' non-response will be indicated in the engineers' accommodations. This recommendation has been adopted and the note has been deleted for the reasons given.

Paragraph (h) requires a fire control station located outside the machinery spaces. One comment recommended adding to the rule the requirement that control of machinery space oil piping positive shutoff valves required by § 56.50–60(d) be located at this central fire control station. This recommendation has been adopted. The final rule is consistent with NVIC 1–69, SOLAS, and classification society requirements.

Paragraph (j) of the proposed rule required automatic bilge pumps to be provided for periodically unattended machinery spaces. One comment recommended deleting this requirement because it is counterproductive to safety, can give a false sense of security, and because these pumps can permit leaks in machinery piping to go undetected without causing either a bilge high level alarm or an automatic bilge pump excessive run alarm to alert the crew. This comment said that bilge high level alarms provide better protection. This recommendation has been adopted for the reasons stated and because automatic bilge pumps are an option usually provided for removal of routine bilge accumulations. The bilge high level alarms recommended by the comment are required by § 62.50–20(e)(1).

Paragraph (k) of the rule requires the electrical plant to be arranged in such a way that upon failure of any one operating ship service generator, power to the main switchboard loads essential to propulsion, maneuvering, and safety is automatically maintained or restored within 30 seconds. One comment recommended permitting the generator to restore power within 45 seconds, instead of 30 seconds, to coincide with the requirements of the ABS. This recommendation has not been adopted. It is essential that ship service power be restored as quickly as possible in the event of a blackout. Also, contemporary designs readily comply with this criteria, which has been a longstanding requirement in NVIC 1–69. Relaxation of this safety criteria is not justified.

Section 113.35–3 Engine Order Telegraph Systems, General

Paragraph (f) of the rule requires engine order telegraph and remote propulsion control systems to be separate and independent, except that a single operator control device with separate transmitters and connections for each system may be used. Two comments recommended that the single operator control device be required instead of being an option, because it reduces confusion and is safer because the operator uses the same lever for engine orders in all operating modes. This recommendation has not been adopted. A single operator control device is not being required because it would prevent optional use of numerous independent engine order telegraph system designs that have been used safely and effectively for years.

One comment said the requirement for separate transmitters and connections should be deleted because it is unnecessary and serves no purpose. This recommendation has not been adopted. Separate transmitters and connections are required to permit the engine order telegraph to serve as an independent backup means of passing propulsion orders in the event the remote propulsion control system fails.

Section 111.01–9 Watertight, Waterproof, and Dripproof Equipment

Paragraph (b) of the rule requires central control consoles and similar enclosures to be dripproof, regardless of location. One comment said that this may not always be possible and alternatives should be offered such as use in dry locations and use of dripshields. These recommendations have not been adopted. Dripproof construction to prevent electrical damage or malfunction from dripping, spilling, or sprayed fluids in common practice.

Evaluation and Certification

These regulations are considered to be non-major under Executive Order 12291 and non-significant under the DOT regulatory policies and procedures (44 FR 11034; February 26, 1979). A regulatory evaluation has been prepared and placed in the rulemaking docket. The evaluation may be inspected and copied at the address listed under **ADDRESSES.** Copies may also be obtained by contacting the person listed under **FOR FURTHER INFORMATION CONTACT.** The Coast Guard does not have specific monetary information, nor does it have specific information on the type of automation or the number of vessels that would apply for inspection under the rules. The evaluation is based on certain assumptions that characterize current industry practice and trends relating to automation and vessel construction.

The primary benefit of the rules will be increased safety for crewmembers and property. It is estimated that at least $1.6M per year in damages associated with U.S. flag vessel casualties can be averted by these requirements. It is also estimated that the rules will result in a net savings to the marine industry of $100,000 per year, or $5,000 per new vessel, as compared to compliance with previous requirements and guidelines. The primary beneficiaries of these savings will be self-propelled vessel owners and operators, shipyards, and designers and manufacturers of automation systems. The savings will result from the elimination of the requirement for certain equipment that is of questionable safety value, more efficient and consistent evaluation of automation, and the reduction of costs associated with uncertainty and misinterpretation of requirements.

The rules should also produce an estimated annual cost savings for the Coast Guard of $15,000. These savings will result from possible further Coast Guard delegations of plan review and inspection functions to the ABS, which may reduce certain duplications of effort. The ABS would also benefit monetarily from such a delegation.

This rulemaking contains information collection and recordkeeping requirements in sections 61.40–1(a), 61.40–1(c), 61.40–10(a), 62.50–20(h), 62.50–30(j), and Subpart 62.20. They have been previously submitted to the Office of Management and Budget for approval under the provisions of the Paperwork Reduction Act of 1980 (P.L. 96–511, 44 U.S.C. 3501 et seq.) and have been approved. Approval numbers have been assigned as set out in revised § 50.01–20 of these rules.

This action has been analyzed in accordance with the principles and criteria contained in Executive Order 12612, and it has been determined that this rulemaking does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

The Coast Guard has determined that this rulemaking does not significantly affect the environment. An Environmental Assessment was prepared in accordance with COMDTINST 16475.1B, National Environmental Policy Act, Implementing Procedures and Policy for Considering Environmental impacts. The Environmental Assessment is included in the Final Evaluation. A finding of no significant impact (FONSI) has been prepared. The Environmental Assessment and FONSI are available for public inspection and copying in the rulemaking docket at the address listed above under **"ADDRESSES."**

As the rules substantially involve the design, construction, and operation of large vessels, ferries, and coastal tankers, and freighters over 500 gross tons, the Coast Guard certifies that these rules will not have a significant economic impact on a substantial number of small entities.

List of Subjects

46 CFR Part 50

Reporting and recordkeeping requirements, Vessels.

46 CFR Part 52

Marine safety, Vessels.

46 CFR Part 56

Marine safety, Vessels.

46 CFR Part 58

Oil and gas exploration, Marine safety, Vessels.

46 CFR Part 61

Marine safety, Vessels.

46 CFR Part 62

Electric power, Fire prevention, Incorporation by reference, Marine safety, Vessels.

46 CFR Part 110

Administrative practice and procedure, Coast Guard, Electric power, Vessels.

46 CFR Part 111

Electric power, Marine safety, Vessels.

46 CFR Part 113

Communications equipment, Fire prevention, Vessels.

In consideration of the foregoing, Chapter 1 of Title 46, Code of Federal Regulations is amended as follows:

PART 52—POWER BOILERS

1. The authority citation for Part 52 is revised to read as follows:

Authority: 46 U.S.C. 3306, 3703; 49 CFR 1.46.

2. In § 52.01–10, by revising paragraph (a) to read as follows:

§ 52.01–10 Automatic controls.

(a) Each main boiler must meet the special requirements for automatic safety controls in § 62.35–20(a)(1) of this chapter.

* * * * *

3. The authority citation for Part 50 continues to read as follows:

Authority: 46 U.S.C. 3306, 3703; 46 App. U.S.C. 86; 43 U.S.C. 1333 (d)(1), 1347(c), 1348(c), 1356(a)(2); 49 CFR 1.46.

3a. In § 50.01–20, by revising paragraph (b) to read as follows:

§ 50.01–20 OMB Control Numbers assigned pursuant to the Paperwork Reduction Act.

* * * * *

(b) *Display.*

46 CFR Part or Section where Identified or Described	Current OMB Control No.
Part 61	2115–0142
Part 62	2115–0548
Part 63	2115–0142

PART 56—PIPING SYSTEMS AND APPURTENANCES

4. The authority citation for Part 56 is revised to read as follows:

Authority: 46 U.S.C. 3306, 3703; 49 CFR 1.46.

5. In § 56.50–80, by adding a new paragraph (i) to read as follows:

§ 56.50–80 Lubricating oil system.

* * * * *

(i) Steam driven propulsion machinery must be provided with an emergency supply of lubricating oil that must operate automatically upon failure of the lubricating oil system. The emergency oil supply must be adequate to provide lubrication until the equipment comes to rest during automatic shutdown.

6. In § 56.50–95, by revising the existing last sentence of paragraph (d)(1) and by adding an additional sentence immediately thereafter to read as follows:

§ 56.50–95 Overboard discharges and shell connections.

* * * * *

(d)(1) * * * These controls shall be readily accessible above the floor plates and shall be provided with indication showing whether the valve is opened or closed. Manned machinery spaces include the main machinery space and are either attended by the crew or are automated in accordance with Part 62 of this subchapter to be comparable to an attended space.

* * * * *

PART 58—MAIN AND AUXILIARY MACHINERY AND RELATED SYSTEMS

7. The authority citation for Part 58 is revised to read as follows:

Authority: 46 U.S.C. 3306, 3703; 49 CFR 1.46. and all other authority citations in this part are removed.

8. In Subpart 58.01, a new § 58.01–35 is added to read as follows:

§ 58.01–35 Main propulsion auxiliary machinery.

Auxiliary machinery vital to the main propulsion system must be provided in duplicate unless the system served is provided in independent duplicate, or otherwise provides continued or restored propulsion capability in the event of a failure or malfunction of any single auxiliary component.

Note.—Partial reduction of normal propulsion capability as a result of malfunction or failure is acceptable if the reduced capability is not below that necessary for the vessel to run ahead at 7 knots or half speed, whichever is less, and is adequate to maintain control of the ship.

PART 61—PERIODIC TESTS AND INSPECTIONS

9. The authority citation for Part 61 is revised to read as follows:

Authority: 46 U.S.C. 3306, 3703, 49 CFR 1.46.

10. In Part 61, the table of contents is amended and a new Subpart 61.40 is added, to read as follows:

Subpart 61.40—Design Verification and Periodic Testing of Vital System Automation

Sec.

61.40–1 General.
61.40–3 Design verification testing.
61.40–6 Periodic safety tests.
61.40–10 Test procedure details.

* * * * *

Subpart 61.40—Design Verification and Periodic Testing of Vital System Automation

§ 61.40–1 General.

(a) All automatically or remotely controlled or monitored vital systems addressed by Part 62 of this subchapter must be subjected to tests and inspections to evaluate the operation and reliability of controls, alarms, safety features, and interlocks. Test procedures must be submitted to the Coast Guard for approval.

(b) Persons designated by the owner of the vessel shall conduct all tests and the Design Verification and Periodic

Safety tests shall be witnessed by the Coast Guard.

(c) Design Verification and Periodic Safety test procedure documents approved by the Coast Guard must be retained aboard the vessel.

§ 61.40–3 Design verification testing.

(a) Tests must verify that automated vital systems are designed, constructed, and operate in accordance with all applicable requirements of Part 62 of this subchapter. The tests must be based upon the failure analysis, if required by § 62.20–3(b) of this subchapter, functional performance requirements, and the Periodic Safety tests of § 61.40–6.

(b) Tests must be performed immediately after the installation of the automated equipment or before the issuance of the initial Certificate of Inspection.

§ 61.40–6 Periodic safety tests.

(a) Periodic Safety tests must demonstrate the proper operation of the primary and alternate controls, alarms, power sources, transfer override arrangements, interlocks, and safety controls. Systems addressed must include fire detection and extinguishing, flooding safety, propulsion, maneuvering, electric power generation and distribution, and emergency internal communications.

(b) Tests must be conducted at periodic intervals specified by the Coast Guard to confirm that vital systems and safety features continue to operate in a safe, reliable manner.

Note.—Normally, these tests are conducted annually.

§ 61.40–10 Test procedure details.

(a) Test procedure documents must be in a step-by-step or checkoff list format. Each test instruction must specify equipment status, apparatus necessary to perform the tests, safety precautions, safety control and alarm setpoints, the procedure to be followed, and the expected test result.

(b) Test techniques must not simulate monitored system conditions by mis-adjustment, artificial signals, improper wiring, tampering, or revision of the system unless the test would damage equipment or endanger personnel. In the latter case, the use of a synthesized signal or condition applied to the sensor is acceptable if test equipment is maintained in good working order and is periodically calibrated to the satisfaction of the Officer in Charge, Marine Inspection. Other test techniques must be approved by the Commandant (G–MTH).

11. Part 62 is added to 46 CFR Subchapter F to read as follows:

PART 62—VITAL SYSTEM AUTOMATION

Subpart 62.01–General Provisions

Sec.

Subpart 62.05–Reference specifications

Subpart 62.10–Terms used

Subpart 62.15–Equivalents

Subpart 62.20–Plan submittal

Subpart 62.25–General Requirements for All Automated Vital Systems

Subpart 62.30–Reliability and Safety Criteria, All Automated Vital Systems

Subpart 62.35–Requirements for Specific Types of Automated Vital Systems

Subpart 62.50–Automated Self-propelled Vessel Manning

Authority: 46 U.S.C. 3306, 3703, 8105; 49 CFR 1.46.

Subpart 62.01—General Provisions

§ 62.01–1 Purpose.

The purpose of this part is to make sure that the safety of a vessel with automated vital systems, in maneuvering and all other sailing conditions, is equal to that of the vessel with the vital systems under direct manual operator supervision.

§ 62.01–3 Scope.

(a) This part contains the minimum requirements for vessel automated vital systems. Specifically, this part contains—

(1) In subpart 62.25, the general requirements for all vital system automation;

(2) In subpart 62.30, the criteria used to evaluate the designed reliability and safety of all automated vital systems;

(3) In subpart 62.35, the minimum additional equipment, configuration, and functional requirements necessary when certain vital systems are automated; and

(4) In subpart 62.50, the minimum additional requirements when automated systems are provided to replace specific personnel or to reduce overall crew requirements.

§ 62.01–5 Applicability.

(a) *Vessels.* This part applies to self-propelled vessels of 500 gross tons and over that are certificated under Subchapters D, I, or U and to self-propelled vessels of 100 gross tons and over that are certificated under Subchapter H.

(b) *Systems and Equipment.* Except as noted in § 62.05–5(c), this part applies to automation of vital systems or equipment that—

(1) Is automatically controlled or monitored;

(2) Is remotely controlled or monitored; or

(3) Utilizes automation for the purpose of replacing specific personnel or to reduce overall crew requirements.

(c) *Exceptions.* This part does not apply to the following systems and equipment unless they are specifically addressed or unless their failure would degrade the safety and reliability of the systems required by this part:

(1) Automatic auxiliary heating equipment (see part 63 of this subchapter).

(2) Steering systems (see subparts 58.25 and 111.93 of this chapter).

(3) Non-vital and industrial systems.

(4) The communication and alarm systems in part 113 of this chapter.

(d) *Central control rooms.* The requirements of subpart 62.50 only apply to vessels automated to replace specific personnel or to reduce overall crew requirements, except where the main propulsion or ship service electrical generating plants are automatically or remotely controlled from a control room. In this case, § 62.50–20(a)(3) (except the

provision in paragraph 62.50–20(a)(3)(ii) relating to electrical power distribution), (b)(3), (c), (e)(1), (e)(2), (e)(4), and (f)(2) apply, regardless of manning.

Subpart 62.05—Reference Specifications

§ 62.05–1 Incorporation by reference.

(a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register. To enforce any edition other than the one listed in paragraph (b) of this section, notice of the change must be published in the Federal Register and the material made available to the public. All approved material is on file at the Office of the Federal Register, Washington, DC 20408 and at the Office of Marine Safety, Security, and Environmental Protection (G–MTH–2/12), Room 1218, U.S. Coast Guard Headquarters Building, 2100 Second Street SW., Washington, DC 20593–0001.

(b) The material approved for incorporation by reference in this part is:

(1) Rules for Building and Classing Steel Vessels, 1986, issued by the American Bureau of Shipping. This document is available from: American Bureau of Shipping, 45 Eisenhower Drive, Paramus, New Jersey 07653–0910. Sections affected by this incorporation by reference are: 62.25–1(c), 62.25–5(a), 62.25–30(a)(1), (a)(2), (a)(3), (a)(5), 62.35–5(d), 62.35–35(a), 62.35–40(c), 62.35–50, 62.50–30(c), and 62.50–30(k).

Subpart 62.10—Terms Used

§ 62.10–1 Definitions.

(a) For the purpose of this part:

"Alarm" means an audible and visual indication of a hazardous or potentially hazardous condition that requires attention.

"Automated" means the use of automatic or remote control, instrumentation, or alarms.

"Automatic control" means self-regulating in attaining or carrying out an operator-specified equipment response or sequence.

"Boiler low-low water level" is the minimum safe level in the boiler, in no case lower than that visible in the gage glass (see § 52.01–110 of this chapter, Water Level Indicators).

"Engineering Control Center (ECC)" means the centralized engineering control, monitoring, and communications location.

"Failsafe" means that upon failure or malfunction of a component, subsystem, or system, the output automatically reverts to a pre-determined design state of least critical consequence. Typical failsafe states are listed in Table 62.10–1(a).

TABLE 62.10–1(a)—TYPICAL FAILSAFE STATES

System or component	Preferred failsafe state
Cooling water valve	As is or open.
Alarm system	Annunciate.
Safety system	Shut down, limited, or as is & alarm.
Burner valve	Closed.
Propulsion speed control	As is.
Feedwater valve	As is or open.
Controllable pitch propeller.	As is.
Propulsion safety trip	As is & alarm.
Fuel tank valve	See § 56.50–60(d).

"Flooding safety" refers to flooding detection, watertight integrity, and dewatering systems.

"Independent" refers to equipment arranged to perform its required function regardless of the state of operation, or failure, of other equipment.

"Limit control" means a function of an automatic control system to restrict operation to a specified operating range or sequence without stopping the machinery.

"Local control" means operator control from a location where the equipment and its output can be directly manipulated and observed, e.g., at the switchboard, motor controller, propulsion engine, or other equipment.

"Manual control" means operation by direct or power-assisted operator intervention.

"Monitor" means the use of direct observation, instrumentation, alarms, or a combination of these to determine equipment operation.

"Remote control" means non-local automatic or manual control.

"Safety trip control system" means a manually or automatically operated system that rapidly shuts down another system or subsystem.

"System" means a grouping or arrangement of elements that interact to perform a specific function and typically includes the following, as applicable:

A fuel or power source.
Power conversion elements.
Control elements.
Power transmission elements.
Instrumentation.
Safety control elements.
Conditioning elements.

"Vital system or equipment" is essential to the safety of the vessel, its passengers and crew. This typically includes, but is not limited to, the following:

Fire detection, alarm, and extinguishing systems.
Flooding safety systems.
Ship service and emergency electrical generators, switchgear, and motor control circuits serving vital electrical loads.
The emergency equipment and systems listed in § 112.15 of this chapter.
Propulsion systems, including those provided to meet § 58.01–35.
Steering systems.

Subpart 62.15—Equivalents

§ 62.15–1 Conditions under which equivalents may be used.

(a) The Coast Guard accepts a substitute or alternate for the requirements of this part if it provides an equivalent level of safety and reliability. Demonstration of functional equivalence must include comparison of a qualitative failure analysis based on the requirements of this part with a comparable analysis of the proposed substitute or alternate.

Subpart 62.20—Plan Submittal

§ 62.20–1 Plans for approval.

(a) The following plans must be submitted to the Coast Guard for approval in accordance with § 50.20–5 and § 50.20–10 of this chapter:

(1) A general arrangement plan of control and monitoring equipment, control locations, and the systems served.

(2) Control and monitoring console, panel, and enclosure layouts.

(3) Schematic or logic diagrams including functional relationships, a written description of operation, and sequences of events for all modes of operation.

(4) A description of control or monitoring system connections to non-vital systems.

(5) A description of programable features.

(6) A description of built-in test features and diagnostics.

(7) Design Verification and Periodic Safety test procedures described in subpart 61.40 of this chapter.

(8) Control system normal and emergency operating instructions.

§ 62.20–3 Plans for information.

(a) One copy of the following plans must be submitted to the Officer in Charge, Marine Inspection, for use in the evaluation of automated systems provided to replace specific personnel or to reduce overall crew requirements:

(1) Proposed manning, crew organization and utilization, including routine maintenance, all operational evolutions, and emergencies.

(2) A planned maintenance program for all vital systems.

(b) One copy of a qualitative failure analysis must be submitted in accordance with § 50.20–5 of this chapter for the following:

(1) Propulsion controls.

(2) Microprocessor-based system hardware.

(3) Safety controls.

(4) Automated electric power management.

(5) Automation required to be independent that is not physically separate.

(6) Any other automation that, in the judgement of the Commandant, potentially constitutes a safety hazard to the vessel or personnel in case of failure.

Note.—The qualitative failure analysis is intended to assist in evaluating the safety and reliability of the design. It should be conducted to a level of detail necessary to demonstrate compliance with applicable requirements and should follow standard qualitative analysis procedures. Assumptions, operating conditions considered, failures considered, cause and effect relationships, how failures are detected by the crew, alternatives available to the crew, and possible design verification tests necessary should be included. Questions regarding failure analysis should be referred to the Marine Safety Center at an early stage of design.

§ 62.20–5 Self-certification.

(a) The designer or manufacturer of an automated system shall certify to the Coast Guard, in writing, that the automation is designed to meet the environmental design standards of § 62.25–30. Plan review, shipboard testing, or independent testing to these standards is not required.

Note.—Self-certification should normally accompany plan submittal.

Subpart 62.25—General Requirements for All Automated Vital Systems

§ 62.25–1 General.

(a) Vital systems that are automatically or remotely controlled must be provided with—

(1) An effective primary control system;

(2) A manual alternate control system;

(3) A safety control system, if required by § 62.25–15;

(4) Instrumentation to monitor system parameters necessary for the safe and effective operation of the system; and

(5) An alarm system if instrumentation is not continuously monitored or is inappropriate for detection of a failure or unsafe condition.

(b) Automation systems or subsystems that control or monitor more than one safety control, interlock, or operating sequence must perform all assigned tasks continuously, i.e., the detection of unsafe conditions must not prevent control or monitoring of other conditions.

(c) Vital control and alarm system consoles and similar enclosures that rely upon forced cooling for proper system operation must meet section 41.23.2 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

§ 62.25–5 All control systems.

(a) Controls for engines and turbines equipped with jacking or turning gear must meet section 41.21.4 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

(b) Automatic control systems must be stable over the entire range of normal operation.

(c) Inadvertent grounding of an electrical or electronic safety control system must not cause safety control operation or safety control bypassing.

§ 62.25–10 Manual alternate control systems.

(a) Manual alternate control systems must—

(1) Be operable in an emergency and after a remote or automatic primary control system failure;

(2) Be suitable for manual control for prolonged periods;

(3) Be readily accessible and operable; and

(4) Include means to override automatic controls and interlocks, as applicable.

(b) Permanent communications must be provided between primary remote control locations and manual alternate control locations if operator attendance is necessary to maintain safe alternate control.

Note.—Typically, this includes main boiler fronts and local propulsion control.

§ 62.25–15 Safety control systems.

(a) Minimum safety trip controls required for specific types of automated vital systems are listed in Table 62.35–50.

Note.—Safety control systems include automatic and manual safety trip controls and automatic safety limit controls.

(b) Safety trip controls must not operate as a result of failure of the normal electrical power source unless it is determined to be the failsafe state.

(c) Automatic operation of a safety control must be alarmed in the machinery spaces and at the cognizant remote control location.

(d) Local manual safety trip controls must be provided for all main boilers, turbines, and internal combustion engines.

(e) Automatic safety trip control systems must—

(1) Be provided where there is an immediate danger that a failure will result in serious damage, complete breakdown, fire, or explosion;

(2) Require manual reset prior to renewed operation of the equipment; and

(3) Not be provided if safety limit controls provide a safe alternative and trip would result in loss of propulsion.

§ 62.25–20 Instrumentation, alarms, and centralized stations.

(a) *General.* Minimum instrumentation and alarms required for specific types of automated vital systems are listed in Table 62.35–50.

(b) *Instrumentation Location.* (1) Manual control locations, including remote manual control and manual alternate control, must be provided with the instrumentation necessary for safe operation from that location.

Note.—Typically, instrumentation includes means to monitor the output of the monitored system.

(2) Systems with remote instrumentation must have provisions for the installation of instrumentation at the monitored system equipment.

(3) The status of automatically or remotely controlled vital auxiliaries, power sources, switches, and valves must be visually indicated in the machinery spaces or the cognizant remote control location, as applicable.

Note.—Status indicators include run, standby, off, open, closed, tripped, and on, as applicable. Status indicators at remote control locations other than the ECC, if provided, may be summarized. Equipment normally provided with status indicators are addressed in Table 62.35–50 and Subparts 58.01, 56.50, and 112.45.

(4) Sequential interlocks provided in control systems to ensure safe operation, such as boiler programing control or reversing of propulsion diesels, must have summary indicators in the machinery spaces and at the cognizant control location to show if the interlocks are satisfied.

(5) Instrumentation listed in Table 62.35–50 must be of the continuous display type or the demand display type. Displays must be in the ECC or in the machinery spaces if an ECC is not provided.

(c) *Instrumentation details.* Demand instrumentation displays must be clearly readable and immediately available to the operator.

(c) *Alarms.* (1) All alarms must clearly distinguish among—

(i) Normal, alarm, and acknowledged alarm conditions; and

(ii) Fire, general alarm, CO_2/halon, vital machinery, flooding, engineers' assistance-needed, and non-vital alarms.

(2) Required alarms in high ambient noise areas must be supplemented by visual means, such as rotating beacons, that are visible throughout these areas. Red beacons must only be used for general or fire alarm purposes.

(3) Automatic transfer to required backup or redundant systems or power sources must be alarmed in the machinery spaces.

(4) Flooding safety, fire, loss of power, and engineers' assistance-needed alarms extended from the machinery spaces to a remote location must not have a duty crewmember selector.

Note.—Other alarms may be provided with such a selector, provided there is no off position.

(5) Automation alarms must be separate and independent of the following:

(i) The fire detection and alarm systems.

(ii) The general alarm.

(iii) CO_2/halon release alarms.

(6) Failure of an automatic control, remote control, or alarm system must be immediately alarmed in the machinery spaces and at the ECC, if provided.

(e) *Alarm details.* (1) All alarms must—

(i) Have a manual acknowledgement device (No other means to reduce or eliminate the annunciated signal may be provided except dimmers described in paragraph (g)(2) of this section);

(ii) Be continuously powered;

(iii) Be provided with a means to test audible and visual annunciators;

(iv) Provide for normal equipment starting and operating transients and vessel motions, as applicable, without actuating the alarm;

(v) Be able to simultaneously indicate more than one alarm condition, as applicable;

(vi) Visually annunciate until the alarm is manually acknowledged and the alarm condition is cleared;

(vii) Audibly annunciate until manually acknowledged;

(viii) Not prevent annunciation of subsequent alarms because of previous alarm acknowledgement; and

(ix) Automatically reset to the normal operating condition only after the alarm has been manually acknowledged and the alarm condition is cleared.

(2) Visual alarms must initially indicate the equipment or system malfunction without operator intervention.

(3) Power failure alarms must monitor on the load side of the last supply protective device.

(f) *Summarized and grouped alarms.* Visual alarms at a control location that are summarized or grouped by function, system, or item of equipment must—

(1) Be sufficiently specific to allow any necessary action to be taken; and

(2) Have a display at the equipment or an appropriate control location to identify the specific alarm condition or location.

(g) *Central control locations.* (1) Central control locations must—

(i) Be arranged to allow the operator to safely and efficiently communicate, control, and monitor the vital systems under normal and emergency conditions, with a minimum of operator confusion and distraction;

(ii) Be on a single deck level; and

(iii) Co-locate control devices and instrumentation to allow visual assessment of system response to control input.

(2) Visual alarms and instruments on the navigating bridge must not interfere with the crew's vision. Dimmers must not eliminate visual indications.

(3) Alarms and instrumentation at the main navigating bridge control location must be limited to those that require the attention or action of the officer on watch, are required by this chapter, or that would result in increased safety.

§ 62.25-25 Programable systems and devices.

(a) programable control or alarm system logic must not be altered after Design Verification testing without the approval of the cognizant Officer in Charge, Marine Inspection (OCMI). (See subpart 61.40 of this subchapter, Design Verification Tests). Safety control or automatic alarm systems must be provided with means, acceptable to the cognizant OCMI, to make sure setpoints remain within the safe operating range of the equipment.

(b) Operating programs for microprocessor-based or computer-based vital control, alarm, and monitoring systems must be stored in non-volatile memory and automatically operate on supply power resumption.

(c) If a microprocessor-based or computer-based system serves both vital and non-vital systems, hardware and software priorities must favor the vital systems.

(d) At least one copy of all required manuals, records, and instructions for automatic or remote control or monitoring systems required to be abroad the vessel must not be stored in electronic or magnetic memory.

§ 62.25-30 Environmental design standards.

(a) All automation must be suitable for the marine environment and must be designed and constructed to operate indefinitely under the following conditions:

(1) Ship motion and vibration described in Section 41.37 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

Note.—Inclination requirements for fire and flooding safety systems are described in § 112.05-5(c) of this chapter.

(2) Ambient air temperatures described in Section 41.29.1 and 41.29.2 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

(3) Electrical voltage and frequency tolerances described in Section 41.29.3 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

(4) Relative humidity of 0 to 95% at 45 °C.

(5) Hydraulic and pneumatic pressure variations described in Section 41.39.3e of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

Note.—Considerations should include normal dynamic conditions that might exceed these values, such as switching, valve closure, power supply transfer, starting, and shutdown.

(b) Low voltage electronics must be designed with due consideration for static discharge, electromagnetic interference, voltage transients, fungal growth, and contact corrosion.

Subpart 62.30—Reliability and Safety Criteria, All Automated Vital Systems

§ 62.30-1 Failsafe.

(a) The failsafe state must be evaluated for each subsystem, system, or vessel to determine the least critical consequence.

(b) All automatic control, remote control, safety control, and alarm systems must be failsafe.

§ 62.30-5 Independence.

(a) Single non-concurrent failures in control, alarm, or instrumentation systems, and their logical consequences, must not prevent sustained or restored operation of any vital system or systems.

(b)(1) Except as provided in paragraphs (b)(2) and (b)(3) of this section, primary control, alternate control, safety control, and alarm and instrumentation systems for any vital system must be independent of each other.

(b)(2) Independent sensors are not required except that sensors for primary speed, pitch, or direction of rotation control in closed loop propulsion control systems must be independent and physically separate from required safety control, alarm, or instrumentation sensors.

(b)(3) The safety trip control of § 62.35—5(b)(2) must be independent and physically separate from all other systems.

(c) Two independent sources of power must be provided for all primary control, safety control, instrumentation and alarm systems. Failure of the normal source of power must actuate an alarm in the machinery spaces. One source must be from the emergency power source (see part 112 of this chapter, Emergency Lighting and Power Systems) unless one of the sources is—

(1) Derived from the power supply of the system being controlled or monitored;

(2) A power take-off of that system; of

(3) An independent power source equivalent to the emergency power source.

§ 62.30–10 Testing.

(a) Automated vital systems must be tested in accordance with subpart 61.40 of this chapter.

(b) On-line built-in test equipment must not lock out or override safety trip control systems. This equipment must indicate when it is active.

Subpart 62.35—Requirements for Specific Types of Automated Vital Systems

§ 62.35–1 General.

(a) Minimum instrumentation, alarms, and safety controls required for specific types of automated vital systems are listed in Table 62.35–50.

(b) Automatic propulsion systems, automated electric power management systems, and all associated subsystems and equipment must be capable of meeting load demands from standby to full system rated load, under steady state and maneuvering conditions, without need for manual adjustment or manipulation.

§ 62.35–5 Remote propulsion control systems.

(a) *Manual propulsion control.* All vessels having remote propulsion control from the navigating bridge, an ECC or maneuvering platform, or elsewhere must have a manual alternate propulsion control located at the equipment.

Note.—Separate local control locations may be provided for each independent propeller.

(b) *Centralized propulsion control equipment.* Navigating bridge, ECC, maneuvering platform, and manual alternate control locations must include—

(1) Control of the speed and direction of thrust for each independent propeller controlled;

(2) A guarded manually actuated safety trip control (which stops the propelling machinery) for each independent propeller controlled;

(3) Shaft speed and thrust direction indicators for each independent propeller controlled;

(4) The means to pass propulsion orders required by § 113.30–5 and § 113.35–3 of this chapter; and

(5) The means required by paragraph (e) of this section to achieve control location transfer and independence.

(c) *Main navigating bridge propulsion control.* (1) Navigating bridge remote propulsion control must be performed by a single control device for each independent propeller. Control must include automatic performance of all associated services, and must not permit rate of movement of the control device to overload the propulsion machinery.

(2) On vessels propelled by steam turbines, the navigation bridge primary control system must include safety limit controls for high and low boiler water levels and low steam pressure. Actuation of these limits must be alarmed on the navigating bridge and at the maneuvering platform or ECC.

(3) On vessels propelled by internal combustion engines, an alarm must annunciate on the navigating bridge and at the maneuvering platform or ECC, if provided, to indicate starting capability less then 50% of that required by § 62.35–35(a). If the primary remote control system provides automatic starting, the number of automatic consecutive attempts that fail to produce a start must be limited to reserve 50% of the required starting capability.

(d) *Control location transfer.* Control location transfer must meet Sections 41.19.3 and 41.19.4 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels." Manual alternate propulsion control locations must be capable of overriding and operating independent of all remote and automatic control locations.

(e) *Control system.details.* (1) Each operator control device must have a detent at the zero thrust position.

(2) Propulsion machinery automatic safety trip control operation must only occur when continued operation could result in serious damage, complete breakdown, or explosion of the equipment. Other than the overrides mentioned in § 62.25–10(a)(4) and temporary overrides located at the main navigating bridge control location, overrides of these safety trip controls are prohibited. Operation of permitted overrides must be alarmed at the navigating bridge and at the maneuvering platform or ECC, as applicable, and must be guarded against inadvertent operation.

(3) Remote propulsion control systems must be failsafe by maintaining the preset (as is) speed and direction of thrust until local manual or alternate manual control is in operation, or the manual safety trip control operates. Failure must activate alarms on the navigating bridge and in the machinery spaces.

§ 62.35–10 Flooding safety.

(a) Automatic bilge pumps must—

(1) Be provided with bilge high level alarms that annunciate in the machinery spaces and at a manned control location and are independent of the pump controls;

(2) Be monitored to detect excessive operation in a specified time period; and

(3) Meet all applicable pollution control requirements.

(b) Remote controls for flooding safety equipment must remain functional under flooding conditions to the extent required for the associated equipment by § 56.50–50 and § 56.50–95 of this chapter.

(c) Remote bilge level sensors, where provided, must be located to detect flooding at an early stage and to provide redundant coverage.

§ 62.35–15 Fire safety.

(a) All required fire pump remote control locations must include the controls necessary to charge the firemain and—

(1) A firemain pressure indicator; or

(2) A firemain low pressure alarm.

§ 62.35–20 Oil-fired main boilers.

(a) *General.* (1) All main boilers, regardless of intended mode of operation, must be provided with the automatic safety trip control system(s) of paragraphs (h)(1), (h)(2)(i), (h)(2)(ii), and (i) of this section to prevent unsafe conditions after light off.

(2) Manual alternate control of boilers must be located at the boiler front.

(3) A fully automatic main boiler must include—

(i) Automatic combustion control;

(ii) Programing control;

(iii) Automatic feedwater control;

(iv) Safety controls; and

(v) An alarm system.

(4) Following system line-up and starting of auxiliaries, fully automatic

main boilers must only require the operator to initiate the following sequences:

(i) Boiler pre-purge.

(ii) Trial for ignition of burners subsequent to successful initial burner light-off.

(iii) Normal shutdown.

(iv) Manual safety trip control operation.

(v) Adjustment of primary control setpoints.

(5) All requirements for programing control subsystems and safety control systems must be met when a boiler—

(i) Automatically sequences burners;

(ii) Is operated from a location remote from the boiler front; or

(iii) Is fully automatic.

(6) Where light oil pilots are used, the programing control and burner safety trip controls must be provided for the light oil system. Trial for ignition must not exceed 15 seconds and the main burner trial for ignition must not proceed until the pilot flame is proven.

Note: Light oil is defined in § 63.05–75(a) of this chapter.

(b) *Feedwater control.* Automatic feedwater control subsystems must sense, at a minimum, boiler water level and steam flow.

(c) *Combustion control.* Automatic combustion control subsystems must provide—

(1) An air/fuel ratio which ensures complete combustion and stable flame with the fuel in use, under light off, steady state, and transient conditions; and

(2) Stable boiler steam pressure and outlet temperatures under steady state and transient load conditions; and

(3) A low fire interlock to prevent high firing rates and superheater damage during boiler warm up.

(d) *Programing control.* The programing control must provide a programed sequence of interlocks for the safe ignition and normal shutdown of the boiler burners. The programing control must prevent ignition if unsafe conditions exist and must include the following minimum sequence of events and interlocks:

(1) *Prepurge.* Boilers must undergo a continuous purge of the combustion chamber and convecting spaces to make sure of a minimum of 5 changes of air. The purge must not be less than 15 seconds in duration, and must occur immediately prior to the trial for ignition of the initial burner of a boiler. All registers and dampers must be open and an air flow of at least 25 percent of the full load volumetric air flow must be proven before the purge period commences. The prepurge must be complete before trial for ignition of the initial burner.

Note: A pre-purge is not required immediately after a complete post-purge.

(2) *Trial for ignition and ignition.* (i) Only one burner per boiler is to be in trial for ignition at any time.

(ii) Total boiler air flow during light off must be sufficient to prevent pocketing and explosive accumulations of combustible gases.

(iii) The burner igniter must be in position and proven energized before admission of fuel to the boiler. The igniter must remain energized until the burner flame is established and stable, or until the trial for ignition period ends.

(iv) The trial for ignition period must be as short as practical for the specific installation, but must not exceed 15 seconds.

(v) Failure of the burner to ignite during a trial for ignition must automatically actuate the burner safety trip controls.

(3) *Post-purge.* (i) Immediately after normal shutdown of the boiler, an automatic purge of the boiler equal to the volume and duration of the prepurge must occur.

(ii) Following boiler safety trip control operation, the air flow to the boiler must not automatically increase. Post purge in such cases must be under manual control.

(e) *Burner fuel oil valves.* Each burner must be provided with a valve that is—

(1) Automatically closed by the burner or boiler safety trip control system; and

(2) Operated by the programming control or combustion control subsystems, as applicable.

(f) *Master fuel oil valves.* Each boiler must be provided with a master fuel oil valve to stop fuel to the boiler automatically upon actuation by the boiler safety trip control system.

(g) *Valve closure time.* The valves described in paragraphs (e) and (f) of this section must close within 4 seconds of automatic detection of unsafe trip conditions.

(h) *Burner safety trip control system.* (1) Each burner must be provided with at least one flame detector.

(2) The burner valve must automatically close when—

(i) Loss of burner flame occurs;

(ii) Actuated by the boiler safety trip control system;

(iii) The burner is not properly seated or in place; or

(iv) Trial for ignition fails, if a programing control is provided.

(i) *Boiler safety trip control system.* (1) Each boiler must be provided with a safety trip control system that automatically closes the master and all burner fuel oil valves upon—

(i) Boiler low-low water level;

(ii) Inadequate boiler air flow to support complete combustion;

(iii) Loss of boiler control power;

(iv) Manual safety trip operation; or

(v) Loss of flame at all burners.

(2) The low-low water level safety trip control must account for normal vessel motions and operating transients.

§ 62.35–35 Internal combustion engine starting systems.

(a) The starting system for propulsion engines and ship service generator prime movers required to automatically start must meet Sections 34.23.3, 34.37.2, and 34.39 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels," except the sections referenced therein.

§ 62.35–40 Fuel systems.

(a) *Level alarms.* Where high or low fuel tank level alarms are required, they must be located to allow the operator adequate time to prevent an unsafe condition.

(b) *Coal fuels.* (1) Controls and instrumentation for coal systems require special consideration by the Commandant (G–MTH).

(2) Interlocks must be provided to ensure a safe transfer of machinery operation from one fuel to another.

(c) *Automatic fuel heating.* Automatic fuel heating arrangements must meet Section 41.78.1 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

(d) *Overflow prevention.* Fuel oil day tanks, settlers, and similar fuel oil service tanks that are filled automatically or by remote control must be provided with a high level alarm that annunciates in the machinery spaces and either an automatic safety trip control or an overflow arrangement.

§ 62.35–50 Tabulated monitoring and safety control requirements for specific systems.

(a) The minimum instrumentation, alarms, and safety controls required for specific types of systems are listed in Table 62.35–50.

TABLE 62.35-50—MINIMUM SYSTEM MONITORING AND SAFETY CONTROL REQUIREMENTS FOR SPECIFIC SYSTEMS (1)

System	Service	Instrumentation	Alarm	Safety control	Notes
Main (Propulsion) boiler.	(1)	(1)	(1)		(2, 3)
	Supply casing and uptakes		Fire		
	Burner flame	Status	Failure	Burner auto trip	(3)
	Burner seating		Failure	....do	(3)
	Trial for ignition	Status	Failure	....do	
	Control power	Available (pressure)	Failure (low)	....do	(3)
				Manual trip	(3)
	Burner valve	Open/closed			
	Low fire interlock	Status			
	Program control interlock	Status			
Main (Propulsion steam) turbine.	(2)	(2)	(2)		(4, 5)
				Manual trip	
Main propulsion, diesel.	(1)	(1)	(1)		(4, 5)
				Manual trip	
Main propulsion, remote control.			Failure	....do	
	Auto safety trip override		Activated		
	Starting power	Pressure (voltage)	Low	Limit	(2)
	Location in control	Status	Override		(6)
	Shaft speed/direction/pitch	(3)	(3)	(3)	(3)
	Clutch fluid	Pressure	Low		
Main propulsion, electric.	(4)	(4)	(4)	(4)	(7)
Main propulsion, shafting.	Stern tube oil tank level		Low		
	Line shaft bearing	Temperature, forced lubrication	High		
		Pressure	Low		
Main propulsion, controllable pitch propeller.	Hydraulic oil	Pressure	High, Low		
		Temperature	High		
Generators	Ship service	(1)	(1)		
		Starting pressure/voltage	Low		
			Tripped		
	Emergency	(5)	(5)	(5)	(5)
	Turbogenerator	(1, 6)	(1, 6)	(6)	
				Manual trip	
	Diesel	(1, 7)	(1, 7)	(7)	(5)
				Manual trip	
Auxiliary boiler		Run	Trip		(12)
Gas turbine	(8)	(8)	(8)	(8)	(8)
Engines and turbines.	Jacking/turning gear	Engaged			(8)
Fuel oil	(9)	(9)	(9)		
	Remote/auto fill level		High	Auto trip or overflow arrangement.	
	Hi. press. leakage level		High		
Bilge	Pump remote control	Run			
	Pump auto control	Run	Excessive operations		
	Level		High/location		
Machinery space CL.3 W.T. doors.		Open/closed			
Fire detection	Machinery spaces		Space on fire		(9)
Fire main		Pressure	Low		
Personnel	Deadman		Fail to acknowledge		(10)
General, control and alarm systems.	Power supply	Available (pressure)	Failure (low)		
	System function		Failure		(11)
	Console air conditioning		Failure		
	Built in test equipment	Active			
	Sequential interlock	Activated			
	Safety control		Activated	Auto trip/limit	(11)
Redundant auxiliary, system, power supply.		Status	Auto transfer		

[1] See ABS Table 41.1.
[2] See ABS Table 41.1, except Shaft Roller.
[3] See § 113.37 of this chapter.
[4] See subparts 111.33 and 111.35 of this chapter.
[5] See subparts 112.45 and 112.50 of this chapter.
[6] See § 111.12-1(c) of this chapter.
[7] See § 111.12-1 (b), (c) of this chapter.
[8] See § 58.10-15(g) of this chapter.
[9] See ABS Table 41.1, "Additional Services."

Notes on Table 62.35–50:

1. The monitoring and controls listed in this table are applicable if the system listed is provided or required. References to ABS Table 41.1 apply to the "Operation," "Display," "Alarm," and "Notes" 1 through 12, except the reference to ACCU in Note 11.

2. Safety limit controls must be provided in navigating bridge primary propulsion control systems. See § 62.35–5(c).

3. Safety trip controls and alarms must be provided for all main boilers, regardless of mode of operation. See § 62.35–20(a).

4. Loss of forced lubrication safety trip controls must be provided, as applicable.

5. Override of overspeed and loss of forced lubrication pressure safety trip controls must not be provided. See § 62.35–5(e)(2).

6. Transfer interlocks must be provided.

7. Semiconductor controlled rectifiers must have current limit controls.

8. Interlocks must be provided. See § 62.25–5(a).

9. See subparts 113.10, 161.002, and fire protection requirements of the applicable subchapters. The use of thermal detectors alone is subject to special consideration by the Commandant (G–MTH). Flame detectors may only be used in conjunction with smoke or heat detectors.

10. See § 62.50–20(b)(1).

11. Alarms and controls must be failsafe. See § 62.30–1.

12. Vital auxiliary boilers only. Also see Part 63.

Subpart 62.50—Automated Self-propelled Vessel Manning

§ 62.50–1 General.

(a) Where automated systems are provided to replace specific personnel in the control and observation of the engineering plant and spaces, or reduce overall crew requirements, the arrangements must make sure that under all sailing conditions, including maneuvering, the safety of the vessel is equal to that of the same vessel with the entire plant under fully attended direct manual supervision.

(b) Coast Guard acceptance of automated systems to replace specific personnel or to reduce overall crew requirements is predicated upon—

(1) The capabilities of the automated systems;

(2) The combination of the personnel, equipment, and systems necessary to ensure the safety of the vessel, personnel, and environment in all sailing conditions, including maneuvering;

(3) The ability of the crew to perform all operational evolutions, including emergencies such as fire or control or monitoring system failure;

(4) A planned maintenance program including routine maintenance, inspection, and testing to ensure the continued safe operation of the vessel; and

(5) The automated system's demonstrated reliability during an initial trial period, and its continuing reliability.

Note: The cognizant Officer in Charge, Marine Inspection, (OCMI) also determines the need for more or less equipment depending on the vessel characteristics, route, or trade.

(c) Equipment provided to replace specific personnel or to reduce overall crew requirements that proves unsafe or unreliable in the judgment of the cognizant Officer in Charge, Marine Inspection, must be immediately replaced or repaired or vessel manning will be modified to compensate for the equipment inadequacy.

§ 62.50–20 Additional requirements for minimally attended machinery plants.

Note: Minimally attended machinery plants include vessel machinery plants and spaces that are automated, but not to a degree where the plant could be left unattended. Emphasis is placed on the centralized remote control and monitoring of the machinery plant and machinery spaces.

(a) *General.* (1) Navigating bridge propulsion control must be provided.

(2) An ECC must be provided and must include the automatic and remote control and monitoring systems necessary to limit the operator's activity to monitoring the plant, initiating programed control system sequences, and taking appropriate action in an emergency.

(3) The ECC must include control and monitoring of all vital engineering systems, including—

(i) The propulsion plant and its auxiliaries;

(ii) Electrical power generation and distribution;

(iii) Machinery space fire detection, alarm, and extinguishing systems; and

(iv) Machinery space flooding safety systems.

(4) ECC control of vital systems must include the ability to place required standby systems, auxiliaries, and power sources in operation, unless automatic transfer is provided, and to shut down such equipment when necessary.

Note: ECC remote control need not include means for a single operator to bring the plant to standby from a cold plant or dead ship condition or controls for non-vital systems or equipment.

(b) *Alarms and instrumentation.* (1) A personnel alarm must be provided and must annunciate on the bridge if not routinely acknowledged at the ECC or in the machinery spaces.

(2) Continuous or demand instrumentation displays must be provided at the ECC to meet the system and equipment monitoring requirements of this part if the ECC is to be continuously attended. If the watchstander's normal activities include maintenance, a roving watch, or similar activities in the machinery spaces but not at the ECC, both alarms and instrumentation must be provided.

(3) All required audible alarms must annunciate throughout the ECC and machinery spaces.

(c) *Fire detection and alarms.* An approved automatic fire detection and alarm system must be provided to monitor all machinery spaces. The system must activate all alarms at the ECC, the navigating bridge, and throughout the machinery spaces and engineers' accommodations. The ECC and bridge alarms must visually indicate which machinery space is on fire, as applicable.

Note: For purposes of this part, the specific location of fires that are not in machniery spaces need not be indicated.

(d) *Fire pumps.* (1) The ECC must include control of the main machinery space fire pumps.

(2) Remote control of a required fire pump must be provided from the navigating bridge. Where one or more fire pumps is required to be independent of the main machinery space, at least one such pump must be controlled from the navigating bridge.

(e) *Flooding safety.* (1) Machinery space bilges, bilge wells, shaft alley bilges, and other minimally attended locations where liquids might accumulate must be monitored from the ECC to detect flooding angles from vertical of up to 15° heel and 5° trim.

(2) ECC must include the controls necessary to bring at least one of the bilge pumps required by subpart 56.50 of this chapter into operation to counter flooding in the locations listed in paragraph (e)(1).

(3) Where watertight doors in subdivision bulkheads are required in the machinery spaces, they must be Class 3 watertight doors and must be controllable from the ECC and the required navigating bridge control location.

(4) Controls must be provided to operate the sea inlet and discharge valves required by § 56.50–95(d) of this chapter and the emergency bilge suction required by § 56.50–50(f). These controls must be arranged to allow time for operation in the event of flooding with the vessel in the fully loaded condition. Time considerations must include detection, crew response, and control operation time.

(f) *Communications.* (1) A means must be provided at the ECC to selectively summon any engineering department member from the engineering accommodations to the ECC.

(2) The voice communications system required by § 113.30–5(a) of this chapter must also include the engineering officers' accommodations.

(g) *Electrical systems.* (1) The ECC must include the controls and instrumentation necessary to place the ship service and propulsion generators in service in 30 seconds.

(2) The main distribution and propulsion switchboards and generator controls must either be located at the ECC, if the ECC is within the bounaries of the main machinery space, or the controls and instrumentation required by Part 111 of this chapter must be duplicated at the ECC. Controls at the switchboard must be able to override those at the ECC, if separate. Also see § 111.12–11(g) and § 111.30–1(a)(4) regarding switchboard location.

(g) *Maintenance program.* (1) The vessel must have a planned maintenance program to ensure continued safe operation of all vital systems. Program content and detail is optional, but must include maintenance and repair manuals for work to be accomplished by maintenance personnel and checkoff lists for routine inspection and maintenance procedures.

(2) The planned maintenance program must be functioning prior to the completion of the evaluation period for reduced manning required by § 62.50–1(b)(5).

(3) Maintenance and repair manuals must include details as to what, when, and how to troubleshoot, repair and test the installed equipment and what parts are necessary to accomplish the procedures. Schematic and logic diagrams required by § 62.20–1 of this part must be included in this documentation. Manuals must clearly delineate information that is not applicable to the installed equipment.

§ 62.50–30 Additional requirements for periodically unattended machinery plants.

Note. Periodically unattended machinery plants include machinery plants and spaces that are automated to the degree that they are self-regulating and self-monitoring and could safely be left periodically unattended. Emphasis is placed on providing systems that act automatically until the crew can take action in the event of a failure or emergency. Requirements are in addition to those of a minimally attended machinery plant.

(a) *General.* The requirements of this section must be met in addition to these of § 62.50–20 of this part.

(b) *Automatic transfer.* Redundant vital auxiliaries and power sources must automatically transfer to the backup units upon failure of operating units.

(c) *Fuel systems.* The fuel service and treatment system(s) must meet Section 41.77.1 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels."

(d) *Starting systems.* Automatic or remote starting system receivers, accumulators, and batteries must be automatically and continuously charged.

(e) *Assistance-needed alarm.* The engineer's assistance-needed alarm (see subpart 113.27 of this chapter) must annunciate if—

(1) An alarm at the ECC is not acknowledged in the period of time necessary for an engineer to respond at the ECC from the machinery spaces or engineers' accommodations; or

(2) An ECC alarm system normal power supply fails.

(f) *Remote alarms.* ECC alarms for vital systems that require the immediate attention of the bridge watch officer for the safe navigation of the vessel must be extended to the bridge. All ECC alarms required by this part must be extended to the engineers' accommodations. Other than fire or flooding alarms, this may be accomplished by summarized visual alarm displays.

(g) *ECC alarms.* All requirements of this part for system or equipment monitoring must be met by providing both displays and alarms at the ECC.

(h) *Fire control station.* A control station for fire protection of the machinery spaces must be provided outside the machinery spaces. At least one access to this station must be independent of category A machinery spaces, and any boundary shared with these spaces must have an A–60 fire classification as defined in § 72.05 of this chapter. Except where such an arrangement is not possible, control and monitoring cables and piping for the station must not adjoin or penetrate the boundaries of a category A machinery space, uptakes, or casings. The fire control station must include—

(1) Annunciation of which machinery space is on fire;

(2) Control of a fire pump required by this chapter to be independent of the main machinery spaces;

(3) Controls for machinery space fixed gas fire extinguishing systems;

(4) Control of oil piping positive shutoff valves located in the machinery spaces and required by § 56.50–60(d);

(5) Controls for machinery space fire door holding and release systems, skylights and similar openings;

(6) The remote stopping systems for the machinery listed in § 111.103 of this chapter; and

(7) Voice communications with the bridge.

(i) *Oil leakage.* Leakages from high pressure fuel oil pipes must be collected and high levels must be alarmed at the ECC.

(j) *Maintenance program.* The maintenance program of § 62.50–20(h) must include a checkoff list to make sure that routine daily maintenance has been performed, fire and flooding hazards have been minimized, and plant status is suitable for unattended operation. Completion of this checkoff list must be logged before leaving the plant unattended.

(k) *Continuity of electrical power.* The electrical plant must meet Sections 41.75.1 and 41.75.3 of the American Bureau of Shipping's "Rules for Building and Classing Steel Vessels" and must—

(1) Not use the emergency generator for this purpose;

(2) Restore power in not more than 30 seconds; and

(3) Account for loads permitted by § 111.70–3(f) of this chapter to automatically restart.

PART 110—GENERAL PROVISIONS

12. The authority citation for Part 110 continues to read as follows:

Authority: 46 U.S.C. 3306, 3703, 4104; 49 CFR 1.46.

13. In § 110.25–1, by removing the existing paragraphs (i) and (j) and renumbering the existing paragraphs (k) through (p) as (i) through (n), respectively.

PART 111—ELECTRIC SYSTEMS—GENERAL REQUIREMENTS

14. The authority citation for Part 111 continues to read as follows:

Authority: 46 U.S.C. 3306, 3703, 4104; 49 CFR 1.46.

15. In Subpart 111.01, § 111.01–9 is revised to read as follows:

§ 111.01–9 Watertight, waterproof, and dripproof equipment.

(a) Electric equipment exposed to the weather or located in a space where it is exposed to seas, splashing, or similar moisture conditions must be watertight

or be in a watertight enclosure, except a motor, which must be either watertight or waterproof. A watertight enclosure must be designed in such a way that the total rated temperature of the equipment inside the enclosure is not exceeded.

(b) Central control consoles and similar control enclosures must be dripproof, regardless of location.

16. In § 111.12–11, a new paragraph (j) is added to read as follows:

§ 111.12–11 Generator protection.

* * * * *

(j) *Circuit breaker reclosing.* Generator circuit breakers must not automatically close after tripping.

17. In Subpart 111.54, a new § 111.54–3 is added to read as follows:

§ 111.54–3 Remote control.

Remotely controlled circuit breakers must have local manual means of operation.

PART 113—COMMUNICATION AND ALARM SYSTEMS AND EQUIPMENT

18. The authority citation for Part 113 continues to read as follows:

Authority: 46 U.S.C. 3306, 3703, 4104; 49 CFR 1.46.

19. In 113.35–3, a new paragraph (f) is added to read as follows:

§ 113.35–3 General requirements.

* * * * *

(f) Engine order telegraph and remote propulsion control systems must be electrically separate and independent, except that a single mechanical operator control device with separate transmitters and connections for each system may be used.

April 1, 1988.

P.C. Lauridsen,

Captain, U.S. Coast Guard, Acting Chief, Office of Marine Safety, Security and Environmental Protection.

[FR Doc. 88–10622 Filed 5–17–88; 8:45 am]

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federal register

Wednesday
May 18, 1988

Part III

Department of Health and Human Services

Food and Drug Administration

Sulfamethazine; Availability of National Center for Toxicological Research's Technical Report and Sulfamethazine in Food Producing Animals; Notices

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Food and Drug Administration

[Docket No. 88N-0040]

Sulfamethazine; Availability of National Center for Toxicological Research's Technical Report

AGENCY: Food and Drug Administration.

ACTION: Notice.

SUMMARY: The Food and Drug Administration (FDA) is announcing the availability of a technical report from its National Center for Toxicological Research (NCTR) entitled "Chronic Toxicity and Carcinogenesis Study of Sulfamethazine in Fischer 344 Rats." FDA is also announcing the availability of additional data associated with an NCTR technical report entitled "Chronic Toxicity and Carcinogenesis Study of Sulfamethazine in B6C3F$_1$ Mice," which FDA previously made available. FDA's Center for Veterinary Medicine (CVM) is reviewing the reports. On May 25 and 26, 1988, the Commissioner of Food and Drugs will hold a public hearing on sulfamethazine use.

ADDRESS: Written requests for copies of the technical report or the additional data to the Dockets Management Branch (HFA-305), Food and Drug Administration, Rm. 4-62, 5600 Fishers Lane, Rockville, MD 20857. (Send two self-addressed adhesive labels to assist the Branch in processing your request.) The technical report and the additional data are available for public examination in the Dockets Management Branch, from 9 a.m. to 4 p.m., Monday through Friday.

FOR FURTHER INFORMATION CONTACT: Max Crandall, Center for Veterinary Medicine (HFV-4), Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, 301-443-3450.

SUPPLEMENTARY INFORMATION: FDA has received from NCTR and is making available a technical report of a 24-month chronic toxicity and carcinogenesis study conducted by NCTR in which rats were fed a diet containing sulfamethazine. Sulfamethazine is a new animal drug widely used in food-producing species.

Groups of male and female rats were fed a diet containing 0, 10, 40, 600, 1200, or 2400 parts per million (ppm) sulfamethazine. The feeding portion of the study was conducted from November 1982 to December 1984. The study results showed dose-related changes in mortality, i.e., the dosed animals had a lower mortality rate than the control group. There was a slight reduction in mean body weight in each dose group relative to the control group. In the animals scheduled for sacrifice at 24 months, NCTR reported the following incidences of thyroid follicular cell adenomas and adenocarcinomas.

Dose (ppm)	Female		Male	
	Incidence	Percent	Incidence	Percent
0	6/170	4	0/170	0
10	0/86	0	2/87	2
40	1/85	1	0/84	0
600	4/84	5	4/88	5
1200	8/87	9	4/83	5
2400	9/88	10	9/87	10

The increased incidence of adenomas and adenocarcinomas was statistically significant for trend ($P=0.005$ for females; $P=0.00005$ for males). The increased incidence of adenocarcinomas alone was statistically significant for trend ($P=0.003$ for females; $P=0.00006$ for males). NCTR did not report any other significant neoplastic lesions in rats.

NCTR calculated the concentration of sulfamethazine corresponding to a 1 in 1 million lifetime risk in rats, based on thyroid follicular cell adenocarcinomas alone, to be 0.027 ppm (27 parts per billion (ppb)) for females and .023 ppm (23 ppb) for males.

In conjunction with the chronic study in rats, NCTR measured the concentrations of T3 (total triiodothyronine), T4 (total thyroxine), and TSH (thyroid-stimulating hormone) in the rats at 12, 18, and 24 months. These data were published (Ref. 1) and are presented in Tables 1, 2, and 3 below.

TABLE 1.—SERUM TRIIODOTHYRONINE (T3) LEVELS (ng/100ml)[1] IN FISCHER 344 RATS DOSED WITH SULFAMETHAZINE

Sulfamethzine does level (ppm)	Duration of exposure (mo)		
	12	19	24
Males			
0	168±30(15)	120±45(14)	100±45(62)
10	155±26(15)	112±71(14)	112±42(30)
40	164±38(15)	126±61(13)	103±39(32)
600	153±61(15)	104±30(15)	72±35(30)
1200	176±26(15)	127±33(12)	78±31(29)
2400	173±43(15)	112±39(13)	84±46(30)
Females			
0	188±51(15)	151±31(13)	104±32(50)
10	194±54(15)	149±57(15)	96±26(23)
40	204±41(15)	124±45(14)	99±32(19)
600	208±19(15)	141±36(15)	101±35(29)
1200	175±35(15)	136±49(14)	97±42(27)
2400	206±38(14)	114±56(14)	78±31(29)

[1] Mean ± standard deviation (number of animals).

TABLE 2.—SERUM THYOXINE (T4) LEVELS (μg/100) ml)[1] in Fischer 344 RATS DOSED WITH SULFAMETHAZINE

Sulfamethazine dose level (ppm)	Duration of exposure (mo)		
	12	19	24
Males			
0	4.5±0.9(15)	4.0±0.7(14)	3.1±1.4(62)
10	5.7±0.7(15)	4.5±1.4(14)	3.0±1.7(31)
40	5.5±0.9(15)	4.7±1.1(13)	3.2±1.1(32)
600	5.1±1.9(15)	4.6±0.8(15)	2.3±0.9(30)[2]
1200	5.0±0.7(15)	4.1±0.8(12)	2.2±0.8(29)[2]
2400	6.1±1.2(15)	4.9±0.6(13)	2.4±1.4(30)[2]
Females			
0	3.2±1.3(15)	3.1±0.5(13)	1.9±1.0(56)
10	4.4±1.1(15)	3.9±0.9(15)	1.7±0.9(29)
40	3.9±0.8(15)	3.5±0.8(14)	1.8±0.8(28)
600	4.5±0.7(15)	3.2±0.8(15)	1.5±1.0(29)
1200	3.6±0.7(15)	2.7±0.4(14)[2]	1.4±1.1(30)
2400	4.2±1.0(14)	2.4±0.8(14)[2]	2.1±1.0(30)

[1] Mean ± standard deviation (number of animals).
[2] Significant at $p < 0.05$. Levels of significance were compared with values for 0 dose levels.

TABLE 3.—SERUM TSH LEVELS (ng 1.00 μl)[1] IN FISCHER 344 RATS DOSED WITH SULFAMETHAZINE

Sulfamethazine dose level (ppm)	Duration of exposure (mo)		
	12	18	24
Males			
0	575±133(15)	217±81(14)	155±57(31)
10	461±135(15)	374±117(14)	155±98(20)
40	395±112(15)	347±275(13)	177±63(19)
600	670±188(15)	394±107(15)	165±55(20)
1200	631±225(15)	347±155(12)	166±60(20)
2400	703±206(15)	420±184(13)	182±76(20)
Females			
0	367±101(15)	257±121(13)	170±59(29)
10	372±93(15)	341±88(15)	170±47(21)
40	318±68(15)	285±109(14)	160±33(20)
600	515±96(15)	375±86(15)	202±96(20)
1200	464±193(15)	314±128(14)	180±52(20)
2400	435±207(14)	290±84(14)	174±42(20)

[1] Mean ± standard deviation (number of animals).

FDA is also making available additional data associated with an NCTR study in mice entitled "Chronic Toxicity and Carcinogenesis Study of Sulfamethazine in B6C3F$_1$ Mice," which FDA previously made available (March 23, 1988; 53 FR 9492). The new data consist of the organ weights of the test animals.

The data from NCTR's rat study, like those from its mouse study, are undergoing review by the National Toxicology Program as well as FDA. The agency's decisions on the presence or absence of tumors in the test rats, like its decisions on the presence or absence of tumors in the test mice (see 53 FR 9492; March 23, 1988), will not become final until these reviews are completed. FDA does not expect the reviews of either study to be completed until fall 1988. Nonetheless, the results in rats and mice reported by NCTR raise significant questions about the safety of residues of sulfamethazine in the edible products of food-producing animals. FDA advises that *if* the incidence of thyroid lesions in rats (or mice) is confirmed, *and* FDA concludes that sulfamethazine should be regulated as a carcinogen, FDA would determine the safe concentration of residue using the agency's risk assessment procedures codified at 21 CFR 500.84 and guidelines for evaluating the safety of compounds used in food-producing animals (52 FR 49589; December 31, 1987). Based on the data in NCTR's technical report on the rat study, the permitted concentration of total residue in a total diet of 1500 grams in humans would be about 25 ppb. For each species in which sulfamethazine is approved, FDA would need to determine a target tissue and marker residue (21 CFR 500.86) from residue depletion data to ensure that the residue of carcinogenic concern would not exceed 25 ppb in the total diet of humans. Currently, FDA has sufficient residue depletion data only for swine.

The data from a total residue depletion and metabolism study in swine were previously published (Ref. 2). The concentrations of ^{14}C-residues in tissues of swine dosed with ^{14}C-sulfamethazine are shown in Table 4 below. The concentrations are parts per billion of sulfamethazine equivalents (mean ± standard error). All swine were dosed for 7 days and then sacrificed 8 hours or 2, 5, or 10 days after the last dose.

TABLE 4

Tissue	Time after last date (days)	Total residue (parts per billion)	Sulfamethazine (parts per billion)
Skeletal Muscle...	0.3	3150±170	1107±21
	2	930±100	315±59
	5	60±23	20.2±8.1
	10	4±1	0.56±0.12
Liver.....	0.3	6970±570	1747±478
	2	2410±410	513±121
	5	230±50	43.4±13.8
	10	62±7	4.60±1.44
Kidney.....	0.3	9270±830	4275±496
	2	2810±320	1364±208
	5	180±58	80.3±30.2
	10	26±4	2.35±0.35
Adipose	0.3	1200±70	288±27
	2	340±40	79±14
	5	20±9	3.8±2.1
	10	3±1	0.13±0.04

If FDA concludes that these data are reliable, FDA's application of the procedures specified in 21 CFR 500.86 to those data will result in a tolerance of approximately 5 ppb for parent sulfamethazine (the marker residue) in kidney (the target tissue) of swine to ensure that each edible tissue has total residue below the safe concentration.

Interested parties may receive a copy of the NCTR technical report "Chronic Toxicity and Carcinogenesis Study of Sulfamethazine in Fischer 344 Rats" or the additional data (for organ weights) for the chronic mouse study by writing to the Dockets Management Branch (address above).

FDA has scheduled a public hearing before the Commissioner of Food and Drugs for May 25 and 26, 1988, to provide an opportunity for interested persons to present relevant scientific data and pertinent information on the safety of sulfamethazine and whether sulfamethazine can be used in food-producing animals without illegal drug residues in tissue resulting from such use (53 FR 15886). FDA requests that, at or after the hearing (see 53 FR 15886 at 15890), interested persons address the following questions in addition to those set out in the May 4, 1988, notice of hearing (53 FR 15886 at 15888):

(1) Assuming that they are reliable, whether the data on the effects of sulfamethazine on T3, T4, and TSH levels (Ref. 1) are consistent or inconsistent with a hypothesis that the thyroid tumors in rats as reported by NCTR were caused by thyroid perturbation.

(2) What data are needed to show that the thyroid tumors in rodents following sulfamethazine feeding (as reported by NCTR) are the result of thyroid perturbation and not the result of a direct effect of sulfamethazine on the thyroid cells?

References

The following references have been placed on display in the Dockets Management Branch (address above) and may be seen by interested persons between 9 a.m. and 4 p.m., Monday through Friday.

1. Fullerton, F.R., R.J. Kushmaul, R.L. Suber, and N.A. Littlefield, "Influence of Oral Administration of Sulfamethazine on Thyroid Hormone Levels in Fischer 344 Rats," *Journal of Toxicological and Environmental Health*, 22:175–185, 1987.

2. Mitchell, A.D. and G.D. Paulson, "Depletion Kinetics of ^{14}C-Sulfamethazine Metabolism in Swine," *Drug Metabolism and Disposition*, 14:161–165, 1986.

Dated: May 12, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–11076 Filed 5–13–88; 11:20 am]

BILLING CODE 4160–01–M

[Docket No. 88N–0040]

Sulfamethazine in Food-Producing Animals; Public Hearing Before the Commissioner; Time Change

AGENCY: Food and Drug Administration.

ACTION: Notice.

SUMMARY: The Food and Drug Administration (FDA) is announcing a change in the starting time for a public hearing before the Commissioner of Food and Drugs (the Commissioner) on the safety of the new animal drug sulfamethazine and on whether sulfamethazine can be used in food-producing animals without illegal drug residues in tissue (drug residues) resulting from such use. The hearing, originally scheduled to begin at 8:30 a.m. on May 25, 1988, is being changed to begin at 10 a.m. On May 26, the hearing will begin at 8:30 a.m.

FOR FURTHER INFORMATION CONTACT:

Judith A. Gushee, Center for Veterinary Medicine (HFV–236), Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, 301–443–2830.

or

David F. Tishler, Center for Veterinary Medicine (HFV–238), Food and Drug Administration, 5600 Fishers Lane, Rockville, MD 20857, 301–443–6244.

SUPPLEMENTARY INFORMATION: In the **Federal Register** of May 4, 1988 (53 FR 15886), FDA announced a public hearing before the Commissioner on the safety of the new animal drug sulfamethazine and on whether sulfamethazine can be used in food-producing animals without illegal drug residues in tissue (drug residues) resulting from such use.

Residues of sulfamethazine in tissue are of particular concern at this time because FDA's National Center for Toxicological Research has recently completed a chronic toxicity and carcinogenesis feeding study of sulfamethazine in mice, the results of which indicate that sulfamethazine may be a carcinogen. FDA will use information presented at and after the public hearing, together with other data and information, to determine whether the use of sulfamethazine in food-producing animals presents an unacceptable risk to human health and, if so, an appropriate course of action to minimize that risk.

The hearing is scheduled to be held on May 25 and 26, 1988, at the Jack Masur Auditorium, Bldg. 10, Clinical Center, National Institutes of Health, 9000 Rockville Pike, Bethesda, MD 20205. The hearing, originally scheduled to begin at 8:30 a.m. on May 25, is being changed to begin at 10 a.m. On May 26, the hearing will begin at 8:30 a.m.

Dated: May 11, 1988.

John M. Taylor,

Associate Commissioner for Regulatory Affairs.

[FR Doc. 88–11075 Filed 5–13–88; 11:20 am]

BILLING CODE 4160–01–M