U.S. Department of Homeland Security

United States Coast Guard

Commandant
United States Coast Guard

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COMDTINST M9000.6E
October 21, 2004

COMMANDANT INSTRUCTION M9000.6E

Subj: NAVAL ENGINEERING MANUAL

1. PURPOSE. This Manual promulgates Coast Guard Naval Engineering policy and selected procedures.

2. ACTION. Area and district commanders, commanders of maintenance and logistics commands, commanding officers of headquarters units, assistant commandants for directorates, Chief Counsel, and special staff at Headquarters shall comply with the provisions of this Manual. Internet release authorized.

3. DIRECTIVES AFFECTED. Naval Engineering Manual, COMDTINST M9000.6D is canceled.

4. SUMMARY OF CHANGES. This Notice incorporates all changes to previous editions of the Naval Engineering Manual and the following significant new changes:

   a. Chapter 001:

      Changed information in Section B "**CHANGE PROCESS**" to reflect new NEM change process.

   b. Chapter 041:

      This chapter was re-worded to define the CCB process. Updated List of Standard Boats.

   c. Chapter 042:

      Changed Sect A. "Hierarchy of Guidance" for Naval Engineering publications and directives. Providing new guidance for referenced specification usage.

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d. Chapter 076:

New Chapter Added

e. Chapter 077:

Removed Industrial Hygiene Manual COMDTINST M6260.9 (series) as reference.

f. Chapter 079:

Corrected misspelled words in section D “Weight” and Section E “Damage Control Organization.” Updated Table 079-1 “Table Of Damage Control Organization.” Removed all references to 133’ and 213’ cutters.

g. Chapter 080:

Updated Integrated Logistics Support Requirements.

h. Chapter 081:

Introduces Lead MLC for Cutter Classes. Changed Sect G.1.c Provides MLC direction for use of cutter class Standard Support Level (SSL) allocated each Fiscal Year. Distributing SSL funds to be strictly used to address the maintenance needs for specific platforms within the class, or otherwise gain concurrence from operational commanders. Removed all references to 133’ and 213’. Section F. redefines management of the Engineering Change process to include new scoring and resource allocation methodology to ensure highest priority needs are consistently acted on.

i. Chapter 083:

Added Supply Policy and Procedures Manual (SPPM), COMDTINST M4400.19 (series) as a reference in section C “APPROPRIATIONS.”

j. Chapter 085:

Rewrote Section D. Para 3 MANAGEMENT OF ENGINEERING DRAWINGS FOR COAST GUARD PLATFORMS: to incorporate referencing NE-TIMS.

k. Chapter 086

Updated ELC Technical Information Management Branch (O2T) to (O5T) in all references.

l. Chapter 088:

New definition of Maintenance Augmentation Teams (MAT)

m. Chapter 090:

Removed 090 G.; **ADDITIONAL RECORDS**: Added Oil History Log (Cutters only); Degaussing Folder; Record of tank inspections; and Zinc Log. Removed Machinery Allowance Book; and Stability and Loading Booklet.

n. Chapter 233:

Modified tables 233-1 and 233-3. Updated Diesel Engine Maintenance Program

o. Chapter 262:

Changed address for submitting oil samples to the Navy Lab in Norfolk, Va. Changed wording to address new procedure in section C, "Lubricating Oil Testing and Analysis Procedures."

p. Chapter 505:

Aligned verbiage to incorporate NSTM definitions.

q. Chapter 540:

Section A.3.a "Authorized Gasoline Containers" revised.

r. Chapter 541:

Updated new fuel requirements.

s. Chapter 555:

Removed Sections F.10 & G.1.b. Section G, definitions for Clothing/Battle Dress and Repair Party Firefighting Ensemble (FFE). Updated Section F.4 b. to include 2 other classes of vessels authorized Halon 1301. Updated Section H.4, Hose Replacement Schedule.

t. Chapter 570:

Aligned verbiage to incorporate NSTM definitions.

u. Chapter 573:

Changed Section C. PADEYES, CHOCKS, CLEATS AND BITTS. To: ATON WEIGHTHANDLING FITTINGS.

v. Chapter 583:

Table 583-1 NOTES: Note 6 Changed to "Weight does not include 2000 pound cargo."

w. Chapter 589:

Changed the format of the entire chapter.

x. Chapter 593:

Section E.3, contents completely revised

y. Chapter 634:

Made changes to Table 6341-1, "AUTHORIZED DECK COVERING MATERIAL".

5. REQUESTS FOR CHANGES. Recommendations for improvements to this Manual should be submitted in accordance with chapter 001.

6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS. Environmental considerations were examined in the development of this Manual and have been determined not to be applicable.

7. FORMS AND REPORTS AVAILABILITY. Machinery History Card, CG-2929, SN 7530-00-F01-2260; Operating Record Main Engines, CG-3186, SN 7530-00-F01-3000; Operating Record-Main Propulsion, CG-3186A, SN 7530-01-GF2-5750; Watch Quarter and Station Bill, CG-3485, SN 7530-00-F01-4340; and Request for Directives, CG-4428, SN 7530-00-F02-0620 may be ordered from Engineering Logistics Center (ELC) Baltimore. Ship's Maintenance Action Form, OPNAV4790/2K, and Ship's Maintenance Action Automated, OPNAV 4790/2Q can be found at http://forms.daps.dla.mil/. All other forms called for in this Manual are available in USCG Electronic Forms on SWSIII or on the Internet at http://www.uscg.mil/ccs/cit/cim/forms1/welcome.htm or the Intranet at http://cgweb.uscg.mil/g-c/g-ccs/g-cit/g-cim/forms1/main.asp.

ERROLL BROWN /s/
Assistant Commandant For Systems

Naval Engineering Manual

COMDTINST M9000.6E

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CHAPTER 001. INTRODUCTION

A. **PURPOSE.** The Naval Engineering Manual (NEM), COMDTINST M9000.6 E, is published to promulgate Coast Guard Naval Engineering policy and selected procedures. Area commanders, unit commanding officers, and officers-in-charge responsible for the operation, maintenance, repair, and alteration of HM&E systems on cutters and standard boats shall comply with the guidance provided in this Manual. In addition, Weapons officers and Weapons petty officers responsible to their respective commands for maintenance, repair, and alteration of Navy-owned ordnance systems shall also comply with the guidance provided in this Manual.

1. The NEM includes certain technical information not readily available in other reference documents. When adequate information is available from another source, this Manual references the appropriate source. Such information will not be duplicated in this Manual.

2. The NEM contains detail only to the extent necessary to clearly establish information reporting requirements and/or define testing, maintenance, repair, and engineering change procedures not sufficiently explained elsewhere. It shall be the responsibility of the Area Commander/Maintenance and Logistics Commander to develop and promulgate the detailed procedures necessary to execute this policy.

3. The indexing format for the NEM generally conforms with the Ship Work Breakdown Structure (SWBS), NAVSEA 0900-LP-039-9010, as used in the Naval Ships Technical Manual (NSTM).

B. **CHANGE PROCESS.** To ensure this Manual remains up-to-date, coincides with current practices, and continues to meet program needs, future change proposals shall be forwarded as specified in the following paragraphs.

1. Change proposals may be originated at any organizational level. Proposals shall be submitted via web-enabled form located on the Office of Naval Engineering (G-SEN) website at http://cgweb.comdt.uscg.mil/g-sen/resources/nem.htm.

2. The web form requests the following information: change originator's name / rate / rank, unit, phone number, e-mail, NEM chapter reference, section title, proposed new text, background / reason for change and suggested references (if any). When the change proposal is submitted, the web form will display a confirmation page with instructions and point of contact for following-up. The proposal will then be e-mailed automatically to the NEM Manager at G-SEN-1.

3. Upon receipt, the G-SEN-1 NEM Manager will initiate the following action:

   a. Immediately contact the change proposal originator to confirm receipt of the submission.

b. Conduct a thorough investigation of the proposal to justify the need, identify possible conflicts with other directives and publications, and assess the affects of implementation.

c. Forward the proposal to the appropriate NEM Chapter Owner who is the point of contact for technical review.

4. Upon receipt, the NEM Chapter Owner will:

   a. Immediately contact the change proposal originator to confirm receipt of the submission

   b. Conduct a technical review of the change proposal. The Chapter Owner is responsible for ensuring that all interested parties (including MLC's) are provided an opportunity to review the change proposal and provide concur/non-concur input.

   c. Contact the change proposal originator to discuss the proposal and background. If the change is not approved, the Chapter Owner will notify the originator via e-mail with an explanation for the disapproval.

   d. Approved changes will be forwarded to the G-SEN-1 NEM Manager for inclusion in the next revision.

5. G-SEN is the final approving authority and has overall responsibility for the Naval Engineering Manual.

   a. All approved changes are immediately entered into the electronic version of the next NEM revision.

   b. In December of each year the new revision of the NEM, including all changes submitted throughout the previous year, will be routed for sequential clearance to the Assistant Commandant for final approval.

   c. Upon obtaining Assistant Commandant approval, the revision will be submitted to CG-612 for annual publishing to the online USCG Directives System. The most recent revision of the NEM is available online at http://cgweb.uscg.mil/g-c/g-ccs/g-cit/g-cim/directives/cgcim.html.

   d. As hard copy printing and distribution of the NEM is a significant budget item, the revision will be sent to the printer for hard copy printing and distribution every other year at the beginning of even numbered years (ie: 2006, 2008 etc…). The G-SEN-1 NEM Manager is responsible for ensuring that funding is requested and obtained for printing and distribution in the appropriate years.

C. **DISTRIBUTION.** Commandant (G-SEN) shall determine distribution of this Manual. Requests for changes to the distribution should be submitted on "Request for Allowance

Change" (Form CG-5323), addressed to Commandant (G-CIM), via the chain of command.

D. **ORDERING.** The Directives Publication and Reports Index (DPRI), COMDTNOTE 5600 provides guidance for ordering M9000.6E and its associated changes. Form CG-4428, Request For Directives, shall be completed and forwarded to the appropriate stockpoint.

E. **FORMS AND REPORTS.** Machinery History Card, CG-2929, SN 7530-00-F01-2260; Operating Record Main Engines, CG-3186, SN 7530-00-F01-3000; Operating Record-Main Propulsion, CG-3186A, SN 7530-01-GF2-5750; Watch Quarter and Station Bill, CG-3485, SN 7530-00-F01-4340; and Request for Directives, CG-4428, SN 7530-00-F02-0620 may be ordered from Engineering Logistics Center (ELC) Baltimore. Ship's Maintenance Action Form, OPNAV4790/2K, and Ship's Maintenance Action Automated, OPNAV 4790/2Q can be found at http://forms.daps.dla.mil/. All other forms called for in this Manual are available in USCG Electronic Forms on SWSIII or on the Internet at http://www.uscg.mil/ccs/cit/cim/forms1/welcome.htm or the Intranet at http://cgweb.uscg.mil/g-c/g-ccs/g-cit/g-cim/forms1/main.asp.

CHAPTER 041. ENGINEERING CHANGES

A. GENERAL.

1. Scope. This chapter defines and promulgates processes to request, develop, and implement Engineering Changes. The Engineering Change process is used by the Coast Guard to field new equipments and systems as a control element in support of Configuration Management. Engineering Changes to electronic equipment under the authority of the Command, Control, Communications, and Computers Directorate (CG-6) shall follow the procedures outlined in the Electronics Manual, COMDTINST M10550.25 (series). Electronic Engineering Changes that impact HM&E equipment (i.e. power load, arrangements, weight, etc.) shall also follow the Engineering Change process outlined in this chapter. Engineering Changes to Navy-owned ordnance equipment (ORDALTs) are promulgated by the Naval Sea System Command and are not within the scope of this chapter. Ordnance Manual, COMDTINST M8000.2 (series), Chapter 4, contains policy and procedures regarding ORDALTs. This chapter complies with, but does not specifically address the Coast Guard Configuration Management guidelines outlined in Commandant Instruction 4130 (series). Naval Engineers shall be aware of these instructions prior to taking any significant role in the Engineering Change process.

2. Intent of Engineering Changes. Changes to cutters and boats which initially seem to be minor and simple, often accumulate to negatively impact system capability and operational availability. Additionally, it must be realized that the resources used to accomplish Engineering Changes typically reduce funding available for maintenance. Many change requests have merit, but a lack of a clear, positive benefit to cost ratio across a cutter or boat class may prevent approval. In addition, limited funding may cause delays in Engineering Change execution.

   All HM&E Engineering Change Requests (ECR)s will be reviewed using an Engineering Change Needs Analysis process maintained by the ELC. This analysis will determine if the ECR is necessary to meet operational requirements, address a safety or environmental issue, or provides enough cost benefit over the system's life cycle to justify the expense of an Engineering Change. If an ECR does not warrant an Engineering Change it will be disapproved by the ELC or CCB and returned to the originator with the rationale for disapproval.

3. Applicability. The procedures set forth in this section apply to all cutters, standard boats, and Port Security Units. Standard boats are listed in Table 041-1. The respective District Commander must approve changes to nonstandard boats. The authority to change barges is delegated to the MLCs who shall administer Barge Engineering Changes.

Table 041-1: List of Standard Boats

14' CB-S	Cutter Boat, Small
18' CB-M	Cutter Boat, Medium

22’ CB-L	Cutter Boat, Large
24' CB-OTH	Cutter Boat, Over-the-Horizon
25’ TPSB	Transportable Port Security Boat
25' RB-S	Response Boat, Small (includes Response Boat, Homeland Security)
26’ MSB	Motor Surf Boat, MK V
30’ SPC (SURF)	Special Purpose Craft, Surf Rescue Boat
41’ UTB	Utility Boat
44’ MLB	Motor Lifeboat
45' RB-M	Response Boat, Medium
47’ MLB	Motor Lifeboat
49’ BUSL	Buoy Boat, Stern Loading
52' SPC (HWX)	Special Purpose Craft (Heavy Weather Surfboat)
55’ ANB	Aids to Navigation Boat

B. **ENGINEERING CHANGES THROUGHOUT THE LIFECYCLE.** There are two distinct, but integrated periods to Engineering Changes throughout the lifecycle of an asset: Acquisition and Sustainment.

1. Acquisition Engineering Changes. This period covers the time between acquisition inception to the time the last asset has been delivered and the warranty period is completed. During this time, the Engineering Change process is managed by the Acquisition Program office. The Program Manager for the acquisition will be the Configuration Manager, having final approval/disapproval authority for all Engineering Changes. The ELC will be a member of the Configuration Control Board and may be a voting member depending upon each individual project’s Configuration Management Plan. As a member of the CCB, the ELC will provide technical advice, including recommendation for approval/disapproval, to the Program Manager. During this period, the Acquisition Program office will normally fund Engineering Changes, with exceptions being coordinated with G-SEN.
2. Sustainment Engineering Changes. This period covers the time between acquisition completion and decommissioning. G-O is the Configuration Manager during this period, having final approval/disapproval authority for all Platform Engineering Changes. ELC has authority to approve/disapprove System Engineering Changes. Systems Management and Engineering Facilities (SMEFs) have authority to approve/disapprove electronic System Engineering Changes.
3. Multi-user ECP Automated Review System (MEARS). MEARS is an on-line Engineering Change process that is currently in the testing phase. This Engineering Change system, if accepted, would be used during both the Acquisition and Sustainment phases of an assets lifecycle. An implementation decision will be made after a test period is completed. The plan is for MEARS to not alter the established Engineering Change approval processes. It will just move the process on-line, improving process efficiency.
4. Detailed descriptions of processes, roles, and responsibilities for Sustainment Engineering Changes are covered in the following sections of this chapter. Detailed

descriptions for Acquisition Engineering Changes are located in the Major Systems Acquisition Manual (COMDINST M4150.2 series), Coast Guard Configuration Management guidelines (COMDINST 4130 series), and program specific plans (Configuration Management Plan and Configuration Control Board charter).

C. **DEFINITIONS.** Engineering Changes fall into two categories: Platform and System.

1. Platform Engineering Change. A modification to a cutter or standard boat that meets one of the following criteria:

   a. Changes to cutter or standard boat class mission characteristics/capability.

   b. Changes in weight or moment that significantly affect intact or damaged stability. Although each case is unique due to different limiting factors (e.g., hull strength, damaged stability, etc.), changes that create more than a 0. 001-foot change in KG or add/delete more than 1/20 of 1% of the full load displacement (i.e. 112 lbs. per 100 tons of displacement), require a Platform Engineering Change. If in doubt about the effect of the intended weight change, request technical advice from the ELC platform manager or MLC Type Desk.

   c. Changes to the hull structure, space allocations, watertight integrity, or compartmentation.

   d. For standard boats, changes to outfitting requirements specified on approved Allowance Equipage Lists (AEL) and additions of new outfitting items that would be required to be placed on an AEL.

2. System Engineering Change. An Engineering Change that does not meet the criteria of a Platform Engineering Change and meets one of the following criteria:

   a. A change to any system, part, component, or subassembly that is documented on an Allowance Parts List (APL).

   b. A change to an approved system software, fluid, or paint system. Such changes will usually be to improve reliability, maintainability, or operational efficiency of the system or equipment.

   c. Forms, fit or functional change to a closure or fitting.

      (1) Form. Form is defined by the quantitative and qualitative descriptions of material features, such as composition, dimensions, size, weight, finishes, and the respective tolerances. Any change affecting the weight, balance, or inertia; shape, size, dimensions, mass, and/or other visual parameters, which uniquely characterize an item, affect the form.

      (2) Fit. Fit is the ability of an item to physically interface or interconnect with or become an integral part of another item. A change that would affect interface connectivity affects fit.

      (3) Function. Function is the operations or actions that an item is designed and required to perform. Performance parameters include operational requirements such as range, speed, lethality, reliability, maintainability,

survivability, or safety, including operational and logistics parameters and their respective tolerances. Any change affecting intended performance affects function.

d. Damage control classification change.

3. Prototype. A full-scale installation to evaluate the usefulness and effectiveness of an Engineering Change and/or to develop or modify installation specifications.

D. ENGINEERING CHANGE PROCESS. All Engineering Changes shall be initiated through the submission of an Engineering Change Request (ECR). ECRs may originate at any organizational level. Figures 041-1 and 041-2 are process flow chart depictions of the Engineering Change process. The process is completed in four phases: Concept, Validation, Development, and Deployment. These phases are described in detail below.

1. Concept Phase. All ECRs must be submitted using CG Form 5682, ENGINEERING CHANGE REQUEST (see Figure 041-3). Instructions are included on page two of the form. The form may be submitted electronically or on paper. The originator is encouraged to provide as much amplifying detail as possible to assist with the proper evaluation of the request.

Note: Configuration Change Forms (4790/CK) shall not be used as a tool to request Engineering Changes, but should only be used to notify the ELC of the completion of an authorized Engineering Change that affects the cutter/boat's configuration.

a. Field Units and Area/District Staffs. Group units shall submit ECRs to the servicing MLC (v or t) via the Group and District Commander. Other field units shall submit ECRs to the servicing MLC (v or t) with an information copy to the operational commander. In either case, the originator shall send an information copy to the ELC (01) to ensure proper tracking of the request.

b. MLCs. MLCs shall evaluate each ECR from the perspective of requirements and impact on current operations. MLCs shall endorse the requirements and comment specifically on the system need, safety, program/capability need, and risk. MLCs shall also recommend a source of funding and a classification (see paragraph E.4). MLCs shall endorse the request with approval or disapproval on the ECR form within 45 days of receipt. If approved, the request shall be forward to the ELC (01) for further development. If disapproved, the request shall be returned to the originator with an explanation for disapproval, and an informational copy shall be sent to the ELC (01). For HM&E ECRs that have initial funding projected to be AFC-45 (see E.1), the MLCs shall add approved ECRs to the World of Work (WOW) or to a waiting list pending assignment to the WOW. For more information on the WOW see Ch 080 C.2.

c. Headquarters Unit/Level Organizations. Although most ECRs are generated through the MLCs, the G-O facility managers, G-A, CG-6, ELC, Systems Maintenance Engineering Facilities (SMEF), Boat Standardization Teams, and other Headquarters unit/level organizations may also submit ECRs. These units/organizations shall complete the appropriate sections of the ECR Form. All ECRs shall be forwarded to the ELC (01).

d. Engineering Logistics Center. The ELC shall review and categorize all ECRs to determine the appropriate development and approval process. Upon receipt of the ECR, the ELC shall start a case file and begin tracking the case in the DARTS database. ECRs categorized as Platform Engineering Changes shall be forwarded to G-SEN & G-O for Headquarters Configuration Control Board (CCB) review and approval. ECRs categorized as System Engineering Changes to electronic equipment managed by a SMEF shall be forwarded to the appropriate SMEF for review, development, and approval (see Electronics Engineering Manual COMDTINST 10550.25 (series)). All other ECRs shall be retained at the ELC for review, development, and approval. All ECRs received by the ELC shall have this initial disposition completed within 60 days of receipt.

2. Validation, Development, and Deployment Phases. The process used for these phases is dependent upon the category assigned to the ECR. These phases are described below for each category of ECR.

a. Platform Engineering Change. (Figure 041-1)

(1) Validation Phase. During this phase, the ECR is validated against engineering, operational, and resource requirements. The CCB will provide conceptual approval/disapproval for the ECR. Although the CCB may provide conceptual approval, ECP development may be delayed for funding determination. ECRs without funding support shall not be developed further.

(a) G-SEN. G-SEN manages the validation of Platform Engineering Changes at Headquarters from an engineering perspective. G-SEN shall also coordinate with the G-O facility manager and CG-6 to validate the ECRs from the perspective of requirements and impact on future operations.

(b) G-O. G-O manages the validation of Platform Engineering Changes at Headquarters from a requirements and operations perspective.

(c) CCB. The CCB shall review the ECR and provide initial approval/disapproval within 30 days of receipt. The conceptual approval provided in this phase is for the ECR to move forward and be fully developed. This does not provide final approval authority to implement the Engineering Change. If the ECR is disapproved, the CCB shall return the request to the originator with an explanation for disapproval, and an information copy shall be sent to the ELC (01). For conceptually approved HM&E ECRs that will be funded out of AFC-45 money, the CCB shall forward the ECR to the NEMLWG for funding approval. For all other conceptually approved HM&E ECRs, the CCB shall forward the request to the ELC for further development. Conceptually approved electronic ECRs shall be forwarded to the appropriate SMEF for technical development. Only ECRs with identified funding sources shall be fully developed.

(d) NEMLWG. The NEMLWG shall receive all conceptually approved HM&E ECRs that will be funded through AFC-45 funds from the CCB. The NEMWLG shall approve funding for ECP development and deployment based on WOW prioritization (see Ch 080 C.2). ECRs with identified funding shall be forwarded to the ELC for development.

(2) Development Phase. During this phase, the Platform Engineering Change request is prepared for implementation from the perspective of configuration management, life cycle logistics support, and installation. The ELC or SMEF is primarily responsible for this phase.

(a) SMEF. Appropriate SMEFs shall develop electronic system ECRs, forwarded from the CCB. During development, considerations for life cycle logistics support and installation requirements shall be made. Upon completion of the technical package, the SMEF shall forward the package to the ELC for final logistical development. The technical package shall be forwarded to the ELC in the standard Engineering Change format (see paragraph (d) below).

(b) ELC. The ELC shall develop HM&E ECRs from a technical, configuration management, life cycle logistics support, and installation perspective. The ELC shall also finish development of electronic ECRs after initial development by the appropriate SMEF. The ELC shall forward complete Engineering Change packages to the CCB for final approval.

(c) CCB Concurrent Clearance. All members of the CCB shall review the final Platform Engineering Change package in concurrent clearance and provide their recommendation to the Configuration Manager (CCB Chair). CG-6 and SMEFs are included for electronic Engineering Changes. After receiving the recommendation of the CCB the Configuration Manager shall approve or disapprove the Engineering Change. If there are no future modifications to the Engineering Change, this approval provides final authority to proceed with implementation of the change. The Configuration Manager shall forward the Engineering Change to the ELC for deployment.

(d) A fully developed Platform Engineering Change (CGHQ 3379) is comprised of a cover sheet and sufficient information to directly accomplish the Engineering Change, or to support development of a contract specification. This information shall be formatted into the following 21 areas, which reflect the general Engineering Change description, installation specifications, and the ILS elements.

Purpose
Background
References
Material Required
Equipment Removals/Relocation/Disposal
Equipment Installations

Quality Control/Quality Assurance
Safety
Stability Impact
Funding Requirements and Sources
Supply Support (including packaging, handling, and storage)
Special Tools/Test Equipment
Technical Information
    Manuals
    Drawings
Computer Resources
Maintenance
Training and other manpower and personal issues
Documentation
Reprocurement Data
Repair Program

(3) Deployment Phase. During this phase, the actual Engineering Change is installed on applicable units. Once a finalized EC is distributed to the cutter or boat, they shall follow the guidance contained on the Engineering Change form and schedule completion with their applicable NESU or Group when funded from the source directed by the EC. Completion of the EC is mandatory and shall be completed within the period defined on the EC. NESUs and Groups will ensure timely completion of ECs on cutters and boats during their regular platform visits. Deviations from the specifications developed for the change will only be authorized by the Configuration Manager.

(a) ELC. After receiving final approval authority from the Configuration Manager, the ELC shall sign the Platform Engineering Change and distribute it to appropriate commands. If additional development is required during this phase and this development leads to changes in cost or scope approved by the CCB or significant support or operational parameters change the ELC shall return the Engineering Change to the CCB for further review.

(b) Field Units. After completion of an Engineering Change, installing units shall fill out the completion section of the Engineering Change authorization form and submit two copies, one to their servicing MLC and one to the ELC. In addition, installing units shall complete a Configuration Change Form (4790/CK) and submit it to the ELC.

b. System Engineering Change. (Figure 041-2)

(1) Validation Phase. The ELC or SMEF manages this phase of the process. System Engineering Change requests shall be reviewed from the perspective of technical feasibility. Disapproved System Engineering Change requests shall be returned to the originator with an explanation of the reason for the disapproval. SMEFs shall send the ELC (01) an info copy of all ECR disapproval notices.

NOTE: If necessary, the ELC/SMEF shall consult with Headquarters and/or MLCs to determine the proper funding requirements of the ECR. ECRs without funding support shall not be developed further.

(2) Development Phase. The ELC or SMEF shall develop all approved System Engineering Change requests that have identified funding sources. These ECs shall be developed and formatted in the same way as Platform Engineering Changes. System Engineering Changes developed by a SMEF will have a concurrent clearance review limited to the MLCs (v/t) and the ELC. System Engineering Changes developed by the ELC shall have a concurrent clearance review limited to the MLCs (v).

(3) Deployment Phase. Once concurrent clearance feedback issues are resolved, the ELC or SMEF shall sign the System Engineering Change and distribute it to appropriate commands. Once a finalized EC is distributed to the cutter or boat, they shall follow the guidance contained on the Engineering Change form and schedule completion with their applicable NESU or Group when funded from the source directed by the EC. Completion of the EC is mandatory and shall be completed within the period defined on the EC. NESUs and Groups will ensure timely completion of ECs on cutters and boats during their regular platform visits. Deviations from the specifications developed for the change will only be authorized by the ELC. Field units shall complete a Configuration Change Form and forward to the ELC. In addition, field units shall fill out the completion section of the Engineering Change and submit it to their servicing MLC and the ELC.

3. Prototypes. The Engineering Logistics Center (ELC) shall be the sole Engineering Change prototype approving authority. Figures 041-1 and 041-2 depicts where prototypes fit into the Engineering Change process. Requests for prototypes should be incorporated into the Engineering Change request. Unsuccessful prototypes shall be removed after completion of the evaluation period. The removal shall be funded by the organization that funded the installation.

a. ELC. Prototypes shall not be approved prior to CCB approval for Platform level Engineering Changes. Upon receipt of the prototype request, the ELC shall evaluate the technical impact of the request and, if appropriate and after consultation with the originator, issue a prototype authorization letter. Prototype authorization letters shall typically be issued to the UTB Systems Center for UTBs and to the National Motor Lifeboat School (NMLBS) for MLBs. Prototype authorization letters for other boat and cutter classes will typically be issued to the MLC or SMEF. The letter shall include a Prototype Evaluation Plan (PEP), developed by the ELC, or SMEF for electronic systems. Completed Prototype Evaluation Plans for Platform Engineering Changes shall be forwarded to the Configuration Manager for review.

b. Field Units. The Prototype Evaluation Plan shall be completed by the unit on which the prototype was installed and returned to the ELC with a copy to other activities involved in the prototype (i.e. SMEF, MLC, etc.). Because prototypes are often an integral part of the Engineering Change development process, it is critical that the Prototype Evaluation Plan be completed and returned.

c. CCB. For Platform Engineering Changes, the CCB shall review completed Prototype Evaluation Plans and provide a recommendation to the Configuration Manager for full implementation of the Engineering Change. The Configuration Manager provides the final approval or disapproval over full implementation of the Engineering Change.

4. Emergency Procedures. Circumstances requiring immediate action to meet emergency operational commitments or recently discovered safety hazards may preclude use of the normal ECR process. In these cases, the MLC or HQ unit shall submit the ECR (CG Form 5682) and Configuration Change Form (4790/CK) by message, e-mail, or express mail to ELC (01). Cost data shall be provided to the extent that it is available without holding up the resolution of the emergency situation. The approval decision shall be made within three working days of receipt. This abbreviated procedure shall only be used to meet vital operation commitments or resolve immediate safety or health threats. Regardless of the urgency of the Engineering Change, the full development of the ECR must eventually be accomplished as outlined above.

E. ENGINEERING CHANGE ADMINISTRATION.

1. Funding. Funding for Engineering Changes will be determined through the ECR process as outlined in this chapter. It is anticipated that funding will come from one of three major sources as outlined below:

Funding Source	Low Cost	Medium Cost	High Cost
Unit AFC 30	X		
MLC AFC 4X		X	
Program Manager (3X/4X/AC&I)			X

a. Low Cost. Low cost engineering changes are those changes which have a total cost (including design, material, life cycle cost, logistic support and installation) less than or equal to the MLC established AFC 30 CSMP funding threshold for the particular cutter class.

b. Medium Cost. Medium cost engineering changes are those changes which have a total cost (including design, material, life cycle cost, logistic support and installation) greater than the MLC established AFC 30 CSMP funding threshold but not to exceed 5% of the affected cutter class annual AFC 45 Standard Support Level (SSL).

c. High Cost. High cost engineering changes are those changes that have a total cost (including design, material, life cycle cost, logistic support and installation) greater than 5% of the affected cutter class annual AFC 45 standard support level (SSL). AC&I threshold levels are listed in the Financial Resource Management Manual (FRMM), COMDTINST M7100.3 (Series).

2. Tracking. The ELC shall maintain an ECR database (DARTS) that tracks the status of all ECRs. In order for the ELC to keep this database complete and accurate, ECR status information shall be submitted to the ELC as noted in Figure 041-1 and 041-2. The database shall be maintained and be available on the ELC's intranet site (http://cgweb.elcbalt.uscg.mil/dartsqry.htm). The database shall include the following information:

    a. ELC Case file number/Tracking number.
    b. ECR
    c. Title
    d. Originator
    e. Request Date
    f. Current Status Date
    g. Current Location
    h. Current Status
    i. Change Type
    j. Milestones (For open & funded ECRs only)

3. Engineering Change Numbering. Engineering Changes shall be numbered as identified in COMDTINST M4130.8, using three groups of letters and numbers. The first group defines the cutter or boat class to which the Engineering Change is applicable. The second group defines the classification of the Engineering Change. The third group is the serial number of the Engineering Change for the particular cutter or boat class (e.g., 110A-B-010, 41UTB-A-005). The ELC shall issue all Engineering Change numbers.

    NOTE: This is the same system used for the old Ship and Boat Alteration system and serial numbers will carry forward from that system.

4. Engineering Change Classification. Platform Engineering Changes shall be classified in accordance to COMDINST M4130.8.

    a. Class A. Class A Engineering Changes are of the utmost importance for correcting conditions that impair the service characteristics of a cutter, its safety, or the health of its personnel. Class A Engineering Changes shall be considered to be equivalent to urgent repairs and shall be accomplished at the first opportunity, but in no case later than one full availability cycle after the Engineering Change is issued.

    b. Class B. Class B Engineering Changes are less urgent than Class A Engineering Changes, but are of importance by reason of the resultant improvement in the service characteristics of the cutter, the health and comfort of its personnel, or notable improvements in efficiency and economy of operations and upkeep.

Class B Engineering Changes shall be accomplished within two availability cycles from the time the Engineering Change is issued.

c. Class C. Class C Engineering Changes are to be accomplished upon the occurrence of a specific event (e.g., contingent upon receipt of Commandant funding or upon the need to renew a specific item). This class of change describes a future configuration such as the use of an improved joiner bulkhead panel or renewal of a reliable but obsolete pump. These changes are either impossible or undesirable to accomplish quickly on all vessels of a class. Delay in accomplishing this class of Engineering Change will not impact operational capability. The Engineering Change will identify the contingency. Once the contingent aspect of the Engineering Change has occurred, the Engineering Change becomes mandatory and must be completed within two years.

5. Reports and Records.

a. Report of Completion. Upon completion of an Engineering Change, the unit shall fill in the completion section of the Engineering Change authorization form (CGHQ 3379) and forward two signed copies, one to the ELC and one to the servicing MLC. The unit will also retain a copy in their files. If the Engineering Change pertains to an electronic system, a copy shall also be forwarded to CG-6. Cutters which are MICA/CALMS supported shall also submit a Configuration Change Form (Form 4790/CK) when directed to do so by the Engineering Change. A unit that receives a class related Engineering Change that does not apply to their particular boat/cutter should note the same in the completion section of the form and send the signed copies as noted above.

b. Records.

(1) Units. Each unit shall maintain a file of pending and completed Engineering Changes as part of the general engineering files, IAW Chapter 090 of this manual. Appropriate entries shall be made in the Machinery History, Hull History, etc. Vessels with CMPlus will update the database IAW the CMPlus user's guide to reflect completion of Engineering Changes.

(2) ELC. The ELC shall maintain the master Engineering Change file for all cutter and boat classes. This file will contain the original signed copies of each Engineering Change issued. The ELC shall also maintain a case file for each Engineering Change proposal. This file shall be a historical repository of all relevant documents associated with the Engineering Change issue.

F. TESTING OF COMMERCIAL PRODUCTS.

1. Unsolicited Proposals. Manufacturer's agents often approach field commands to propose tests and trials of new products or equipment. While Coast Guard policy is to continually seek improvements, cutters and boats shall not be used indiscriminately by vendors to field test unproven products or to generate product endorsements. Coast Guard Acquisition Procedures (CGAP), COMDINST M4200.19 (series) provides guidance for process and handling unsolicited proposals.
2. New Products or Equipment. Coast Guard initiated proposals for testing proprietary products or materials shall be processed using the same procedures detailed under the Engineering Change Process paragraph of this chapter.

Platform Engineering Change

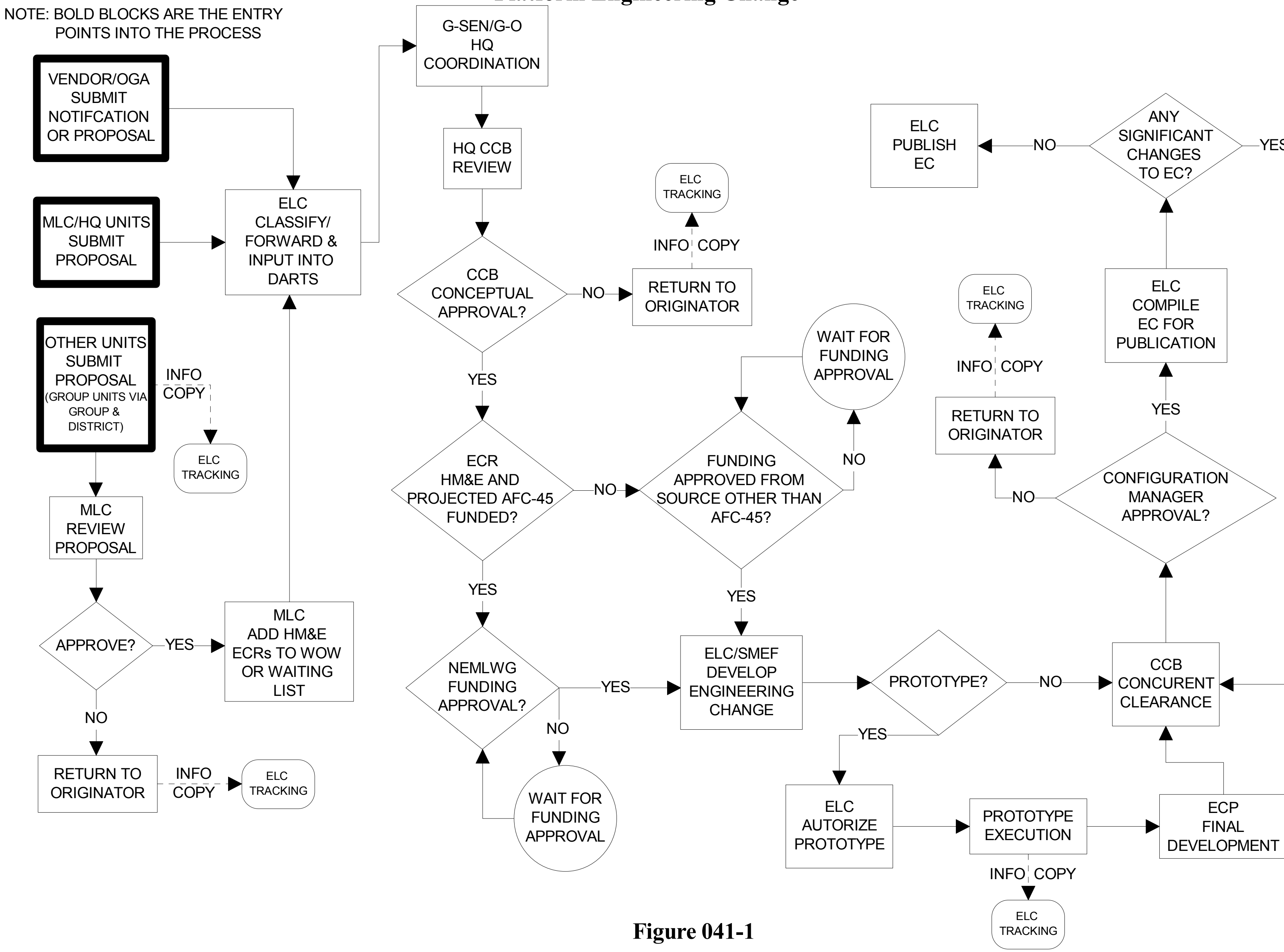

Figure 041-1

System Engineering Change

NOTE: BOLD BLOCKS ARE THE ENTRY POINTS INTO THE PROCESS

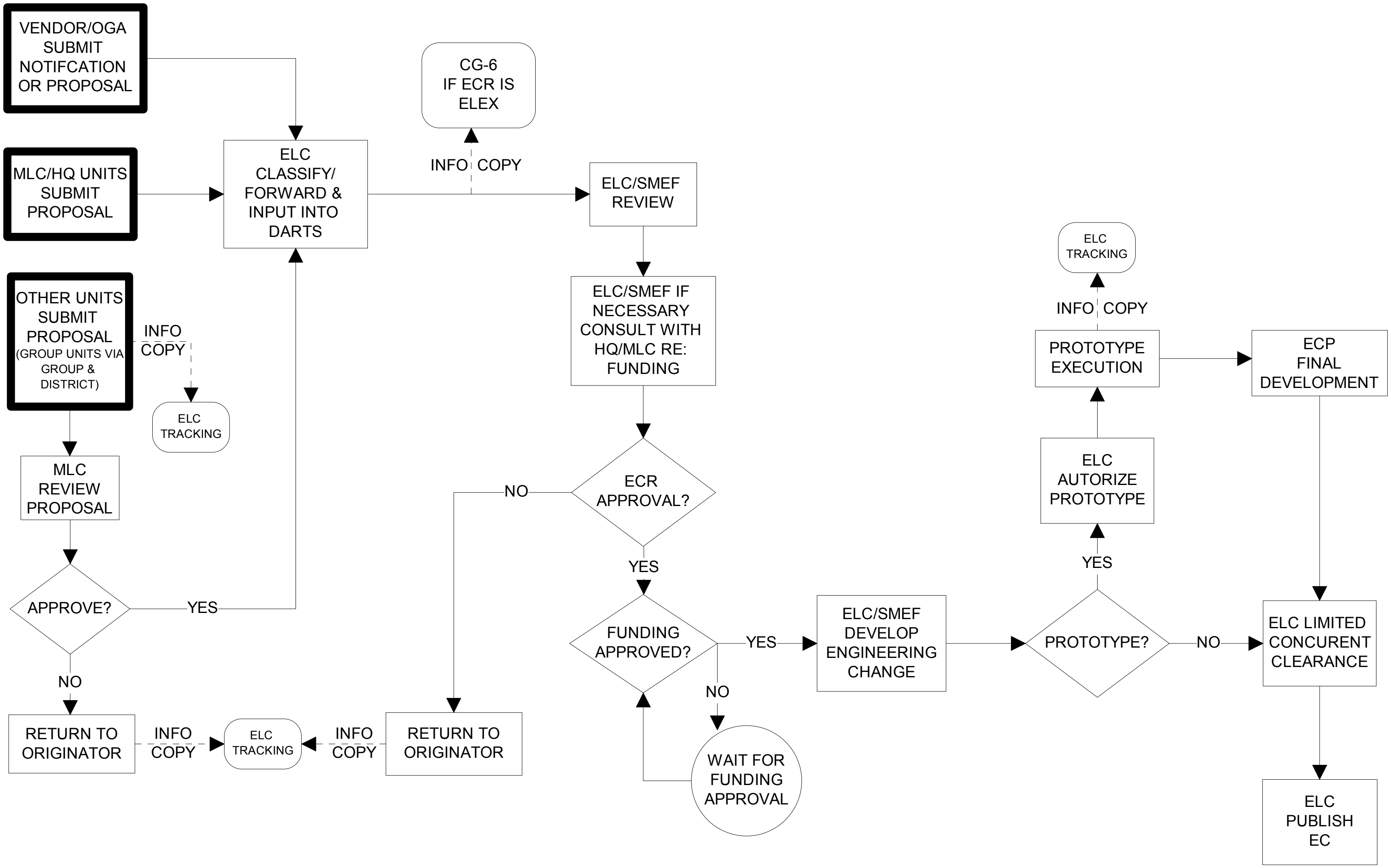

Figure 041-2

DEPARTMENT OF HOMELAND SECURITY U.S. COAST GUARD CG-5682 (3/2003)	**ENGINEERING CHANGE REQUEST** (Instructions on page 2)	ELC CASE FILE NUMBER DATE ENTERED:

ELC USE ONLY

ORIGINATING UNIT

UNIT NAME:	UNIT POC/TEL. #:
UNIT SIGNATURE/DATE:	E-MAIL:
TITLE:	
BACKGROUND/PURPOSE:	
IMPACT ON CUTTER/BOAT MISSION CHARACTERISTICS/CAPABILITIES (IF ANY):	
ATTACHMENTS/REFERENCES:	

Route to servicing MLC, with copy to ELC (01). Group units route to servicing MLC with copy to ELC(01) via Group and District

HQ UNITS AND MLCs

APPROVE ☐	SIGNATURE:	
DISAPPROVE (comments required) ☐	TITLE:	DATE:
Weight Estimate LBS ☐ LT ☐ ____________	CENTER OF GRAVITY LOCATION FEET AFT OF FWD PERPENDICULAR: ________ FEET ABOVE BASELINE: ________ FEET PORT/STBD OF CENTERLINE: ________	

PROTOTYPE RECOMMENDED?	YES ☐	NO ☐	Mission Critical	YES ☐	NO ☐
RECOMMENDED ECR CATEGORY	PLATFORM ☐		SYSTEM ☐		
RECOMMENDED ECR CLASSIFICATION	A ☐		B ☐		C ☐
LIST HULLS AFFECTED (i.e. all 210s, or 723-725)					

RECOMMENDED FUNDING SOURCE

AFC:	30 (unit) ☐	30 (program) ☐	42 ☐	45 (POP) ☐	45 (MLC) ☐	OTHER ☐

ESTIMATED ONE-TIME COST	30 ☐	42 ☐	45 ☐	OTHER ☐
ESTIMATED ANNUAL RECURRING COST (SAVING)	30 ☐	42 ☐	45 ☐	OTHER ☐
COMMENTS				

Route approved ECRs to ELC (01). Route disapproved ECRs back to originator with a copy to the ELC (01).

ENGINEERING LOGISTICS CENTER

CATEGORY	PLATFORM ☐	SYSTEM ☐
DISAPPROVE (comments required) ☐	SIGNATURE:	
FORWARDED TO: ____________	TITLE:	DATE:
COMMENTS:		

Route all Platform ECRs to G-SEN. Route all System ECRs for SMEF managed systems to appropriate SMEF (copy to G-SCE). If disasspproved, route back to originator.

Reset

Figure 041-3

DEPARTMENT OF HOMELAND SECURITY U.S. COAST GUARD CG-5682 (3/2003)	**ENGINEERING CHANGE REQUEST**	**Page 2**

G-SEN (PLATFORM ENGINEERING CHANGES ONLY)

APPROVED FOR DEVELOPMENT ☐		SIGNATURE:									
DISAPPROVE (comments required) ☐		TITLE:							DATE:		
ENGINEERING CHANGE CLASS		A ☐			B ☐				C ☐		
FUNDING SOURCE											
AFC:	30 (unit) ☐	30 (program) ☐		42 ☐		45 (POP) ☐		45 (MLC) ☐		OTHER ☐	
COMMENTS (include that address scope and funding boundaries):											

Routing: APPROVED: For HM&E Forward to ELC (01); ELECTRONICS, forward to SMEF w/copy to ELC (01).
DISAPPROVED: Return to originator, with copy to ELC (01).

INSTRUCTIONS

Much of this form is self explanatory, but the following is provided to further describe selected sections of the form. Continue on blank sheet and indicate appropriate block headings.

Originating Unit: Fill in section titled "Originating Unit" and if known, the weight and cost data in the section titled "HQ Units and MLCs".

Background/Purpose: Provide a brief description of the problem and recommendation of how you feel it should be corrected. You are encouraged to attach sketches, photos, etc that support your explanation. Digital photos compatible with SWIII are acceptable. A proper evaluation of the request is dependent on the accuracy and detail of the information provided here.

Impact on Cutter/Boat Mission Characteristics/Capabilities: Describe how the recommended change will impact the cutter or boats mission characteristics. Examples of mission characteristics include fuel consumption, speed, range, crew size, etc.

Attachments?References: List any attachments you have included and list any references that you fell apply to this change. References may include manufacturer's technical publications, Maintenance Procedure Cards, drawings, etc.

Headquarters Units & MLCs: Fill in the section titled "HQ Units and MLCs". Forward all ECRs to the ELC (01).

Recommended Engineering Change Class: Check A, B, or C to match definition provided in the COMDTINST M9000.6 (series), chapter 041.

List Hulls Effected: Provide a list of applicable hull numbers. If it applies to an entire class, then just the class designation.

Estimated One-Time Costs (Savings): Provide a total development/installation cost estimate.

Estimated Annual Recurring Costs (Savings): Provide an estimate of the change in recurring costs associated with this change. If the change results in a savings, indicate so by using parenthesis around the estimate.

G-SEN: Comments shall provide scope and funding boundaries beyond which the ELC or SMEF would be required to resubmit to the ECR to the HQ CCB.

Reset

Figure 041-3 (Cont'd)

CHAPTER 042. SPECIFICATIONS AND STANDARDS

A. **HIERARCHY OF GUIDANCE.** In general, Naval Engineering design and maintenance decisions shall be based on the following guidance, in descending order of priority:

1. Compulsory Federal Law and regulation, generally related to safety, such as Occupational Safety and Health Administration (OSHA) standards.

2. Naval Engineering Manual (NEM), COMDTINST M9000.6 (series), and any reference cited by NEM as mandatory, with the exception of conflicts with the class specific preventive maintenance manual which shall take precedence over the NEM.

3. Other compulsory COMDTINST, generally related to safety, such as Asbestos Exposure Control Manual, COMDTINST M6260.16 (series).

4. "General Specifications for Overhaul of Surface Ships of the US Navy"(GSO). GSO is the non-compulsory reference of choice for cutter repair and modification.

5. Naval Ship's Technical Manuals (NSTM). NEM references NSTM as a compulsory reference, with certain exceptions, listed later in this chapter.

6. DoD adopted Non-governmental standardization documents

7. DODISS standardization documents

8. New construction specifications for Coast Guard Cutters. These archival documents are often a rich source of guidance for modifications and maintenance. There are advantages to using the specifications for the cutter in question, and to using later specifications for the Coast Guard's most recent acquisitions.

9. Various non-compulsory titles of the Code of Federal Regulations. In particular 46 CFR, Chapter I, subchapters F and J. Subchapters C, D, H, I, S and T are of lesser applicability.

11. Other Non-governmental standardization documents, such as American Bureau of Shipping Rules for Building and Classing Steel Ships, American Society for Testing and Materials (ASTM), American Welding Society, Institute of Electrical and Electronic Engineers, International Standard For Organization, Manufacturers Standardization Society of the Valve and Fittings Industry, National Electrical Manufacturers Association, National Fire Protection Association, Society of Automotive Engineers, and The Society for Protective Coatings.

B. **REFERENCED SPECIFICATIONS.** FEDSPECS, FEDSTDS, MILSPECS, MILSTDS, CIDSPECS, MLC Standard Specs, and other documents are frequently used as references in construction and repair specifications. The details of referenced specifications shall be closely scrutinized by specification authors to ensure compatibility with the parent document and that no conflicting requirements are generated, and to minimize "layering". Also consider the availability of the documents to potential offerors. In particular, NSTM and other Navy tech pubs are difficult to obtain, and in some cases are not releasable; consult the PHILADELPHIA NAVAL BUSINESS CENTER, Technical Manual and Training Branch, Code 944, 5001 South Broad Street, Philadelphia, PA 19112-1403, Phone 215-897-1233, Fax 215-897-1388 or via NAVICP using stock number 0901-LP-101-0985.

C. APPLICABILITY OF U.S. NAVY GENSPECS. There are three types of U.S. Navy GENSPECS:

1. "General Specifications for Ships of the U.S. Navy". These specifications are not intended for maintenance, but contain important design criteria, which may be used as a guide in the preparation of cutter construction specifications. Last revision is MAY 94.
2. "General Specifications for Overhaul of Surface Ships (GSO)". These specifications may be used as a guide in researching proposed engineering changes and solutions to existing design difficulties. Last revision is Aug 2000.
3. "Commercial General Specifications for T-Ships of the U.S. Navy". These Specifications do not apply to construction, alteration or maintenance of Coast Guard cutters.

D. EXCEPTIONS. These specifications are by no means the sole criteria upon which Coast Guard cutters are designed. The cost of making changes to existing cutters in order to comply with the latest edition of GENSPECS must be weighed against the advantages that may result. In some cases, the cost may far outweigh the gain. Therefore, no cutter shall be required to effect changes, additions, or alterations to existing condition solely as a result of the updating of the GENSPECS. Changes deemed important by the Commandant will be published as Engineering Changes or changes to technical publications.

E. NAVAL SHIPS TECHNICAL MANUALS (NSTM).

1. Applicability. The NSTM contains, in general, the best engineering and damage control practices known today; however, it is not intended as authority to perform engineering changes, nor shall it be used as a guide for submission of engineering or hull reports. The instructions and information it contains shall be used with the following exceptions:

   a. When information in the NSTM conflicts with information in a manufacturer’s instruction book for a certain item of equipment, the manufacturer’s instruction book shall apply.

   b. When information in the NSTM conflicts with information in the Naval Engineering Manual or Commandant-issued directives, the Naval Engineering Manual or directive shall apply.

   c. When information in the NSTM conflicts with information published in various Naval Engineering Technical Publications, the Technical Publication shall apply.

2. Distribution. The Naval Weapon System Engineering Station, Port Hueneme, CA, performs direct distribution of selected chapters of the NSTM. Commandant (G-SEN) determines initial distribution for new units. Requests for changes to the distribution should be submitted on a "Request for Allowance Change" form, CG-5323.

3. Ordering. NSTM (CD-ROM only) can be ordered through NAVSEA PHILADELPHIA, which parts of the data are protected by Limited Rights

F. **LIMITED RIGHTS INFORMATION.** Technical data such as engineering drawings, cutter information book, and vendor's manuals pertaining to certain Coast Guard cutters and boats contain some proprietary information. The Coast Guard has only limited rights to disseminate that information to the general public.

1. Each piece or page of data that is considered proprietary is marked with a Limited Rights Legend. This legend lists the contract number and contractor's name and explains Distribution Statement for each NSTM chapter of Navy tech pub prior to citing in a specification. In addition to their title, referenced specifications shall be described by revision date.

2. Commands maintaining Limited Rights material shall not release, disclose, or allow the use of this material in whole or in part outside the government. Exceptions are normally granted for emergency, repair, modification, or overhaul work related to the affected cutter or boat. Units should consult with their MLC contracting/legal staff prior to releasing material.

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CHAPTER 044. MACHINERY SPACE WATCH REQUIREMENTS

A. **GENERAL.** Engineer Officers and Engineer Petty Officers (EO/EPO) are responsible for developing watch standing policies and procedures which establish and maintain the integrity and safe operation of the cutter's or boat's mechanical plant.

B. **INSPECTIONS OF OPERATING MACHINERY.** All cutter and boat operating machinery shall be inspected every hour, and readings shall be recorded. Cutters equipped with video and electronic control and monitoring systems that in addition to monitoring spaces for fire and flooding, can alert the watchstander of abnormal system parameters prior to failure, can reduce inspection requirements on operating machinery to at least once every four hours. Cutters 110 feet and below can reduce inspection requirements while in port. Operating machinery must be checked at least once every four hours when in port, on electrical shore-tie between the hours of 0600 and 2200. Between the hours of 2200 and 0600, in port inspection requirements can be further reduced if all berthing areas are equipped with adequate installed flooding and fire sensor alarms to alert a sleeping watchstander, provided the watchstander is on board at all times.

C. **UNATTENDED MAIN PROPULSION MACHINERY SPACES.** Due to crew size or level of automation, propulsion machinery on the following classes of cutters and standard boats may run unattended:

Class	Type
26' MSB	Motor Surfboat, MK V
30' SRB	Surf Rescue Boat
41' UTB	Utility Boat
44' MLB	Motor Lifeboat
47' MLB	Motor Lifeboat
49' BUSL	Buoy Boat, Stern Loading
55' ANB	Aids to Navigation Boat
65' WLR	Buoy Tender, River
65' WLI	Buoy Tender, Inland
65' WYTL	Harbor Tug, Small
75' WLR	Buoy Tender, River
75' WLIC	Construction Tender, Inland
82' WPB	Patrol Boat, Medium
87' WPB	Patrol Boat, Medium
100' WLI	Buoy Tender, Inland
110' WPB	Patrol Boat, Medium
140' WTGB	Harbor Tug, Icebreaking (ECC is attended)
175' WLM	Buoy Tender, Coastal
225' WLB	Buoy Tender, Seagoing (ECC is attended)
400' WAGB	Icebreaker(ECC is attended)
420' WAGB	Icebreaker(ECC is attended)

NOTE: ALL propulsion machinery shall be attended during main engine start, warm-up/securing, and during unusual operating conditions.

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CHAPTER 074. WELDING

A. **GROUNDING OF WELDING MACHINES.** For information on grounding of welding machines when welding on or from waterborne cutters, see NSTM 074,Volume1

B. **WELDING ON BOARD CUTTERS AND BOATS.**

1. Welding by Coast Guard Personnel. All welding and allied processes on cutters and boats performed by Coast Guard personnel shall be conducted in accordance with NSTM Chapter 074, Volume 1. Prior to welding, cutting, or burning in voids, tanks, closed compartments, or poorly ventilated spaces, the spaces shall be determined to be Gas Free, Safe for Personnel and Safe for Hot Work per NSTM Chapter 074, Volume 3 and Technical Guide for Respiratory Protection, COMDTINST M6260.2 (series).

2. Welding by Contractor Personnel. All welding and allied processes performed by commercial contractors on cutters and boats shall be conducted in accordance with the MLC specifications that describe those processes.

C. **DEPLOYMENT REPAIRS.** When structural welding repairs are made during underway periods, the commanding officer/officer-in-charge must notify and have the repair procedure approved by Maintenance and Logistics Command (v) and inspected upon return to port.

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CHAPTER 076. RELIABILITY & MAINTAINABILITY

A. **<u>GENERAL</u>.** Reliability engineering addresses a broad range of topics and has the purpose of optimizing operational availability. This chapter discusses reliability management and establishes policy that supports continuous improvement while minimizing life cycle cost.

1. Maintenance comprises a major portion of total ownership costs for Coast Guard cutters and boats. Unnecessary maintenance contributes to inflated ownership costs and reduced readiness. An effective maintenance program performs maintenance when there is objective evidence of need. Effective maintenance must account for safety, mission and environmental compliance, equipment reliability, and minimization of total ownership cost.

2. A condition-based philosophy shall guide maintenance decisions and determine scheduling and resource requirements. The core of this philosophy is Reliability-Centered Maintenance (RCM), which is a process that determines objective evidence of need and ensures that maintenance is both applicable and effective.

B. **<u>DEFINITIONS</u>.**

1. <u>Alterative maintenance</u>. changes to equipment or systems that change the design or design capabilities to improve inherent reliability or functionality.

2. <u>Availability</u>. The percent of time that a system is ready for use. It is calculated using the following equation.

$$\text{Availability} = \frac{\text{Mean Time Between Maintenance}}{\text{Mean Time Between Maintenance} + \text{Mean Down Time}}$$

3. <u>Corrective Maintenance</u>. Maintenance required to restore operation of systems or equipment to design parameters when functional failure has occurred.

4. <u>Inherent Availability (A_i)</u>. The percent of time that a system is theoretically available for use. Inherent reliability assumes that all maintenance and supply support is performed perfectly. Corrective maintenance requirements are estimated using statistics

5. <u>Functional Failure</u>. Failure of an item to perform its normal or characteristic actions within specified limits.

6. <u>Maintenance Manager</u>. Any person responsible for managing alterative, preventive, or corrective maintenance.

7. <u>Operational Availability (A_o)</u>. The percent of time that an operational system is ready for use.

8. Planned Maintenance System(PMS). Navy specification MIL-P-24534 identifies the requirements and standards for the development and production of Planned Maintenance Systems.

9. Preventive maintenance. Maintenance actions taken to minimize conditions that cause unacceptable degradation of functions, prior to the occurrence of actual failure. This includes time-directed, condition-directed, failure finding, servicing and lubrication tasks.

10. Reliability. The percentage of time that a system performs as designed in its stated environment.

11. Reliability Centered Maintenance. a method for determining preventive maintenance requirements based on the analysis of the likely functional failures of hardware having a significant impact on safety, operations and support functions. RCM is a process used to identify maintenance that is required to preserve equipment function by reducing or avoiding unplanned system failures. System failures are defined as any unsatisfactory condition as determined by operational requirements.

12. Risk. The product of Probability of failure P_f times Severity of failure $S_{f.}$ Severity and probability must be evaluated objectively for best long term results.

13. System performance. The ability of the system to meet operational needs and the cost of maintaining it. .

C. RELIABILITY AND THE IMPACT ON ACQUISITIONS.

Reliability prediction is an essential function in evaluating a design from concept through development and in controlling changes during production. Prediction provides a rational basis for design decisions such as choice between alternative concepts, choice of part quality levels, use of proven versus state-of-the art technology, and other factors. Reliability prediction also provides the baseline from which maintenance shall be planned. For these reasons major acquisitions include a requirement for reliability analysis in contracts. The purpose of these analyses is to ensure that performance based requirements are satisfied by the design. For Major acquisitions, reliability analysis information should be considered as a technical evaluation factor and validated. Naval Engineering participation in major acquisitions is described in the Major Systems Acquisition Manual COMDTINST M4150.2 (series).

D. RELIABILITY INFORMATION

1. Reliability information is required in order to support the development and refinement of maintenance and supply support. Equipment failure data can be used to establish age-failure relationships, influence item management, and provide trend information that supports redesign decisions. The Vessel Logistics System (VLS) is the Coast Guard’s enterprise information system for management of logistics. The system is made up of many software applications that exchange data so that it can be used throughout the organization. Since the information in the Vessel Logistics System is used to support decisions affecting the entire fleet it is important that users

understand their responsibilities within the system and that the system is used as designed. The following VLS applications play an important role in managing reliability information.

a. CMplus is a unit level information system that supports management of maintenance, supply and configuration. CMplus exchanges data with the Fleet Logistics System so that both systems are consistent**.** This data is used to describe operational availability at the unit level.

b. The Fleet Logistics System (FLS) is an enterprise application used by G-SEN, ELC, MLCs and NESUs to manage maintenance, contracts, supply and configuration. This data is used to describe operational availability at the fleet level.

c. The ELC Information System, formerly called the Supply Center Computer Replacement (SCCR) system is used to manage supply data for the fleet. This system shares data with FLS and is used to trend supply demand data and provide updates to CMplus.

2. The following policies support the maintenance of reliability information.

a. The Vessel Logistics System will provide the ability to track overhaul and renewal tasks, and support serial number tracking for equipment that is covered by a centralized repair program.

b. Maintenance Managers shall use the Vessel Logistics System to document equipment maintenance.

c. ELC shall use supply demand rates to identify trends and potential reliability deficiencies.

d. System reliability shall be periodically assessed using measures maintained by the ELC.

e. The Systems Maintenance Engineering Facility (SMEF) shall maintain reliability data for all assigned systems throughout the life-cycle. The ELC is assigned SMEF responsibility for HM&E.

E. FAILURE REPORTING AND CORRECTIVE ACTION SYSTEM (FRACAS). Maintenance managers for equipment that is in service shall follow a FRACAS process. The Engineering Logistics Center (ELC) shall manage and administer the FRACAS process. Figure 1 describes the FRACAS process.

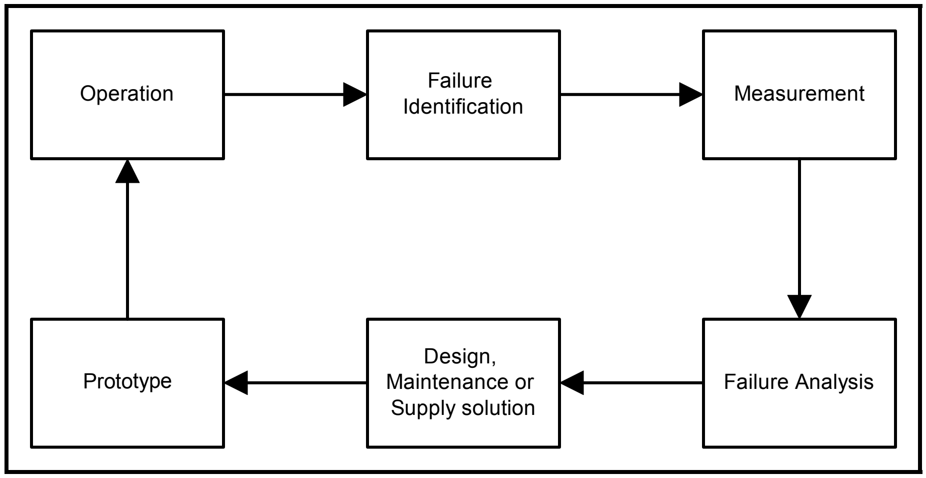

Figure 076-1. FRACAS Process Flow Chart

FRACAS is a closed loop process that supports continuous improvement. When an operational system experiences a failure, the incident is documented within the Vessel Logistics System. Data, which is created by units and used to identify the failure, is reviewed by the MLC and ELC, and where necessary is corrected. Based on this data, measurements are maintained so that system performance may be evaluated. Failure analysis then considers the relative significance of system failures, and selects systems for further analysis. The result of this analysis is an Engineering Change, a revision to maintenance requirements or supply support, or other logistics improvement. To support a FRACAS process the following policies are established.

1. Units, MLCs and the ELC shall report and document all maintenance in CMPlus. All maintenance records will be associated with a configuration record.

2. All parts issued from centralized storerooms that are contained on an Allowance Parts List (APL) will be linked to a maintenance task in CMplus.

3. All parts procured to complete maintenance will be associated with a maintenance item in FLS.

4. The Naval Engineering Maintenance and Logistics Working Group will determine what systems are targeted for improvement efforts, and will provide budget support for the FRACAS process.

F. **<u>RELIABILITY CENTERED MAINTENANCE (RCM)</u>.** To support RCM the following policies are established.

1. RCM shall be used to select the appropriate type of maintenance for new equipment and systems. RCM principles shall also be used to review and modify existing maintenance requirements.

a. The Engineering Logistics Center (ELC) will be the coordinating Activity for new acquisitions. Contracts that include development of maintenance as requirements will specify the use of MIL-P-24534 Planned Maintenance Systems.

b. RCM analyses will include a Failure Mode and Effects Analysis (FMEA). The FMEA documents the rationale behind the decisions made with respect to development of maintenance procedures. The ELC shall establish and maintain a FMEA information system consistent with MIL-P-24534.

2. RCM, which shall be conducted on new Coast Guard equipment, and the Coast Guard Maintenance Effectiveness Review (CGMER), which shall be conducted on equipment in service, are the two analysis techniques for HM&E equipment. A RCM analysis will result in a preventive maintenance system, and may also identify design, operational procedure or supply problems.

   a. Preventive maintenance tasks include time-directed, condition-directed, failure finding, servicing, and lubrication tasks.

   b. Engineering change recommendations shall be reviewed IAW Chapter 041's Engineering Change Analysis.

3. All PMS developers and reviewers shall have completed NAVSEA Level II RCM for PMS Developers training. It is highly recommended that all personnel involved in the drafting of PMS changes attend Level II training or a Coast Guard Maintenance Effectiveness Review (CG MER).

4. RCM PMS consists of five different directed tasks.

   a. <u>CONDITION DIRECTED TASKS (CD)</u>. Life renewal (restore or replace) based on measured condition compared to a standard. A CD task is one that measures a system’s resistance to failure. If the measurement indicates that failure is near-term a preventive maintenance procedure is required. The goal of CD tasks is to identify impending failures before they occur and to allow time for action to be taken to prevent a failure as shown in figure 076-2.

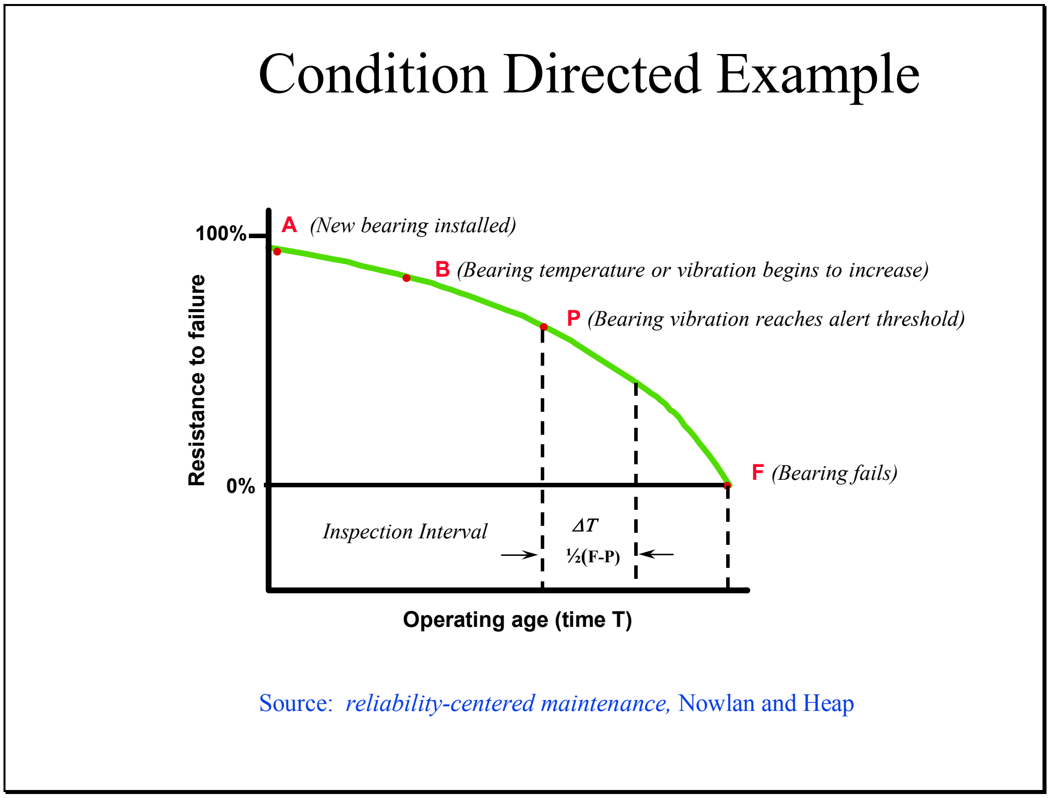

Figure 076-2. Condition-Directed Tasks

During RCM analysis some observable condition is identified that is an indication of the system's resistance to failure. The periodicity of the preventive maintenance task is then set based on the amount of time expected to pass between when resistance to failure is detected and when actual failure is expected. A CD task may not be applicable if sufficient time does not exist between detection of impending failure and actual failure.

b. <u>TIME DIRECTED TASKS (TD)</u>. Life renewal (restore or replace) regardless of condition. TD tasks are used when there is a known relationship between equipment failure and age. This means that a point of "wear-out" is detectable. TD tasks will renew service life based on age regardless of condition. Most complex modern machines do not have an age-failure relationship. Their failure rate is not a function of time. Time directed tasks are only cost effective when this age-reliability relationship is known, such as the simple wear-out example shown in figure 076-3.

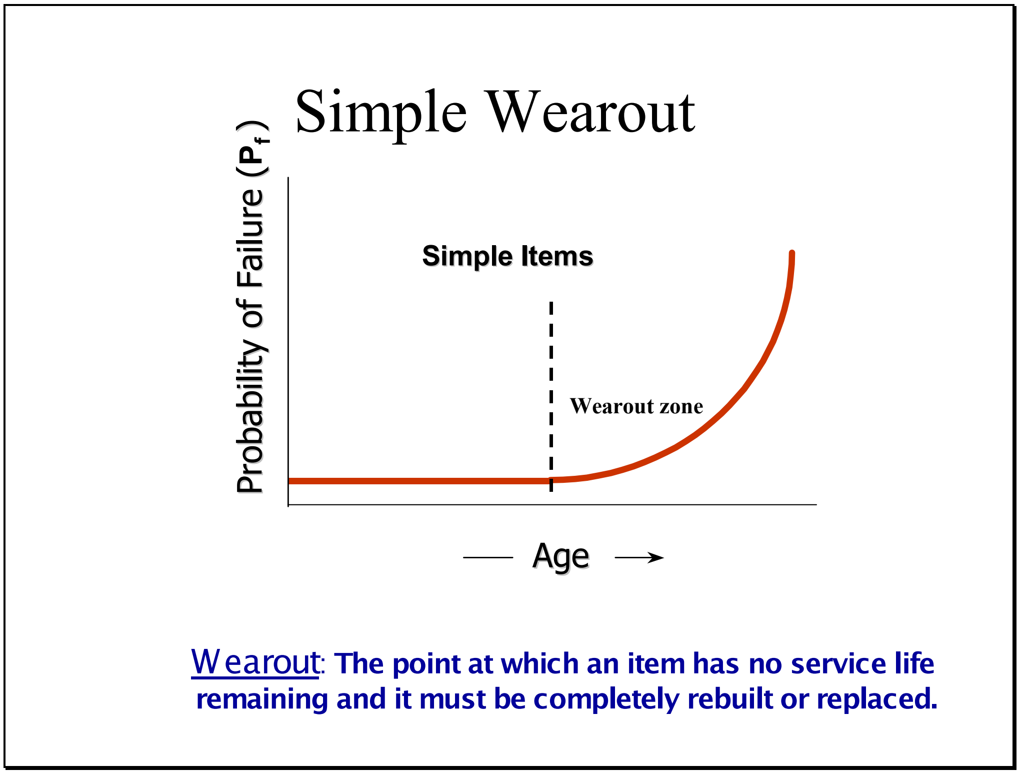

Figure 076-3. Time-Directed Tasks

c. FAILURE FINDING TASKS (FF). FF tasks are used to identify equipment or component failures that are not evident during normal system operation. In many cases FF tasks concern safety or protective devices. For this reason MPCs of this type will provide guidance to help Commanding Officers and Officers-in-Charge meet the safety device inspection requirements of chapter 090 Inspections, Records, Reports, and Tests of the Naval Engineering Manual, COMDTINST M9000.6E. FF MPCs will be annotated to identify them as safety related if applicable, and chapter 090 of the Naval Engineering Manual will identify these MPCs as part of unit level safety programs.

d. SERVICING AND LUBRICATION TASKS. These task types are requirements established by the manufacturer of the equipment. Generally they are tasks necessary to maintain equipment in good running order. Because of their simplicity and low cost, Servicing and Lubrication tasks are accepted as maintenance requirements and not reviewed using RCM principles

G. **CONDITION-BASED MAINTENANCE**. A wide variety technology supports Condition-Based Maintenance (CBM). Because the introduction of new technology increases logistics support requirements the decision to procure and field CBM technology should consider life-cycle costs. The following policy applies to CBM technology.

1. The ELC is the technical authority/facility manager for all condition monitoring technology and will determine its applicability and effectiveness for use by the Coast Guard. Any monitoring technology in Coast Guard use will be considered when developing maintenance procedures.

   a. The ELC Maintenance Branch Code 017 shall manage the introduction of new condition monitoring technology and ELC approval is required before prototype or installation on new monitoring systems. The purpose of ELC oversight is to maintain standard capability and to minimize the logistics impact of new technology.

   b. Prototypes will be requested using the Class Maintenance Plan change process identified in chapter 081 Maintenance of Cutters and Boats.

   c. The ELC shall maintain a record of prototype requests and evaluations.

2. A CBM policy shall be incorporated into the Integrated Logistics Support Plan logistics elements during acquisitions.

3. Since rapid system demonstration and testing is desired to implement CBM technologies and since commercial off-the-shelf (COTS) or government off-the-shelf (GOTS) items are typically the most cost effective solution, maximum use shall be made of existing COTS/GOTS items. Initial logistics support for prototypes need only be sufficient to ensure valid testing and proof of concept. Prior to comprehensive and repetitive installations of CBM supported systems, complete logistics support is required. The ELC will participate in NAVSEA's Maintenance Engineering Technology Team to maintain awareness of Navy and industry initiatives that improve system performance or reduce maintenance cost.

4. It is essential that full CBM implementation include training for maintenance managers, technicians afloat, and technical support personnel ashore. All new and unique training requirements, including embedded and onboard capabilities, as well as the impact of the introduction of new training technology, shall be identified in training plan documentation. The Naval Engineering Program strongly encourages professional development training and participation in professional societies dedicated to furthering maintenance and reliability advances in government and industry.

5. CBM enabling information systems, data collection and information analysis, shall be integrated with maintenance management and logistics support information systems. The impact of information systems data collection, processing, and warehousing requirements on afloat and ashore resources shall be considered in system design, development and life cycle planning. Using principles of open system architecture, acquisition managers shall fully consider the advantage of common interface standards for afloat, ashore and legacy information systems.

6. NESU Maintenance Augmentation Teams shall maintain capabilities as required to complete various CBM task requirements as part of routine HM&E preventative and

corrective maintenance of chartered customer cutters Standard equipment and training that supports these capabilities will be provided by the ELC. Port Engineers should also be trained in these technologies for contract support quality assurance. Port Engineers and MLC ASSIST personnel will consider these tools when providing troubleshooting assistance.

a. Thermographic imaging

b. Vibration Monitoring

c. Bore Scope inspection

d. Flow Measurement

e. Ultrasonic Inspection

f. Laser Alignment

7. The ELC shall provide centralized support including data storage and analysis for CBM information systems such as vibration data management. In order to avoid the use of proprietary systems that will limit competition all vibration data management systems will be certified as Machinery Information Management Open Systems Alliance (MIMOSA) compliant. More information regarding MIMOSA can be obtained from **http.//www.mimosa.org**. Standard data collection equipment will be provided to units with equipment subject to vibration monitoring.

8. Units will be provided data storage capability that will communicate with a centralized analysis facility.

H. QUALITY CONTROL. Maintenance managers are responsible for developing and requiring quality control as part of maintenance standards. When equipment maintenance is controlled by condition monitoring technology new baselines shall be established after repairs. The following policy shall be followed in order to support a condition-based maintenance philosophy.

1. The application and requirement of condition-based maintenance technology shall be documented in the Class Maintenance Plan.

2. Equipment subject to special testing procedures such as vibration monitoring or laser alignment shall have a new set of readings taken after maintenance.

3. New equipment that is subject to special testing procedures such as vibration monitoring or laser alignment shall have a set of readings taken after installation.

4. The ELC shall establish and maintain standards for condition-based maintenance technology.

I. **QUALITY ASSURANCE.** Maintenance managers shall establish condition assessment programs designed to evaluate and maintain system performance. Assessments will determine the condition of systems, recommend corrective maintenance and provide a report of system condition to the unit, NESU and operational commander. Maintenance managers may provide system grooms or repairs as part of the assessment. System condition assessments are intended to provide an independent evaluation and to assist maintenance managers in determining required maintenance. Requirements for system condition assessments shall be documented in the Class Maintenance Plan and assigned to the intermediate maintenance organization or higher.

J. **RISK MANAGEMENT.** Every failure involves risk, but not all failures have the same risk, and some failures are simply not worth preventing. Well designed maintenance programs use the concept of risk as defined herein to assess the risk of failure on individual, systems and equipment levels, develop tasks to prevent failure on the basis of that risk assessment, and allocate resources where they provide the greatest benefit. Coast Guard Maintenance Managers will follow this risk management approach in making maintenance decisions.

CHAPTER 077. SAFETY

A. **<u>GENERAL</u>.** Safety must and shall be considered an integral part of all Coast Guard evolutions. This chapter provides general guidelines in certain areas, but is not intended to be all-inclusive. Commanding Officers and Officers-in-Charge (CO/OIC) shall ensure that safety requirements and programs are established for the protection of personnel and property under their command. Additional guidance concerning safety related subjects might be found by referring to applicable Naval Ship's Technical Manuals (NSTM) and the following publications:

1. Technical Guide: Practices for Respiratory Protection, COMDTINST M6260.2 (series).
2. Safety and Environmental Health Manual, COMDTINST M5100.47 (series).
3. Cutter Heat Stress Program, COMDTINST M6260.17 (series).
4. Hazard Communication for Workplace Materials, COMDTINST 6260.21 (series).
5. Operational Risk Management, COMDTINST 3500.3 (series)

B. **<u>GAS FREE ENGINEERING/CONFINED SPACE ENTRY</u>.**

1. NSTM Chapter 074 Volume 3, Gas Free Engineering, provides detailed guidance on the testing, inspection, evaluation, and certification of entry into or work in a confined or enclosed space. All Coast Guard cutters and boats shall comply with the information and procedures outlined in NSTM Chapter 074 Volume 3.
2. All confined spaces shall be considered hazardous. Entry or work in confined spaces is prohibited until such spaces have been inspected, tested, and issued a Navy gas free certification and test log by a certified gas free engineer or gas free engineer petty officer. Navy gas free certification and test log forms are available through the National Stock System.
3. Coast Guard gas free engineers /gas free engineer petty officers may certify compartments gas free on commercial vessels only when Coast Guard military personnel must perform in operations on that vessel and a marine chemist is not available. In accordance with Maritime Law Enforcement Manual, COMDTINST M16247.1 (series), which states, "Boarding personnel shall not enter any confined spaces that are suspected of hazardous material contamination or oxygen depletion until a qualified person has tested the space and certified it safe to enter". Coast Guard gas free engineers/gas free engineer petty officers may, by the direction of the CO/OIC, certify spaces safe for entry on non Coast Guard vessels.
4. For commercial contract work that requires entry into and/or work in a confined or enclosed space, contractors shall provide a National Fire Protection Association (NFPA) certified marine chemist, industrial hygienist, or other qualified or competent

person, as specified under the provisions of 29 Code of Federal Regulations (CFR) 1915.

NOTE 1: Coast Guard gas free engineers/gas free engineer petty officers are not authorized to certify spaces as gas free (hot work or cold work) for commercial contract work.

NOTE 2: Coast Guard gas free engineers/gas free engineer petty officers are authorized to certify spaces for cold work only for Coast Guard civilian/DOD civilian personnel.

NOTE 3: Entry into any space suspected of or determined to be Immediately Dangerous to Life and Health (IDLH) is STRICTLY PROHIBITED, EXCEPT when authorized by the CO/OIC during EXTREME EMERGENCY (i.e. rescue efforts, emergency repairs, damage control, and firefighting). Prior to entry, personnel shall be outfitted with the proper respiratory protection as defined by NSTM Chapter 074 Volume 3.

5. Requirements for the education and certification of Coast guard gas free engineers/gas free engineer petty officers as listed in NSTM Chapter 074 Volume 3, shall be adhered to. CO/OICs are responsible for written certification and re-certification of their units' gas free engineer/gas free engineer petty officer. The following waivers are only applicable to afloat Engineer Petty Officers (EPO) (E-6 thru E-9)

    a. E-6 EPOs assigned to a cutter and meeting the educational requirements set forth in NSTM Chapter 074 Volume 3 are authorized to be certified as Gas Free Engineers.

    b. All EPOs assigned to cutters are eligible for certification immediately upon satisfactory completion of GFE school. The 40-hour OJT requirement is waived.

    c. EPOs assigned to cutters must issue at least 1 gas free engineer/gas free engineer petty officer certificate per quarter to keep certifications current, vice 10 per year as stated in NSTM Chapter 074 Volume 3.

    d. EPOs must be re-certified as gas free engineer/gas free engineer petty officers when assigned to a different cutter. For re-certification purposes, one gas free engineer/gas free engineer petty officer certificate must be issued in the presence of a certified gas free engineer/gas free engineer petty officer.

C. WALK IN REFRIGERATOR ALARM AND SAFETY SYSTEMS.

1. Policy. All walk-in reefer boxes, lockers, freezers and chill spaces on cutters shall have door latches and locks that can be opened by a release mechanism located inside the space. This requirement is made to allow a person who is accidentally locked inside to open the door and escape. Additionally, all reefer spaces shall be outfitted with an electrical alarm system that can be manually actuated by an individual locked

inside. This electrical alarm system shall not relax the requirement for maintaining a completely functional reefer door lock, latch, manual alarm, and mechanical release mechanism.

2. Requirements. All walk-in reefer boxes, lockers, freezers and chill spaces on cutters shall have an electrical alarm system installed. The alarm system shall consist of an electrical switch in each reefer space and two alarm bells with red lens lamp indicators. One alarm bell with lamp indicator shall be located on the mess deck; the other shall be located outside the entrances to the reefer spaces. The manual operation of any switch shall sound the alarm, to indicate that someone is locked in a reefer space. Each switch shall be mounted on the bulkhead just inside the door to each reefer space. A sign shall be mounted adjacent to each alarm switch, reading "ALARM SWITCH - PERSON LOCKED IN REEFER." The alarm bells with lamp indicators shall be bulkhead-mounted, with a sign mounted adjacent to each, reading "PERSON LOCKED IN REEFER. "

D. INSTALLED AND PORTABLE EDUCTORS. To prevent asphyxiation to personnel and/or inadvertent flooding of a compartment, extreme caution must be taken when operating both installed and portable eductors.

1. Asphyxiation. In addition to removing water and oily waste from a compartment, the suction created by an eductor can also remove the air supply to a compartment. Therefore, prior to using an eductor to take suction from a space, ensure that there is adequate ventilation in the compartment being dewatered. Using an eductor to take suction on a space that does not have adequate ventilation (air supply) can cause asphyxiation (death) of persons in the compartment. Prior to using a P-250 to dewater a space, extreme caution must be exercised to ensure that the exhaust hose is properly sealed and that carbon monoxide gas is carried into the open atmosphere.

2. Inadvertent Flooding. Installed eductors are operated by water pressure from the firemain. Improper valve alignment and insufficient firemain pressure may cause an eductor to operate in reverse and flood (not dewater) the compartment. CO/OICs shall ensure that their personnel are properly trained in the operation and securing of installed eductor systems. In addition, the following label plate shall be installed on or immediately adjacent to each eductor overboard discharge valve:

   BILGE EDUCTOR SKIN VALVE - KEEP CLOSED
   EXCEPT WHEN BILGES ARE BEING PUMPED
   MAINTAIN WATCH IN COMPARTMENT UNTIL COMPARTMENT
   IS DEWATERED AND THE EDUCTOR IS PROPERLY SECURED

E. MANDATORY SAFETY AND OCCUPATIONAL HEALTH BRIEFING. CO/OICs shall ensure that all personnel on board cutters entering a shipyard or commercial dockside availability are instructed in industrial safety requirements. Prior to the commencement of work in availability, cutter personnel, NESU representatives, industrial activity safety managers and key supervisors shall conduct a safety and occupational health briefing to ensure that safety standards and procedures are consistent and satisfactory to all parties. MLC (kse) staffs have established standard pre-shipyard or commercial dockside availability briefings and are available to assist the unit meet this requirement upon request. It is highly recommended that this be documented in locally maintained individual training records.

F. **ELECTRICAL SAFETY PROGRAM.** Each command shall develop a comprehensive electrical safety program. As a minimum, the program shall contain the following elements:

1. Written designation of a command Electrical Safety Officer (ESO).

2. Comprehensive training for all hands in hazards and safety precautions pertaining to shipboard electrical systems, equipment, and personal electrical/electronic equipment.

3. The Electrical Safety Program is also a required program within the Cutter Organizational Manual, Section 430, as described in Cutter Organization Manual, COMDTINST M5400.16 (Series).

4. Periodic inspections and testing of electrical equipment, tools, and electrical safety equipment to detect and correct potentially unsafe conditions. Accurate inventories of all such equipment must be maintained. CMplus units shall create and schedule local PMS actions for periodic inspections and testing of electrical and electronic equipment that does not have formal maintenance procedures. The inventory module may be utilized to maintain the inventory.

   NOTE: Electrical safety checks of personal electrical and electronic equipment are not required.

5. A 25, 000 volt safety shorting probe shall be conspicuously located in all engineering spaces containing switchboards or other installed high voltage electrical equipment. Shorting probes are used to electrically discharge secured equipment prior to performing maintenance or repairs. NSTM Chapter 300, Table 300-1, provides procurement information on the 25,000 volt shorting probe.

6. Electronics Manual, COMDTINST M10550.25 (series) shall be used to assess the electrical integrity of workshops. Workbench equipment, insulation sheets, and electric insulating matting shall comply with the materials listed in Electronics Manual, COMDTINST M10550.25 (series) and Chapter 634 of this manual.

G. **EQUIPMENT TAG-OUT PROCEDURES.** Equipment Tag-Out Procedures, COMDTINST 9077.1 (series) shall be used to implement an equipment tag-out procedure aboard all Coast Guard cutters and boats. The instruction describes a standardized tag-out procedure for Coast Guard cutters and boats. This procedure shall be used to ensure the safety of personnel and to prevent improper operation of systems or equipment when the system or equipment is isolated or in an abnormal condition because of preventive maintenance or a casualty. The procedure is also used to prevent improper operation of systems or equipment when safety devices such as locking devices, seals, or blank flanges are installed for testing, maintenance, or casualty isolation.

1. The equipment tag-out procedure also provides for the operation of systems, or equipment, when instrumentation is unreliable or is not in normal operating condition. It is similar in nature to the usual tag out procedure except that labels in lieu of tags are used to indicate instrument status.

2. The procedures described in the instruction may be applicable for shore units. However, when conflict occurs OSHA requirements shall take precedence, (e.g., lock out procedures).

H. USE OF DIESEL FUEL AS A SOLVENT.

1. Diesel fuel may be used as a solvent on board cutters if the following precautions are observed.

   a. Keep away from heat or open flame.

   b. Provide adequate ventilation in enclosed spaces.

   c. When skin contact is possible, wear impervious chemical or nitrile rubber gloves.

   d. Goggles shall be worn at all times.

   e. Skin that becomes contaminated with diesel fuel should be promptly washed with soap or a mild detergent and water.

   f. Don't atomize fuel when using it as a solvent.

2. There are a number of solvents available that may be considered as alternatives to diesel fuel for cleaning and degreasing operations if the precautions listed for diesel fuel are not feasible. Among these are PD-680, Type II (flashpoint 140 deg F) and Biotect "Hi-Solv" (flashpoint 200 deg F). These products are available from the National Stock System.

I. GASOLINE.

1. Gasoline is not authorized to be used as a cleaning solvent or as a substitute for lighter fluid.

2. No open flames, smoking, or hot work shall be permitted when handling gasoline or in the vicinity of Gasoline Hazard Areas.

3. Chapter 540 of this manual discusses general requirements for gasoline stowage and safety precautions. NSTM Chapters 542 and 670 contain guidance on the handling and stowage of gasoline.

J. HYDRAULIC FLUID. Personnel shall avoid direct skin contact with hydraulic fluid. Protective clothing (goggles, gloves, etc.) shall be worn when handling hydraulic fluid or working on hydraulic equipment.

K. SPRAY SHIELDS AND PROTECTIVE COVERS.

1. Installation of Protective Covers. Protective covers are installed to deflect any leakage caused by failure of a gasket or joint or through personnel error. Oil spray must be prevented from hitting a hot surface or from harming personnel at their normal operating stations.

   a. A hot surface is defined as 400 degrees F (205 C) and higher, if the piped liquid is fuel oil.

   b. A hot surface is defined as 650 degrees F (343 C) and higher, if the piped liquid is lubricating or hydraulic oil.

   c. For insulated surfaces, the temperature under the insulation is the reference temperature.

   d. A normal operating station is defined as that place where the watchstander stands or the position from which he/she shifts a duplex strainer.

   e. NSTM Chapter 635 provides additional guidance on piping insulation and protective covers.

2. Requirements for Protective Covers. To prevent fire and personnel injury, protective covers and shields shall be placed on piping flanges, filters, and strainers that contain flammable fluids. Protective shields are used to direct fluid spray away from watchstanders, hot surfaces and running equipment.

NOTE: Flammable is defined by Merriam-Webster's Dictionary as "capable of being easily ignited and of burning quickly."

3. Design of Protective Covers.

   a. Guidelines for the design of proper covers for duplex filters and strainers are available in NAVSHIPS 0948-102-2010, "Fuel and Lube Oil Strainer Safety Shield Design Guidance." Maintenance and Logistics Commands hold copies of this publication. The only acceptable material for duplex strainer covers is sheet metal.

   b. Guidelines for the design of a proper shield for simplex strainers or filters have not been published. However, the shield must direct spray away from personnel and hot surfaces. The shield may be sheet metal held in place by the cover bolts, or it may be a cap of three layers of aluminized glass cloth secured with a drawstring.

   c. The Naval Ships Technical Manual (NSTM), Chapter 505, provides guidelines for the design of a proper shield for flanged joints. Metal and aluminum glass cloth are acceptable materials

L. SELF CONTAINED IONIZATION SMOKE DETECTORS.

1. Policy. Where fixed fire and smoke alarm systems are not provided, self-contained smoke detectors shall be installed in living and berthing compartments and passageways. Underwriter Laboratory (UL) approved smoke detectors, that operate on a 9-volt battery and have a 30-day audible low-voltage alarm, are authorized for shipboard use.

   a. At minimum, one detector shall be mounted to the overhead of living and berthing spaces that have a capacity of 1 to 10 people. Spaces, having a capacity of 11 to 20 people, shall have no less than two detectors; 21 to 30 people, no less than three detectors.

   b. At minimum, one smoke detector shall be located in each passageway that serves a living or berthing space.

2. Installation and Maintenance. Smoke detectors shall be installed and maintained in accordance with cutter PMS or manufacturers' instructions if no PMS exists.

NOTE: Special care must be observed when removing fixed system detectors when isolating specific failures so that protection "down the line" is not lost.

M. SAFETY PRECAUTIONS AND OPERATING INSTRUCTIONS.

1. Safety Precautions. Permanent safety precautions shall be posted in a visible location next to all machinery that could cause damage to personnel, systems or equipment, including any rotating machinery, electrically operated equipment, installed eductor systems, and internal combustion engines. Preprinted plastic plates are acceptable if the precautions listed are completely applicable to the particular installation. Safety precautions may be added to the bottom of posted operating instructions. Safety precautions shall be prominently marked as "Safety Precautions". The use of a red border around posted safety precautions is encouraged.

2. Operating Instructions. Permanent operating instructions shall be posted in a visible location next to any piece of equipment that requires more than the pressing of a button or the turning of a switch to operate properly. Operating instructions shall be complete and detailed enough to permit the operator to start, operate, and stop equipment without reference to anything but the posted operating instructions. Preprinted plastic plates are acceptable if the instructions are totally applicable to the equipment.

N. SAFETY PRECAUTIONS FOR GASOLINE-POWERED BOATS.

1. General. Since gasoline is very flammable and highly volatile, extreme caution shall be taken when operating or performing maintenance on gasoline-powered boats. To minimize the hazardous operating conditions, perform the recommended inspections and maintenance that are provided within manufacturer instructions and PMS. Chapter 540 of this manual discusses general requirements for gasoline stowage and

safety precautions. NSTM Chapters 542 and 670 contain guidance on the handling and stowage of gasoline.

2. Specific Maintenance Requirements. Units that use gasoline-powered boats shall exercise extreme caution:

   a. Fuel systems shall be adequately bonded to a common ground on the engine bed. To prevent premature loosening; bonding connections shall be firm and secured. Bond straps or wires shall be braided, of a size not less than No. 6 AWG or equivalent cross-sectional area. Where electrical continuity in fuel lines is broken, bonding shall be used to provide such continuity. This applies to fill connections that must be bonded to tanks.

   b. Fuel lines shall meet SAE J1527 and 33 CFR 183 specifications. These hoses are prominently marked as "USCG TYPE A2", "USCG TYPE B1" or "USCG TYPE B2". Fuel lines shall be properly secured to prevent chafing. The number of fuel system fittings shall be kept to an absolute minimum. Fuel lines for portable fuel systems shall be flexible so that they don't crack, check, or break. Quick disconnect fittings may be used between engine and fuel line and fuel line and fuel tank. When disconnected, they shall automatically shut off fuel flow.

   c. Fuel system components, such as filters, shall be independently supported.

   d. Plug cock or diaphragm fuel shut-off valves shall be installed at the fuel tank outlet. These valves shall be secured when the tank is not in use.

   e. To prevent siphoning, which occurs when fuel tank levels are above the fuel system itself, anti-siphoning check valves shall be installed at the tank outlet close to the shut-off valve.

   f. Battery storage compartments shall be ventilated to reduce the buildup of gases.

   g. Electrical wiring shall contain no splices. It shall be properly secured and protected to prevent heat damage and chafing and shall be run at as high a level as practical. Terminal connections shall be made with lugs or eyelets and secured tightly to prevent arcing.

   h. Hex nuts and lock washers shall be used to secure battery cables to battery terminals and lugs. Wing nuts shall not be used.

   i. High tension leads in the ignition system must be carefully checked for proper insulation to prevent external arcing.

   j. Vent blowers should take suction as low in the machinery space bilge as possible. They must be vented to the atmosphere to minimize the chance of recirculating fumes throughout the boat interior. Only explosion proof blowers shall be used. Suction hoses shall be wire-reinforced and arranged so they do not become crimped. Blower motors are subject to failure caused by electrical overload resulting from seizing of the blower or the attached bilge pump. Therefore, blower motor power leads shall be fused in accordance with manufacturer instruction books, furnished plans, or the National Fire Protection Association (NFPA) Manual No. 302. The possibility of blower failure while underway must be considered. Engine noise will preclude hearing the blower. Therefore, periodic checks of the blower discharge must be made. Blowers shall be run at least 5 minutes before starting the engine, continuously during operation, and whenever fuel vapors are suspected or known to be pocketed in the bilges.

k. Required firefighting equipment shall be in the boat at all times.

l. Smoking shall not be permitted in gasoline-powered boats. "NO SMOKING" signs shall be posted.

m. Boat compartments shall be kept free of foreign matter, particularly combustibles. Bilges shall be inspected at least daily and prior to operation to ensure no fuel, water, oil, or other foreign matter is present. Whenever gasoline fumes are detected in the boat, corrective action shall be taken to eliminate the fumes and their source.

n. When fueling boats, ground the fill nozzle to the fill connection to eliminate the possibility of electric spark as a result of electrostatic charge buildup.

o. Personnel shall continuously review safety and operating procedures to remain proficient in boat operations and maintenance.

p. Portable fuel oil tanks/containers shall be visually inspected semi-annually. If the structural integrity of a tank is in question, the tank shall be replaced. Fuel tanks located in the bilges shall be preserved to minimize corrosion. Every 2 years, installed fuel tanks shall be cleaned, flushed, and inspected in accordance with MLC Standard Specifications.

O. **HEAT STRESS.** Refer to Cutter Heat Stress Program, COMDTINST M6260.17 (series)

P. **HEARING CONSERVATION.** Refer to Safety And Environmental Health Manual, COMDTINST M5100.47 (Series) and Medical Manual, COMDTINST M6000.1 (series).

Q. **REPAIRING AND REMOVING ASBESTOS.** Refer to Technical guide: Practices For Respirator Protection, COMDTINST M6260.2 (series) and Asbestos Exposure Control Manual, M6260.16 (series).

R. **SPRAY PAINTING INSIDE SHIPS.** Refer to Coatings And Color Manual, COMDTINST M10360.3 (series) and: Practices For Respirator Protection, COMDTINST M6260.2 (series).

S. **ORDNANCE AND AMMUNITION.** Refer to Ordnance Manual, COMDTINST M8000.2 (series) and NAVSEA OP 4 (series).

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CHAPTER 079. STABILITY AND DAMAGE CONTROL

A. <u>STABILITY INFORMATION</u>. Knowledge of the stability and buoyancy characteristics of a cutter is essential for its safe operation. Two areas are of concern: (1) intact stability resistance to capsizing and sinkage without damage, and (2) damage stability resistance to capsizing and sinkage after damage. For each cutter the following stability information shall be prepared: (1) Stability Test Data Report, and (2) either a Stability and Loading Data Booklet or, for cutters which have a Damage Control Book (DC Book), a section "Part II(a) - Stability and Loading". The Stability Test Data Report provides information and data about a cutter's displacement and centers of gravity. It is used primarily by ELC naval architects to analyze a cutter's stability and to prepare safe operating guidance. The Stability and Loading Data Booklets and Part II(a) of the DC Book are designed for cutter operators. These documents provide information pertaining to stability and buoyancy, and safe operating guidance necessary to: (1) permit proper control of loading, (2) avoid danger of capsizing or foundering due to storms, high speed turning, etc., (3) maintain an adequate margin of stability and reserve buoyancy to permit survival of damage within the limits imposed by the cutter's design, (4) determine action to be taken after damage, or (5) evaluate probability of survival after damage. Use of the information in the above publications requires background knowledge in the fundamentals of stability and buoyancy.

1. <u>Stability Test Data reports</u>. This section describes requirements for obtaining, preparing and distributing Stability Test Data Reports. Cutters shall receive a stability test as determined by ELC (02). Each stability test shall be conducted and a report of the results prepared in accordance with Chapter 097. Each stability test data report approved by ELC (02) shall be assigned a Coast Guard drawing number. ELC (02) shall distribute copies to the cutter via the MLC. Based on the results of the test, cutter stability status and safe operating guidance shall be updated as needed by ELC (02).

2. <u>Stability and Loading Data Booklets (SLDBs)</u>. This section describes the requirements for the preparation and distribution of SLDBs. SLDBs are required on all cutters 65 feet in length and greater that are not required to maintain DC Books. ELC (02T) assigns drawings numbers to, and ELC (02) prepares and distributes the SLDBS. Cutter personnel shall correct shipboard copies to comply with the stability and loading changes issued by ELC (02). Letters of transmittal make the booklet effective for each cutter or class of cutters.

3. <u>Part II(a) of the Damage Control Book</u>. This section describes the requirements for the preparation and distribution of "Part II(a) - Stability and Loading" of the DC Book. ELC (02) shall prepare Part II(a) of the DC Book. Part II(a) shall be updated as needed, to reflect current stability information.

B. FLOODING CASUALTY CONTROL SOFTWARE (FCCS).

1. Purpose. A computer program named Flooding Casualty Control Software (FCCS), was developed to provide cutter and shore-based personnel with the ability to quickly evaluate a cutter's intact, damaged grounded and ice loaded stability; to review the results; to print hard copies of stability evaluation results, expended liquids reports and stability diagrams; and to save the data for later use. Additionally, FCCS performs load management functions; calculates, displays, and prints the cutter's current hydrostatic situations; and offers recommendations to improve the current condition of loading. The stand-alone notebook computer aboard cutters will simplify the day-to-day process of monitoring the vessel's current condition of loading and also provide instantaneous evaluations during emergency conditions.

2. Database. FCCS is the only computer program approved for stability evaluation of CG cutters (a computer spreadsheet supplied as an attachment to SLDBs is an authorized part of the SLDB). The FCCS program, along with the associated validated databases, will be distributed to all cutters 110 feet and longer. Part II(a) of DC Books and the SLDBs as applicable remain the approved stability documents aboard cutters. FCCS with a *validated* database shall be considered to be supplement to Part II(a) or the SLDB, not a replacement for them.

3. Technical Support. ELC (02) prepares, approves, updates, distributes, and provides technical support for the FCCS program, the data bases, and FCCS manuals to the cutters and on request, to other interested CG offices. Problems with the database should be reported to ELC (02).

C. STABILITY REQUIREMENTS.

1. Standards. Unless otherwise approved by ELC (02):

   a. The stability and reserve buoyancy of Coast Guard cutters 120 feet in length and over shall meet the requirements of U.S. Navy Design Data Sheet, DDS 079-1.

   b. Buoy tenders and cutters that lift heavy weight over the side shall also meet the following additional requirement: The maximum angle of heel shall not exceed the angle of buoy deck edge immersion.

   c. The stability, reserve buoyancy and watertight integrity of Coast Guard boats and cutters under 120 feet in length shall meet the requirements NAVSEACOMBATSYSENGSTA REPORT NO. 6600-99 REV. A May 1988. Boats shall meet wind velocity requirements that develop equivalent pressures to 46 CFR 170.170 based on area of service. Cutters under 120 feet in length in other than open ocean service may be required to meet appropriate requirements of 46 CFR 170 through 46 CFR 174 as determined by ELC in addition to or as an alternative to the requirements of NAVSEACOMBATSYSENGSTA REPORT NO. 6600-99 REV. A May 1988. The governing criteria shall be promulgated in the governing stability documents for the cutter.

d. Surf capable boats shall be self-righting and shall meet a two compartment standard of subdivision throughout their service life.

e. Watertight integrity of cutters 120 feet in length and over shall meet the requirements of DDS 079-1, U.S. Navy General Specifications (see 070, 071, 120, and 512) and the NEM.

2. Operation. Cutter operators shall follow the safe operating guidance provided in their Stability and Loading Data Booklet or Damage Control Book Part II (a) - Stability and Loading or the equivalent document. For cutters with the FCCS program, it shall be used for calculations required to maintain safe operating condition, and to assess the stability in case of casualty or unusual load condition (flooding, grounding, icing, towing, etc.).

3. Maintenance. The stability and reserve buoyancy of cutters shall be maintained by: (1) managing Engineering Changes which change cutter displacement and/or center of gravity; and (2) periodic testing to assure watertight integrity is maintained. ELC (02) shall determine what restrictions are needed to weight and moment changes to cutters and shall advise operators when modifications to cutters and boats are needed to correct weight and/or moment deficiencies. Watertight integrity shall be tested in accordance with the requirements of paragraph I.

D. WEIGHT. The displacement of cutters and boats shall not exceed their limiting displacements as promulgated by ELC in the boat or cutter's stability instruction documents. The limiting displacement may be based on reserve buoyancy, hull strength, speed, hoist lift or other appropriate criteria as determined by ELC. This information is contained in Part II(a) of the cutter's DC Book and SLDB or in equivalent documents or instructions for boats and cutters under 120 feet in length. ELC (02) shall be notified in writing whenever a cutter or boat's speed requirement is changed.

E. DAMAGE CONTROL ORGANIZATION. Based on mission tasking, size, compartmentation and manning capacities, Table 079-1 lists the repair parties and teams required to provide damage control per cutter class.

1. Cutters With a Designated Damage Control Central (DCC). DCC serves as the central control point that receives reports from all damage control parties, and evaluates and initiates any orders necessary for corrective action from a cutter wide point of view. DCC allows the Damage Control Assistant (DCA) to assess damage, inform the Commanding Officer, and provide Recommendations of corrective action to and receive orders for corrective actions from the Commanding Officer.

a. Provisions must be made for accurate, rapid communications among all damage control parties, fire fighting parties or other survivability groups, so an overall coordination of effort and direction can be readily accomplished.

b. Provisions must be made for a repair party located remotely from DCC to assume the DCC functions in the event incapacitating battle damage is sustained by DCC. This is to ensure that the damage control organization is under positive control at all times during emergencies. The order of succession must be firmly established before hand. All status boards and information required to be collected or displayed by DCC shall also be available, collected and displayed at the secondary DCC. The duties and responsibilities of DCC personnel are specified in NWP 3-20.31 (series), Surface Ship Survivability.

c. DCC shall maintain the damage control status boards:

(1) "Casualty Board" which visually shows structural damage sustained by the cutter as determined by reports from the repair party (ies).

(2) "Stability Board" which visually shows the liquid loading as prescribed by current directives, location of flooding boundaries, the effect on list and trim due to flooded compartments and the corrective action taken to maintain the cutter's offensive capabilities.

(3) Graphic display of damage sustained and corrective action taken for all damage control systems.

(4) Graphic display of damage sustained and corrective action taken for all electrical and casualty power circuits..

(5) Plans showing the location and operation of all magazine flooding and sprinkling systems.

(6) "Engineering Casualty Control Status Board" showing the condition of readiness of main propulsion and principal auxiliary machinery and permitting graphic display of engineering casualties and other pertinent information.

2. Cutters With a Modified Damage Control Central (DCC). Due to compartmentation restraints and limited crew size, the WIX, 225' WLB, 180' WLB, and 175' WLM may establish a modified DCC. A modified DCC shall carry out the same functions as a fully outfitted DCC.

a. DCC functions may be performed "at" a cutter's command and control station/bridge or may be co-located with the primary repair locker.

NOTE: Lines of communication between the repair party and DCC, and DCC and the Commanding Officers or Officers-in-Charge (CO/OIC) shall not be compromised.

b. Provisions shall be made for a repair party or designated area to assume the DCC functions in the event DCC becomes incapacitated.

3. Repair Parties. Repair lockers are physically located to combat shipboard damage and casualties, and to serve as DCC in the event that DCC becomes incapacitated. Repair parties shall be self sufficient, capable of communicating with the entire cutter, and outfitted with the necessary equipment to control any type of damage

likely to be encountered. The duties and responsibilities of repair party personnel are specified in NWP 3-20.31 (series), Surface Ship Survivability.

4. Main Repair Station. For cutters that are not outfitted with or do not have a fully equipped repair locker or DCC, CO/OIC shall designate a central location as the Main Repair Station. Main Repair Stations shall perform the same functions as a repair locker and modified DCC. The organizational structure of certain cutters may require personnel to become proficient in more than one repair party function.

5. The Damage Control Petty Officer (DCPO) Program.

   a. Discussion. The extent of the program shall accommodate the cutter manning levels, operational commitments, and damage control maintenance requirements. Small units 160 feet in length and below shall assign 1-2 DCPOs. Units larger than 160 feet in length shall assign at least one DCPO per division.

   b. Basic Function. A DCPO is to perform maintenance on all designated damage control equipment, closures, fittings, and markings located within the unit, the unit's department or division. All DCPO's shall complete the appropriate PQS and training prior to being assigned as a DCPO.

   c. Duties, Responsibilities, and Authority.

      (1) Conduct daily inspections of assigned spaces for the elimination of fire hazards.

      (2) Ensure that safety precautions, operating instructions, and CCOLs are posted in required spaces.

      (3) Perform scheduled PMS as required by Technical Publication 2006 (series), Preventive Maintenance Manual For Damage Control.

      (4) Specific duties and length of assignment to be developed by the cutter.

      (5) Cutter specific requirements.

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TABLE 079-1. TABLE OF DAMAGE CONTROL ORGANIZATION

Cutter Class	WAGB WHEC WMEC* WIX** 225 WLB***	175 WLM 180 WLB WPB	WTGB WYTL WLIC/WLI WLR
Damage Control Central	X	X	N/A
Repair II (Forward Locker)	X	X	N/A
Repair III (Aft Locker)	X	N/A	N/A
Main Repair Station	N/A	N/A	X
Engineering Assist Team	X****	N/A	N/A

* 210’ WMECs and CGC MACKINAW have two repair lockers but only one repair party. The repair party normally operates out of Repair II. CGC STORIS has two repair lockers, but normally operates out of Repair III.

** Repair III is fully outfitted, but only used when trainees are embarked.

*** 225’ WLBs Repair locker (forward locker) is partially outfitted and used only if Repair III (aft locker) is inaccessible due to casualty.

**** WHECs and 400’ WAGBs only.

6. <u>Engineering Assist (Or Machinery Assist) Team Locker (378 WHECs and 400’ WAGBs only)</u>. The purpose of this team is to provide main engineering spaces with additional fire fighting resources outside the existing repair locker and engine room GQ organization. The team is not a fully outfitted Repair Five (as defined by NWP 3-20.31(series)) and is manned by a small group of personnel. Subsequently, their equipment allowances are adjusted to include only that equipment required to accomplish their duties as outlined in the cutter's Battle Organization Manual and Machinery Space Fire Fighting Doctrine.

F. <u>DC BOOKS, DC DIAGRAMS AND COMPARTMENT CHECK-OFF LISTS (CCOLS)</u>. When DC Books are changed, it causes changes to CCOLS and DC Diagrams. All three must have the same information. One DC Book, complete in all respects shall be designated the "Master Copy". All shipboard copies of DC Books, DC Diagrams and CCOLs shall be continuously maintained and reflect current shipboard conditions. They will be maintained by shipboard personnel following the procedures given in later sections of this chapter. Minor changes may be submitted at any time to ELC (02), with a copy of the transmittal letter forwarded to Commander, Maintenance and Logistics Command (MLC (vr)). Five copies of the corrected DC Book will be returned to the cutter and one copy to the appropriate MLC. An up-to-date copy of each DC Book shall be maintained at the MLC for cutters under its cognizance. ELC (02) prepares and distributes computerized DC Books and CCOLS for each cutter of the following classes:

210' WMEC 230' WMEC 270' WMEC 283’ WMEC 290' WAGB 296' WIX
378' WHEC 400' WAGB 420' WAGB

CCOLS ONLY: 225' WLB 175' WLM 140' WTGB

1. Correction and Maintenance of Computerized DC Books and CCOLS. So that DC Books and CCOLS can serve their purpose effectively, they must be the principal source of information on cutter characteristics and data vital to the prevention and control of damage and casualties. It is essential that they be kept up-to-date to correctly reflect conditions as they exist.

    a. DC Books and CCOLS are now computerized for cutters listed in paragraph F. The information contained in the texts, tables, and CCOLS is produced, stored, and maintained using the Automated Damage Control System (AUTODAM). The DC Book and CCOL’s are produced using this program. While the CCOL’s are produced using the updated data contained in the DC Book tables, the Miscellaneous Unclassified Fittings List is formulated based on data supplied by the cutter's force. When updating the Miscellaneous Unclassified Fittings List the cutter's force must ensure that changes to this information are entered into the CCOL sheets.

    b. Accordingly, there is no need to duplicate the same information on CCOL sheets which is already annotated on the DC Book tables. DC Books and CCOLS that are not correct or do not agree with each other are of no value to the cutter and may lead to serious mistakes by shipboard personnel. Therefore, it is imperative that the DC Books and vessel's copy of CCOLS be updated simultaneously to reflect changes, whenever such changes are made.

2. Basic Procedures. The following sections define the procedures for keeping DC Books, DC Diagrams and CCOLS up-to-date with existing material conditions.

    a. Initial Check. Upon receipt, the DC Books, DC Diagrams and CCOLS shall be thoroughly checked by comparing them with existing conditions. The DC Books, DC Diagrams and CCOLS, as issued, indicate conditions on board at the time of the cutter check. Every effort has been made to ensure that the DC Book, DC Diagrams and CCOLS are as correct as possible. However, some discrepancies are inevitable. All closure classifications must be made to conform with the DC Book, and no change in these items shall be made without the approval of ELC per chapter 041. Where conditions regarding closure classifications differ from those indicated in the Book, they shall be reported to ELC (02), who will decide what action is to be taken. If ELC (02) changes the classification, the Branch making the change shall inform CMplus units. CMplus units shall ensure that the configuration data in CMplus is updated.

b. Correction of DC Book, DC Diagrams and CCOLS at Shipyard Overhauls. At each scheduled drydocking availability it shall be the responsibility of the CO/OICs to ensure that revisions to the master and spare copies of DC Book, DC Diagram and CCOLs are accomplished. A corrected copy of the DC Book, DC Diagram and CCOLs shall then be delivered to ELC (02) and CMplus Units. CMplus units shall also ensure that appropriate configuration, classification, etc. changes are made in CMplus. Following receipt by ELC (02) of corrected DC Books and CCOL's spare copies, five copies of the corrected DC Book and three corrected and reprinted CCOL sets will be returned to the cutter and one copy of each to the appropriate MLC. A copy of the transmittal letter shall be forwarded to Commander, Maintenance and Logistics Command (MLC (vr)). Following receipt by ELC (02) of corrected DC Diagram spare copies, corrected DC Diagram standard distribution sets will be returned to the cutter and one copy of each to the appropriate MLC, Leadership Development Center (PCO/PXO school) and SWOSCOLCOM (DCA School).

(1) Upon receipt and validation, by cutter personnel of the updated DC Books, Damage Control Diagrams and CCOL, all prior editions shall be destroyed.

(2) The CO/OICs shall ensure all copies of the DC Book, Damage Control Diagram and CCOL are revised and kept up-to-date to include all engineering changes. Engineering changes should be entered in the DC Book text, tables, and diagrams and on the CCOLS as soon as the engineering changes are completed.

(3) DC Book Text and CCOL Sheet Revisions. The marked-up spare copy of the DC Book (Text and Tabular Sections) and CCOL (Miscellaneous unclassified fittings only) shall be submitted with a letter of transmittal directly to ELC (02) with info copies to the respective chain of command. The changes incorporated into the DC Book and CCOL do not have to be itemized in this letter, but the authorization to change any classifications must be assigned a chapter number. Revisions to the master copy and all other copies of the DC Book and CCOL shall be made as follows:

(a) The manuscript of the text and tables shall be typed using a format similar to that of the original text.

(b) If the revision involves adding items that would congest the original sheet, the surplus items shall be typed on a new sheet bearing the same page number with a letter subscript.

(c) Deletions shall be indicated by drawing a single red ink line through the material to be deleted.

(d) Minor insertions or changes shall be made by neatly printing the change in red ink

(e) Enter all fittings to be modified, added, or deleted in the tabular sections of the DC Book. Only the changed miscellaneous unclassified fittings shall be entered on the CCOL. Unlimited legible pen-and-ink corrections to the computer generated DC Book and CCOLs are permissible for submission to ELC (02) as long as the corrections are made in red ink so that they are easily detected.

(f) There shall be a CCOL for every compartment and weather deck area except tanks. The CCOL shall be permanently posted in the compartment near each access opening or in the area concerned. It shall provide an itemized list indicating the location of all classified fittings and other facilities useful for damage control. The CCOL is intended for ready use by personnel responsible for setting of material conditions of readiness.

c. CCOL Requirements. Three sets of CCOL sheets are supplied to each cutter. The first set shall be designated the master CCOL and stored in an appropriate binder. The cutter's force shall keep the master CCOL tables, miscellaneous unclassified items, and the division responsible columns up-to-date to reflect the CCOL sheets in each compartment.

NOTE: The cutter's force is responsible for ensuring that the information in the master CCOL agrees with the information in the DC Book tables.

(1) The second CCOL set is to be retained as a "spare copy." This set is to be updated to reflect the master CCOL, for cutters listed in paragraph F, and returned to ELC (02) each time the DC Book is to be updated.

(2) The third CCOL set sheets are to be posted in the holder provided in each compartment and weather deck areas.

d. CCOL Contents. CCOL content shall be as required by NSTM Chapter 079, Vol. 2 with the following additions:

(1) Access. Include weather tight, and non-tight doors. Non-tight doors are not classified but will be numbered and listed in "ACCESS".

(2) Drainage. Include classification sewage collection and retention discharge valves.

(3) Fire main, Sprinkling and Wash down. Fireplugs are not classified, but will be numbered and listed in "Fire main, Sprinkling and Wash down" so they can be readily identified.

(4) Lubrication and Hydraulic Systems. Include all classified valves within these systems.

(5) Miscellaneous Unclassified. Only the following unclassified Damage Control related equipment is required to be listed in this section of the CCOL:

(a) Portable fire extinguishers

(b) Foam cans, generators, and proportioners

(c) Dial and sound powered telephones listed in the directory

(d) Casualty communication cables and terminals

(e) Casualty power panels, terminals, and supply cables

(f) Electric submersible pumps

(g) Multipurpose outlets (440 V for submersible pumps and welders)

(h) Shoring

(i) Damage Control equipment not located in the repair locker

NOTE: All non-damage control equipment including EEBD's, smoke detectors, air escapes, vents, and deck drains not outfitted with closure fittings or unclassified valves should be deleted from the listing.

e. Duplicate or Partial Lists. For compartments having two or more entrances over 10 feet apart, duplicate check off lists shall be posted at each entrance. These lists shall be clearly labeled as duplicate. For compartments having alcoves or areas where fittings are located, it may be desirable to have partial check off lists posted in these alcoves or areas. However, these partial lists shall be clearly labeled as partial, and the item numbers on these lists must correspond with the numbers on the main list. Check off lists shall be kept within practical size limits. It may be necessary to divide weather decks and some other decks into sections, such as main deck Frames 90 to 120 port side, and so forth.

f. Basic CCOL Format. There are two authorized formats for CCOLS. The first is AUTODAM, a computer generated Damage Control Book and CCOL, developed by ELC (02). The second is the CG Standard Workstation produced CCOL, which is authorized for Non-AUTODAM

g. Cutters. These CCOLs shall be prepared using the same format as AUTODAM on plain white (8½"x 11") sheet of paper. Coast Guard Form CG-2786 is no longer required. For the purpose of continuity, the word fitting shall include all classified items (i.e. doors, valves, closures, mechanical and electrical actuating devices, etc.) As a standard AUTODAM and Non-AUTODAM CCOLs shall be formatted as follows (See example provided in Figure 079-2):

(1) Compartment Numbers (12 Characters. 1 Line). Are identification numbers assigned to help locate each compartment within the cutter and indicates the function of the compartment. The function of the compartment, designated by an alphabetical letter, shall be in accordance with Naval Engineering Manual, COMDTINST M9000.6 (series).

(2) Compartment Name (25 Characters. 2 Lines). Are compartments aboard the cutter assigned noun names according to their actual use such as; Sickbay, Wardroom, Dry Stores, Deck Berthing, etc.

(3) Item Numbers (Automatically applied for AUTODAM Cutters Only). All damage control items on a CCOL require an item number. The first item on the CCOL shall be number 1. All other fittings and equipment are numbered sequentially to the last item on the CCOL.

(a) When an addition is required for the purpose of correcting CCOLs, new items shall be entered as; 1a, 1b, 2a, or 2b and so on. When an item is deleted, a single line should be drawn through the item in red ink.

(b) The item numbers are not required to be renumbered sequentially until all corrections have been made. Units are authorized 45 days from the completion of a Yard availability, Command Assessment of Readiness to Train (CART) or Tailored Ship Training Availability (TSTA)to effect changes. AUTODAM cutters shall submit corrections to their CCOLs and/or DC Books to ELC (02) for correction. Non-AUTODAM cutters shall correct and update their respective CCOLs.

(4) Fitting Abbreviation (10 Characters. 2 Lines) Standard abbreviations are developed by ELC (02). These standard abbreviations are developed to be easily understood, with minimal training, by cutter personnel. These abbreviations are a shortened variation of the system and function of damage control closures and fittings. Current listings of standard abbreviations may be obtained from ELC (02).

(5) Basic Location Number (9 Characters. 1 Line). All classified damage control closures and fittings are assigned a basic location number. Fire plugs and non-tight doors are also assigned a basic location number even though they are not classified. NOTE: This number is the actual location of a fitting in the compartment listed on the CCOL. The number along with the approved abbreviation helps to identify and locate the fitting or damage control closure within that compartment.

(a) Remote Operation. All items under this heading shall contain the actual location of the fitting operator in the compartment where the CCOL is posted.

(b) Damage control items under the "Miscellaneous Unclassified" heading do not require a typical location number, only a frame number and port/starboard location which will provide the location of these items (i.e. FR 30 Port or FR 30 Stbd).

(6) Location and Purpose (25 Characters. 4 Lines for each item listed). Provides a brief description of items listed on a CCOL. Each description must be clear, concise, and easily understood by cutter's personnel. List special information

such as: restricted access, locked fittings, location of system cutout valves, or compartment affected if the system is secured.

(7) Classification (1 Character 1 Line). Damage control fittings shall be classified in accordance with NSTM Chapter 079, Volume 2.

(a) AUTODAM CCOL cutters SHALL NOT change the assigned Commandant classification of a fitting. If differences appear follow the procedures within this Chapter. This is to ensure consistency throughout the fleet.

(b) Non-AUTODAM cutters. Shall change their classification of fittings to meet the requirements in NSTM Chapter 079, Volume 2, upon receipt of ELC approval. Proposed changes shall be submitted to ELC (02). If questions arise or the cutter cannot determine the proper classification of a fitting the cutter should contact the proper Maintenance Logistics Command type desk. Also, cutters shall ensure not to over classify fittings. Not all fittings require a classification and doing so creates excessive maintenance for the cutter.

TABLE 079-2 – CCOL FORMAT

COMPARTMENT: 1-134-0-L PASSAGEWAY

ITEM	FITTING	NUMBER	LOCATION AND PURPOSE	CL	DR
			ACCESS		
1	QAWTD	1-136-2	TO WEATHER	Z	R2
2	QAWTD	1-140-1	1-140-1-L DECK BERTHING	Z	R2
			MISCELLANEOUS CLOSURES		
3	ATC	1-140-1	1-140-1-L DECK BERTHING	X	E
4	AMMO HD	1-142-2	1-142-2-A AMMO HOIST ELEVATOR	X	D
5	FWCOV	1-148-3	EVAP POTABLE WATER OUTLET COV	Z	E
6	FW	1-148-1	HYDRO-PNEUMATIC TANK BY-PASS	W	E
			DRAINAGE		
7	DDV	1-144-1	SECONDARY DRAINAGE	Z	R3
			DAMAGE CONTROL AND BALLASTING		
8	SWCOV	1-150-1	BALLAST FILL TO 3-152-1-F	X	R3
9	BLSTDV	1-150-3	BALLAST DRAIN TO 3-152-F	X	R2
			FIREMAIN SPRINKLING AND WASHDOWN		
10	FMV	1-155-1	FIRE PUMP #2 DISCHARGE	(X)	R3
11	MAGSPR	1-156-2	TO SMALL ARMS MAG 2-158-2-M	X	R3
12	FMCOV	1-154-1	TO FPL 1-160-1	W	R3
13	FPL	1-160-1	FIRE STATION		
			CHEMICAL FIRE SYSTEM		
14	AFFFCOV	1-155-3	AFFF COV TO FLT DK SPRINKLER SYS	X	R3
			FUEL OIL		
15	FOCOV	1-157-1	FO FILL TO TANK 3-159-1-F 3 ½” BFVL	X	B
			JP-5		
16	JP-5 V	1-144-3	FILL VALVE TO JP-5 TANK 2-145-1-J	W	E

TABLE 079-2 – CCOL FORMAT (CONT'D)

COMPARTMENT: 1-134-0-L PASSAGEWAY

ITEM	FITTING	NUMBER	LOCATION AND PURPOSE	CL	DR
			LUBRICATION AND HYDRAULIC SYSTEMS		
17	LUBOV	1-138-1	FILL FOR LO TANK 3-123-1-F	X	E
18	FANEXH	1-149-2	SERVICING COMPT 2-207-0-L	(W)	R3
			PASSAGEWAY 2-214-2-M		
			SMALL ARMS MAGAZINE		
			REMOTE OPERATION		
19	RCV(FO)	1-136-2	3-96-0-E AUX MACHINERY ROOM	(X)	E
			FOCOV 3-98-2		
20	PUSHBTN	1-137-2	01-98-2 FAN EXHAUST	(W)	R2
			1-101-0-L DECK BERTHING		
			1-99-1-L DECK HEAD		
21	CNTRLR	1-148-1	1-149-2 EXHAUST	(W)	R3
			1-134-2-L PASSAGEWAY		
			COMPRESSED AIR		
22	LPACOV	1-150-0	BHD STOP VLV 1 ½" GLOBE	Z	R3
			MISCELLANEOUS UNCLASSIFIED		
23	CO2		PORTABLE 15 LB CO2	FR 150 PORT	
24	PKP		PORTABLE 27LB PKP	FR 151 STBD	

(8) Division Responsible (7 Characters. 1 Line). The Division responsible column identifies the division or GQ station assigned the primary responsibility to SET classified damage control fittings in the compartment listed on the CCOL. The CO/OIC is responsible for specifying what fittings each division or repair station is required to set.

(a) A dual responsibility is assigned for setting a material condition, which may require fittings to be opened or closed during either non-emergency or emergency situations. Examples are classified darken cutter fittings and ventilation fittings which may be set during non-emergency situations.

(b) Dual responsibility is assigned in the following order, non-emergency to emergency, i.e., D/R2 or OPS/R3. Compartments that are manned during GQ shall only have the division listed which is responsible for setting the material condition in that space. Repair stations shall only be listed for a dual responsibility if the repair station has the primary responsibility for setting that fitting during an emergency.

(9) Material Condition Status. The material condition status is required to be applied at the bottom of each CCOL. This section informs DCPOs and emergency personnel which fittings are opened or closed during material conditions. The material condition status is automatically applied on AUTODAM CCOLs and must be manually applied on Non-AUTODAM CCOLs as indicated in the following example:

Condition XRAY - 'X' ITEMS CLOSED (STOPPED), 'Y', 'Z', AND 'W' OPEN (RUNNING)

Condition YOKE - 'X' AND 'Y' ITEMS CLOSED (STOPPED), 'Z' AND 'W' OPEN (RUNNING)

Condition ZEBRA - 'X', 'Y', AND 'Z' ITEMS CLOSED (STOPPED), 'W' OPEN (RUNNING)

(10) Date. The date shall be applied to the lower left corner of the CCOL to indicate the AUTODAM program prepared it. Dates are not required for Non-AUTODAM produced CCOLs.

(11) Page Numbers. Page numbers will be automatically applied for AUTODAM CCOLs only. The page number shall be centered at the bottom of each page, an example is: 1 of 3, 2 of 3, and 3 of 3, etc. Non-AUTODAM cutters shall number each page manually as per the previous example.

(12) Cutter Identifier Code. Is automatically applied on AUTODAM CCOLs to the lower right hand corner. The code identifies the cutter class and hull number of the cutter. Non-AUTODAM cutters are not required to list the cutter identifier code.

(13) Data Groupings. The following CCOL Groups are the Coast Guard's requirements for ALL CCOLs. These groups shall be listed in the following order of precedence on the CCOL:

ACCESS
MISCELLANEOUS CLOSURES
DRAINAGE
DAMAGE CONTROL AND BALLASTING
FIREMAIN, SPRINKLING AND WASHDOWN
CHEMICAL FIRE SYSTEM
FUEL OIL
JP-5
LUBRICATION AND HYDRAULIC SYSTEM
VENTILATION
REMOTE OPERATION
COMPRESSED AIR
UNCONTAMINATED SEA WATER SYSTEM (WAGB 10 & 11 only)
SPILL OIL RECOVERY SYSTEM (for WLB & WLM only)
MISCELLANEOUS UNCLASSIFIED

(14) Tank Drains. The Coast Guard does not use the tank drain heading. All fittings, which were previously under this heading, SHALL be placed under their proper system heading (i.e. fuel oil, JP-5, potable water, etc.)

(15) Aviation and Automotive Gasoline System. The Coast Guard does not use this heading.

(16) Oxygen, Nitrogen and Inert Gas Valves. The Coast Guard does not use this heading. The Coast Guard does not have fixed or producing systems for oxygen, nitrogen or inert gasses.

NOTE: If there is insufficient bulkhead space to mount CCOLS, they will be placed on bound metal plates and stored in a permanently mounted, metal container. The container will be marked "CCOL" with 3-inch high letters. When a group of two or more accesses are within 10 feet of each other, only one set of CCOLS is required for that group of accesses. When two accesses on one side of a space lead from one adjacent space, only one set of CCOLS is required at a location between them.

h. DC Diagram Revisions. "Pen and ink" revisions of the un-laminated diagrams of the master copy and all other copies of the DC Diagrams shall be made as follows:

(1) Compartment and access changes shall be made on the subdivision diagrams only. All other diagrams shall have a note added that states: "REFER TO SUBDIVISION DIAGRAMS FOR COMPARTMENT CHANGES."

(2) Deletions shall be made by crosshatching the material to be deleted with red ink. No erasures shall be made, nor is it necessary to note on the diagram that the material is to be deleted.

(3) Additions and changes shall be shown in the required color to suit the system. They shall be indicated in the correct position. No indicator lines, circling, or marginal notes are to be inserted unless they are absolutely necessary for clarification.

(4) Obvious adjustments needed on the diagram, such as the relocation of lettering to make room for additions, do not require specific instructions.

(5) Changes or corrections that are too complicated to be shown by the "out and add" method shall be indicated on tracing paper marked in the proper color and exact size. The overlay tracings shall cover as small an area as is consistent with clarity. The overlay shall be taped in the proper place on the diagram; permanent fastening to the diagram is not desired.

G. MATERIAL CONDITIONS OF READINESS AND DAMAGE CONTROL CLASSIFICATIONS. All OPFAC cutters shall comply with NSTM Chapter 079, Volume 2 for material conditions of readiness and damage control closure classifications. Existing damage control classifications shall not be changed to comply with NSTM without permission of ELC (02) as differences may exist to allow special systems to function properly or to allow for an enhanced material condition of readiness arising from stability concerns.

H. COMPARTMENTATION AND DECK NUMBERING SYSTEM. All cutters will be considered as divided horizontally by decks, platforms, levels, and bottoms. Such divisions will apply to the entire cutter, both in the main hull and the superstructure.

1. Subdivision and Compartment Numbering. Coast Guard cutters built since 1949 and the EAGLE shall use the compartment numbering system described in NSTM Chapter 079, Volume 2, Compartment Numbering and Subdivision.

2. Old Numbering System. Cutters built before 1949 use the numbering system described in this section. It includes the following categories:

    a. Subdivision Old Numbering System. Subdivision shall be considered as extending from the keel to the highest deck in the line of the bulkheads, or the bulkheads prolonged. If the bulkheads do not extend to the highest deck, any space between decks that passes through two of the principal divisions shall be numbered as if it were situated entirely in the forward division of the two in which it is placed and shall have this number only. Main compartments with permanent openings to the topside, such as boiler and engine rooms, shall be considered as completely bounded by tight structure for numbering purpose.

    (1) The cutter shall be considered as divided into three principal divisions, lettered A, B, and C, from forward to aft.

(a) Division A. This shall comprise all the space between the bow and the forward transverse bulkhead of the forward machinery compartment.

(b) Division B. This shall comprise all the space between the forward transverse bulkhead of the forward machinery compartment and the after transverse bulkhead of the after machinery compartment.

(c) Division C. This shall comprise all the space aft of the after transverse bulkhead of the after machinery compartment.

(2) The term "Machinery Compartment" shall be construed as meaning engine rooms, main motor rooms, and compartments in which auxiliaries of the main propelling machinery are located.

b. Compartment Numbering. Old Numbering System.

(1) All numbers in each division shall begin at the forward end of that division. Compartments on the starboard side of the cutter shall have odd numbers; those on the port side, even numbers.

(2) All compartments and spaces that are completely bounded by watertight, oil tight, airtight, or fume-tight bulkheads shall be numbered.

(3) When a watertight compartment located below the weather deck is divided into two or more airtight or fume-tight spaces by airtight or fume-tight bulkheads, the appropriate number shall be assigned. The watertight compartment and each airtight or fume-tight subdivision in the compartment shall be designated by the addition of a suffix to this number. Thus, if watertight compartment A-312-L contains a fume tight or airtight bulkhead, the space to starboard of this bulkhead will be designated A-312-1L.

(4) Airtight and fume-tight spaces located above the weather decks and outside of the hull proper, such as those in deckhouses, shall each be given their own individual number without a suffix number, as though each airtight or fume-tight space were a separate watertight compartment. Thus, the number of an airtight or fume-tight space on the superstructure deck may be A-0204-L, even though this space may be one of several airtight or fume-tight spaces located in a deckhouse with a watertight boundary.

(5) Oil tight and watertight compartments on the main deck shall be numbered from 101 to 199. Those on each successive deck or platform below the main deck shall be numbered in the next higher hundred series; consequently, those on the second deck shall be numbered from 201 to 299; on the third, from 301 to 399; and so on.

(6) Watertight, airtight and fume-tight compartments on the next level above the main deck shall be numbered 0101 to 0199. Those on each successive level

above the main deck shall be numbered in the next higher hundred series, prefixed with a zero.

(7) To further define the contents or main use of the compartment, the compartment number shall be followed by a designated letter as follows:

"A" - Storage area such as:

Storerooms
Issue rooms
Refrigerated stores
Repair lockers
Ordnance related stowage, Non-hazardous
Clothing and cleaning gear lockers

"C" - Cutter and fire control operating spaces which are normally manned, such as:

CIC
IC Rooms
Communications office
Control booth
Pilothouse
Plotting rooms
Radio rooms
Electronic operating spaces

"E" - Machinery compartments or spaces which are normally manned, such as:

Main machinery spaces
Auxiliary machinery spaces
Evaporator rooms
Pump rooms
Refrigerating machinery rooms
Steering gear rooms
Windlass rooms

"F" - Fuel area compartment including:

Fuel oil tanks
Lubricating oil tanks
Hydraulic oil tanks
Oily water holding tanks
Spill oil recovery tanks

"G" - Gasoline tanks, including gasoline cofferdams (not used by Coast Guard)

"J" - JP-5 tanks

"K" - Storage of chemical, semi-safe dangerous material, except oil and gasoline.

"L" - Living area or compartment, medical and dental spaces, and horizontal passageways, including:

Officers' quarters
Crew's quarters
Water closets and washrooms
Medical and dental spaces
Passages

"M" - Ammunition spaces including:

Magazines
Small arms magazine
Ammunition handling room
Ammunition hoist and ordnance elevators

"Q" - All spaces not otherwise covered, such as:

Engineering, electrical, and electronics
Spaces that are not normally manned
Galley
Pantries
Scullery
Laundry
Offices
Shops
Wiring and service trunks
Fan rooms
Signalman's shelter
Helo fueling pit
Uptakes
Bow thruster
Chain locker
Shaft alley
Waste handling/incinerator space

"T" - Vertical access trunks

"V" - Voids compartments, such as voids and cofferdams, other than gasoline tank cofferdams

"W" - Water tanks including:

Fresh water tanks
Reserve feed water tank
Peak tanks
Ballast tanks

Bilge tanks
Sump tanks
Built-in sewage holding tanks

"X" - Weather deck area.

3. Painting of Compartment Numbers. A compartment Bull's Eye is required in each space or compartment, except tanks and voids. Refer to Coatings and Color Manual, COMDTINST M10360.3 (series), chapter 10.

I. WATERTIGHT INTEGRITY TESTS AND INSPECTIONS. In lieu of NSTM, Chapter 9880, Section IV, cutters shall conduct a visual inspection of all watertight boundaries as per DC PMS. The DCA, or equivalent, should pay particular attention to the inspection results to ensure the timely correction of watertight discrepancies.

J. ENGINEERING CASUALTY CONTROL MANUAL. All cutters 65 feet in length and greater are required to prepare and maintain an Engineering Casualty Control Manual (ECCM). The purpose of this manual is to establish methods of operating all vital systems and corrective actions to be taken if casualties occur. The ECCM shall consist of the four chapters listed in this section for the following types of cutters; WHEC, WMEC, WIX, WAGB, WLB, WLM, WTGB and WPB. For the WLI, WLIC, WLR, and WYTLs cutters the ECCM shall consist of three chapters listed in this section; chapter one, chapter two, and chapter four. Copies of the ECCM shall be maintained in Main Control, Engineering Assist location, all repair lockers, DCC and the Pilot House.

1. General Outline of the Casualty Control Manual. This section furnishes guidance necessary to assist in the preparation of the ECCM. It describes what each chapter is to address and contain. Further specifics for each chapter are provided in the subsequent paragraphs of this section and NSTM Chapter 079, Volume 3. The four chapters are:

Chapter 1 - Machinery Readiness

Part A: Engineering Plant Information and Set-up

Part B: General Engineering Bills

Part C: Restricted Maneuvering Doctrine

Chapter 2 - Engineering Casualties (BECCEs)

Chapter 3 - General Emergency Casualties

Chapter 4 - Damage Control Organization

Part A: Damage Control Organization and Duties

Part B: Main Space Firefighting Doctrine

The ECCM will have an appropriate Table of Contents developed for the entire manual. In addition a Table of Contents will be set up for each chapter to enable quick reference of material within the manual.

2. Chapter 1 - Machinery Readiness.

   a. Part A. Engineering Plant Information and Set-up. This part will include the following items:

      (1) Propulsion Plant Description. This item describes the engineering plant configuration for the cutter. It should contain information on all major propulsion and auxiliary equipment. Information to be included as a minimum: name, description, model, rpm, capacity, and any other specifics deemed necessary by the Engineer Office/Engineer Petty Officer (EO/EPO).

      (2) Engineering Plant Conditions of Readiness. This item will indicate proper set up for the main propulsion plant under the normal and emergency conditions of readiness maintained by the cutter. It shall also indicate the proper set up for all vital systems that are integral to the propulsion readiness of the cutter.

   b. Part B. General Engineering Bills. The CO or OIC shall require that the bills listed in Table 079-3 be prepared. Those listed under Part (A) shall be prepared by the Executive Officer/Executive Petty Officer (XO/XPO) and those listed under Part (B) shall be prepared by the EO/EPO. Bills listed under Part (A) should be included in the Cutter Organization Manual and need not be included in the Casualty Control Manual. The CO/OIC may require preparation of additional bills deemed necessary for the proper and safe operation of the command.

      (1) General Requirements for All Bills. The following items shall be included in all bills:

         (a) Object of the bill.

         (b) Manner of reporting, if applicable.

         (c) Call signal, if applicable.

         (d) Secure signal, if applicable.

         (e) General plan or procedure.

         (f) Equipment or material to be provided, if applicable.

         (g) Assignment and duty or duties of personnel.

         (h) Brief description of the system, outlining methods and procedures for operating the system, if applicable.

(i) Simplified drawings or diagrams illustrating important parts and functions of the systems, if applicable.

(j) (For each valve or fitting, the bill should indicate its function, casualty control number, location, and setting, if applicable.

(2) Outline of Required Bills. The following section outlines the contents of the bills required under Table

(a) Fuel Oil Service Bill. This bill shall describe the procedure for filling and drawing down service tanks to ensure a continuous supply of clean, burnable fuel. The procedure shall have adequate provisions to avoid:

Interruption of supply due to pump failure.

Interruption of supply due to low oil level in service tanks.

Unnecessary hazard to watertight integrity through lack of segregation.

(b) Evaporator Plant Bill. This bill shall describe the procedure for the control and accounting of make-up feed, replenishment of cutter's potable water, the operation and securing of the evaporator plant, the sounding of tanks, and to obtain the optimum degree of segregation, both for watertight integrity and prevention of contamination.

(c) Ships Service Generator Bill. This bill shall indicate the correct condition of fuel supply, return, cooling, and lubricating systems for optimum damage resistance and continuity of power supply under various engineering conditions of readiness.

(d) Fuel Transfer and Ballast Bill. This bill describes the method of maintaining the optimum degree of damage readiness and resistance in the fuel transfer and ballast system commensurate with operating flexibility for various evolutions. Specifically, it must show the following:

1. Sequence of emptying, recirculating, filtering, and refilling tanks.

2. Instructions for ballasting, deballasting, and stripping of fuel storage and fuel and ballast tanks.

3. Special provisions for the redistribution of fuel for maximum availability for transfer to other cutters.

4. Special provisions required prior to fueling obtaining optimum receiving rates.

5. Instructions for sampling fuel storage tanks for water.

6. Instructions as to fuel soundings, accounting for fuel, and fuel reports.

7. Instructions for the maintenance of proper displacement and removal of list through use of fuel transfer system and ballast system.

(e) Drainage Bill. This bill describes the method of segregation to obtain optimum damage resistance, while permitting prompt use of the drainage system pumps and eductors for pumping out voids, ballast tanks, and flooded compartments, or for deballasting fuel tanks, with a minimum modification of the set-up. Lists of valves and fittings should show location, casualty control number, use, setting for each condition of readiness, and cognizant repair party or watch personnel. This list should include the following parts of the drainage system:

1. Pumps

2. Eductors

3. Sea chests

4. Cut-out valves

5. Remote control devices

6. Sounding tube closures

7. Oil Content Monitors

(f) Fire Main and Salt Water Circulation Bill. This bill describes the principles of operation of the fire main, auxiliary sea water, and salt water circulating systems with respect to pressure, segregation, recirculation, pumps to be used under various conditions, limitations of the systems, and maintenance responsibilities of various divisions. It also identifies communications for the coordination of system control and procedures to be followed if battle damage occurs to the fire main. Lists of valves and fittings should show location, casualty control number, use, setting for each condition of readiness, and cognizant repair party or watch personnel.

(g) Auxiliary Plant Bill. This bill provides instructions covering the segregation, operation, or securing of auxiliary plants, and services not specifically covered elsewhere. This includes the heating system, refrigeration system, cutter's fresh water supply, emergency generator plant, and CHT system.

(h) Main Propulsion Repair Bill. This bill contains detailed instructions for the main propulsion repair party. It includes stationing, communication techniques, assignment of equipment, and primary duties if major damage occurs.

(i) Casualty Power Bill. This bill defines locations and technique of employing the casualty power system.

(j) Interior Communications Bill. This bill identifies all sound powered, voice tube, and cutters power operated communication circuits. The bill will identify each circuit, where receptacle, cut out switches, patch panels, etc., are located (Compartment, frame #, and transverse location) and its purpose (Lookout circuit, control and maneuvering, damage control, etc.).

(k) De-Energizing of Electrical Circuits Bill. This bill establishes policy and procedures for the de-energizing of electrical circuits. It will contain the list of the circuits and their breaker locations. It will also set forth procedures for the securing of electrical power for normal servicing and emergency operations.

(l) Air Conditioning Heating and Ventilation Bill. This bill provides a list of the air conditioning systems, blowers, heating units, and closure devices, so that they may be expeditiously controlled. Control is necessary to:

1. Prevent the spread of water from flooded to undamaged compartments through the ventilation ducts.

2. Prevent the spread of fire.

3. Reduce the entry of radiological, biological and chemical agents from possible enemy attack.

4. Facilitate removal of smoke resulting from a fire in below-deck spaces.

5. Facilitate the ventilation of interior spaces when authorized during general quarters.

6. Avoid supplying oxygen to fires or establishing a draft.

(m) Compressed Air Bill. This bill describes the compressed air system in the cutter. The bill shall include:

1. Instructions for taking action to maintain pressure on:

2. Gun gas ejecting system.

3. Rammer systems of guns so equipped.

4. Pneumatic operated main propulsion control system.

5. Diesel starting air.

6. Clutch air

7. MGT air assist

8. Instructions to ensure that air service is secured to those systems not necessary under combat conditions.

9. Information regarding:

10. Compressors and accumulators

11. Storage bottles

12. Outlets

13. Cross connections

14. Other component parts as required

(n) Aviation Fuel Handling Bill. For those cutters having such equipment, this bill includes:

1. Brief description of the system.

2. Procedures for receiving, maintaining, and delivering fuel to an aircraft.

3. Instructions for testing and recording fuel condition.

c. Part C. Restricted Maneuvering Doctrine. The restricted maneuvering doctrine is a written agreement between the CO/OIC and the EO/EPO regarding the level of casualty control initial action to be taken during periods of restricted maneuverability. It shall cover the circumstances when a watchstander may secure equipment as part of initial actions to effect casualty control, when securing of this equipment may place the vessel in jeopardy. Restricted maneuvering may be considered to be all those times when the vessel is at Special Sea Detail, Unrep, Flight Operations, or other times as the CO/OIC directs.

3. Chapter 2. Engineering Casualties (BECCES).

a. This chapter shall address engineering plant casualty control. It will contain all the Basic Engineering Casualty Control Exercises (BECCE) required for the cutter. The chapter will be developed and regulated by the requirements set forth in the Cutter Training and Qualification Manual, COMDTINST M3502.4 (series) and the Naval Fleet Mobility Exercises Manual (FXP series). Both manuals contain information pertaining to the exercises a cutter is to perform.

Cutter Training And Qualification Manual, COMDTINST M3502.4 (series) states which exercises are required for a given cutter while the FXP establishes the proper numbering of each exercise. This chapter will be organized using the "MOB-E-" numbers from the manuals with a table of contents established for quick reference. The exercises will be set up in the following format for each casualty:

(1) Type of Casualty

(2) Symptoms

(3) Initial Action

(4) Follow up Action

(5) Possible Additional Casualties

b. Additional information on casualty control and the format of these exercises are contained in NSTM Chapter 079 Volume 3.

4. Chapter 3. General Emergency Casualties.

a. This chapter will address general shipboard casualty and damage control. It will establish the procedures for general casualty and damage control for watchstanders and general emergency personnel stationed in the engine room. The casualties will be formatted in the same manner as above.

b. The general casualties to be included in this chapter are listed below and may be expanded as deemed necessary or desirable by the CO/OIC:

(1) Flooding of engine room

(2) Flooding of any compartment

(3) Collision

(4) Fire

(5) Underwater Hull Damage

5. Chapter 4. Damage Control Organization.

a. This chapter will contain the organization necessary for proper shipboard damage control. It will include the duties and responsibilities for all stations and personnel and how the damage control structure is setup. The following shall be included in this chapter:

(1) Damage Control Organization

(2) DC Central location and responsibilities

(3) Repair Party locations and responsibilities

(4) Machinery Space Firefighting Doctrine For Class Bravo Fires, COMDTINST M9555.1 (series)

b. Cutter Standard Repair Locker Inventory, COMDTINST 9664.1 (series), requires all cutters, 65 feet and larger, to develop and maintain a Repair Party Manual. COMNAVSURFLANT INST 3541.1 (series) or Standard Repair Party Manual For Naval Surface Force, COMNAVSURFPAC INST 3541.4 (series), shall be used by those cutters who have been required to do so by their respective Area commanders. Units, not required to use the Standard Repair Party Manual For Naval Surface Force, can satisfy the Repair Party Manual requirements of Cutter Standard Repair Locker Inventory, COMDTINST M9664.l (series) by completing the requirements of paragraph J.5.a. above.

TABLE 079-3. TABLE OF REQUIRED BILLS

							WLIC WLM WLI Over 100’		WYTL WTGB
	WHEC	WAGB	WMEC	WLB	WPB			WLR	

Part (a)								
Steering Casualty				X	X	X	X	X
	X	X	X					
Replenishment at Sea				X		X	X	X
Degaussing					All Units With Degaussing			
Fire					X	X	X	X
	X	X	X	X				
Rescue and Assistance				X	X	X	X	X
	X	X	X					
Strip Ship & Clear Ship				X	X	X	X	X
	X							
Jettison Ship					X	X	X	
Ship Salvage					X	X	X	X
Scuttle Ship					X	X	X	
	X							
Collision				X	X	X	X	X
	X	X	X					
Darken Ship					X		X	
CBR Defense					X		X	
Part (b)								
Fuel Oil Service				X	X	X	X	X
	X	X	X					
Evaporator Plant				All Units With Evaporators				
Ships Service								
Generator				X	X	X	X	
Fuel Oil Transfer & Ballast				X	X	X	X	
Drainage				X	X	X	X	X
	X	X	X					
Fire Main & S/W Circulating				X	X	X	X	X
	X	X	X					
Auxiliary Plant				X	X	X	X	
Main Propulsion Repair				X	X	X	X	X
Casualty Power				X		X	X	
Interior Communication				X	X	X	X	X
De-energizing Electric Circuits			X	X	X	X	X	

Heat & Ventilation X	X	X		X	X
Compressed Air	X	X	X	X	
Aviation Fuel		X	X (210/270/283)		

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CHAPTER 080. INTEGRATED LOGISTICS SUPPORT REQUIREMENTS

A. **<u>INTEGRATED LOGISTICS SUPPORT (ILS)</u>.** ILS is the collection of support requirements and responsibilities associated with platforms, systems, and equipments throughout their life cycle. It addresses the following specific logistics elements during all phases of logistics: Maintenance Planning, Staffing and Personnel, Supply Support, Shore Facilities Support and Test Equipment, Technical Data, Storage, and Transportation (PHS&T) and Design Interface. Refer to U.S. Coast Guard Logistics Handbook, COMDTINST 4000.2 (series), for further guidance.

B. **<u>INTEGRATED LOGISTICS SUPPORT PLAN (ILSP)</u>.** The ILSP establishes policy, procedures, and identifies management responsibilities associated with a specific platform, system, or equipment. During the acquisition phase, the ILSP is a guide. During the sustainment phase it is the plan. Refer to System Integrated Logistics Support (SILS) Manual COMDTINST M4105. 8 (mgt), for further guidance.

C. **<u>INTEGRATED LOGISTICS SUPPORT MANAGEMENT TEAM (ILSMT)</u>.** Cross-functional teams of designated Logistics Element Managers (LEMS) that develop, review and update ILSPs in response to changing operational and logistical requirements. It ensures that appropriate ILS elements are addressed and are current. During acquisition the Acquisition Project Manager's, ILS Manager, chairs the ILSMT. During sustainment the ELC Platform Manger on behalf of the Facility Manager (G-0) usually chairs the ILSMT. The CSR review is scheduled regularly by the ELC and reviews Class Maintenance Plans (CMP), and Long Range Maintenance Plans (LRMP).

D. **<u>CUTTER SUPPORT REVIEW (CSR)/EQUIPMENT SUPPORT REVIEW (ESR)</u>.**

1. <u>Description</u>. A Natural Working Group (NWG) responsible for integrating maintenance philosophy, actual field repair practices, and allowance documents into the Commodity Management Plan and Class Maintenance Plan (CMP) conducts the CSR/ESR. The working group ensures that logistics and maintenance needs of the cutter class are merged so that both scheduled and casualty maintenance actions are fully supported. Specific support responsibilities by the ELC, MLCs, NESUs and cutters are clearly delineated in the completed CMPs. The CSR/ESR NWG is managed and Chaired by the ELC.

2. <u>Members</u>. The CSR/ESR is the forum that enables operators and maintainers to address specific supply and maintenance issues. Field units, operators and maintainers will be required to prepare for and participate in CSRs/ESRs. Generally a CSR/ESR will follow a platform's ILSMT. Where the ILSMT address larger policy issues, the CSR usually operates at a much lower level. Support issues with specific systems and equipment are addressed.

   a. The regular members are:

      (1) Representative and team leader, ELC.

      (2) Representatives from the MLC(s).

(3) Representatives from the applicable NESU(s).

(4) A cutter class facility manager representative from Headquarters.

b. Representatives from the cutter class. For example, a cutter Engineer Officer/Engineer Petty Officer (EO/EPO).

c. Ad hoc members of this working group may consist of various division/branches within the ELC and various external Coast Guard organizations as needed.

3. CSR Functions and Deliverables. The following general functional tasks and deliverables direct and define the scope of the CSR NWG.

a. The working group shall identify the most operationally critical/repair components with support problems for the cutter class. When applicable, a CMP will be developed for each item to ensure support actions required by the CCMP are implemented. The CMP shall include, but not be limited to priorities, organizational responsibilities, quantities required annually, and methods of procurement/repair.

b. Provide input to the headquarters facility manager to ensure ILSP information is correct and up-to-date.

c. Update allowance documents. Modify all Allowance Parts Lists (APLs) to ensure compatibility with the applicable maintenance philosophy and actual field support practices.

d. Provide data for changes to VLS.

e. Along with the above evaluations, ensure appropriate definitions and practices involving repairable equipment, insurance spares, rotatable spares, and drydock consumables are consistent in the development of CMPs.

f. Review available technical and logistics documents as they apply to a cutter class and identify the need for additional documentation. Assign tasking as required.

g. Review the need for the assignments of Quality Action Teams (QAT), Tiger Teams (T/T), or Natural Working Groups (NWG) to assess problems involved with the cutter class. Develop and submit to G-SEN-1, as appropriate WORLD OF WORKS requests.

h. Solicit additional ad hoc members as appropriate.

CHAPTER 081. MAINTENANCE OF CUTTERS AND BOATS

A. **GENERAL.** The goal of cutter and boat maintenance is to optimize readiness to perform assigned missions at the lowest life-cycle cost. The objective of cutter and boat maintenance is to ensure cutters and boats are capable of meeting all scheduled operational requirements with all systems and equipment fully functional. Optimization of cutter and boat readiness is accomplished by preventing and eliminating hull, mechanical and electrical system casualties that degrade mission capability. The most effective maintenance programs are achieved through the efficient use of available resources (time, people, funding, etc.). In those instances where it is not possible to achieve that objective, risk management is used to make decisions concerning when and what repairs will be accomplished and how the unit may be deployed.

B. **RELIABILITY CENTERED MAINTENANCE (RCM).** The Coast Guard shall use MIL-P-24534, the RCM standard, as the governing process for the development of new maintenance systems and the optimization of existing maintenance standards. RCM is a process used to identify maintenance that is required to preserve equipment function by reducing or avoiding unplanned system failures. Chapter 076 provides a more detailed description of RCM.

C. **LEVELS OF MAINTENANCE.** The Coast Guard separates the level of maintenance into three categories collectively known as tri-level maintenance: organizational, intermediate and depot. The complexity and magnitude of the maintenance event determines at what level within the tri-level system the event is performed.

1. Organizational Level Maintenance. Maintenance that is performed by the unit's assigned crew or directly under their auspices (i.e., cutter-funded commercial contract or assistance requested from a Maintenance Augmentation Team)

2. Intermediate Level Maintenance. Maintenance of a more sophisticated nature that requires outside assistance performed by other maintenance entities (such as industrial activities, contracted support, Maintenance Augmentation Teams) Intermediate level maintenance is maintenance other than organizational or depot level

3. Depot Level Maintenance. Maintenance performed on equipment or material requiring major overhaul or a complete rebuild of parts, assemblies, subassemblies, and end-items, including the manufacture of parts, modifications, testing, and reclamation. Typically, maintenance items in this category are normally performed during a dry-dock or dockside availability with commercial or industrial activity support.

D. **LEAD MLC DESIGNATIONS.** The lead MLC for each class as shown in Table 81-1 will maintain the FLS maintenance standard and the standard specification used to describe availability requirements.

Table 81-1: Lead MLC for Cutter Classes

Lead Maintenance Logistics Command	Class
Pacific	WABG 420
Pacific	WAGB 399
Pacific	WHEC 378
Atlantic	WIX 295
Atlantic	WAGB 290
Pacific	WMEC 282
Atlantic	WMEC 270
Pacific	WMEC 230
Atlantic	WLB 225
Pacific	WMEC 213
Atlantic	WMEC 210
Atlantic	WLB 180
Atlantic	WLM 175
Atlantic	WLIC 160
Atlantic	WTGB 140
Atlantic	WPB 110
Atlantic	WLIC 100
Atlantic	WPB 87
Atlantic	WPB 82

E. **TYPES OF MAINTENANCE.** The Coast Guard has three types of maintenance: Corrective, Preventive and Alterative Maintenance, which are described below:

1. Corrective Maintenance.

   a. Corrective Maintenance is the performance of scheduled and unscheduled tasks designed to restore equipment after failure has occurred. In most cases, a failure will have a detrimental affect on the unit's mission capabilities, the unit's operating environment, or the safety of the unit's personnel. Traditionally, the CG has used the Casualty Reporting (CASREP) System to report system or equipment failures affecting mission requirements and to request maintenance or supply support. CASREP reporting policy is contained in Casualty Reporting (CASREP) Procedures (Materiel), COMDTINST M3501.3 (series).

   b. The Commandant's CASREP procedures require units to report material conditions that affect their mission capabilities. CASREPS must be created in CMplus from Corrective Maintenance Actions (CMA) to support management of maintenance data. The MLCs and the ELC shall review and correctCASREP and CMA records data to ensure accuracy.

c. Current Ship's Maintenance Projects (CSMP) will be used to document corrective maintenance needs only. Preventive or alterative maintenance needs will be managed using the VLS and procedures defined by the MLCs and the ELC.

2. Preventive Maintenance. Preventive maintenance outlines minimum maintenance requirements and procedures for HM&E, damage control, electronic and ordnance equipment aboard cutters and standard boats. Procedures are prescribed for inspecting, cleaning, and reconditioning machinery and equipment, to counter the effects of age and environment. Accomplishment of preventive maintenance will increase machinery reliability and availability. Generation and promulgation of preventive maintenance for non-standard boats is the responsibility of the parent unit. Organizational preventive maintenance is defined by the following references.

   a. HM&E Equipment. Naval Engineering Preventive Maintenance System (PMS) Technical Publications for HM&E equipment have been developed for all classes of cutters and standard boats. They can be found in the Naval Engineering Technical Information Management System (NETIMS) as described in Chapters 086 and 834.

   b. Damage Control Equipment. All damage control equipment PMS can be found in the Damage Control PMS Manual, TP 2006 (series). It is applicable to all cutter classes 65 feet and longer.

   c. Ordnance Equipment. All ordnance equipment is to be maintained according to the PMS as described in the Ordnance Manual, COMDTINST M8000.2 (series).

   d. Electronic Equipment. All electronic equipment is to be maintained according to the CGPMS as described in the Electronics Manual, COMDTINST 10550.25 (series).

   e. Rescue and Survival Equipment. Rescue and survival equipment is to be maintained according the Rescue and Survival Systems Manual COMDTINST M10470.10 (series)

   f. The use of PMS is mandatory. CO/OICs shall ensure that their personnel remain fully aware of the PMS requirements and that these mandatory procedures are thoroughly and properly carried out.

3. Alterative Maintenance. Alterative maintenance improves system performance by changing configuration to meet environmental, safety, operational, or economic requirements. Procedures for managing alterative maintenance are described in Chapter 041 Engineering Changes.

F. **MANAGEMENT.** Each command shall develop a comprehensive electrical safetyprogram. As a minimum, the program shall contain the following elements:

1. All maintenance requirements will be contained in the Class Maintenance Plan (CMP), which was formerly known as the Cutter Class Maintenance Plan (CCMP) or the Boat Class Maintenance Plan (BCMP). PMS Manuals will be phased out and replaced by CMP manuals, which will include organization, intermediate, and depot maintenance

requirements. The ELC will manage CMP manuals and their promulgation. These manuals will include maintenance standards for the organizational and intermediate levels.

2. Units, MLCs and the ELC shall report and document all maintenance in the Vessel Logistics System. All maintenance records will be associated with a configuration record. The ELC is responsible for publishing procedures that dictate how CMPs will be managed in VLS.

3. The ELC will manage the CMplus/FLS Configuration Management Data Interchange Standard (CMDIS) transactions to maintain consistency between unit level CMplus systems and the enterprise FLS.

4. Maintenance managers at the MLCs and ELC will maintain maintenance standards. ELC Platform Managers will establish new maintenance standards and provide oversight for changes to existing depot and intermediate maintenance standards. The Lead MLC Maintenance Manager will manage depot and intermediate maintenance standards. Lead MLC Maintenance Managers are responsible for developing and maintaining standard specifications designed to support contract requirements. These documents will follow a standard specification template and be associated to the VLS maintenance standard.

5. The ELC will use RCM to develop and continuously improve these maintenance procedures. RCM or CG Maintenance Effectiveness Review (MER) analysis, when conducted, will determine requirements for all maintenance levels. Depot level maintenance requirements will be provided to the MLCs so that maintenance standards and specifications can be developed or modified.

6. Figure 81-1 shows simplified relationships for different maintenance record types in the VLS. Casualty Reports (CASREP), Current Ships Maintenance Projects (CSMP), and Corrective Maintenance Actions (CMA) are used to describe corrective maintenance requirements. The CMP describes the preventive maintenance system. Engineering Changes describe alterative maintenance. Work requests are created to support corrective maintenance. Maintenance standards are created to support preventive and alterative maintenance. Maintenance items are created to support project management. The MLCs and the ELC shall develop and promulgate instructions that support this policy.

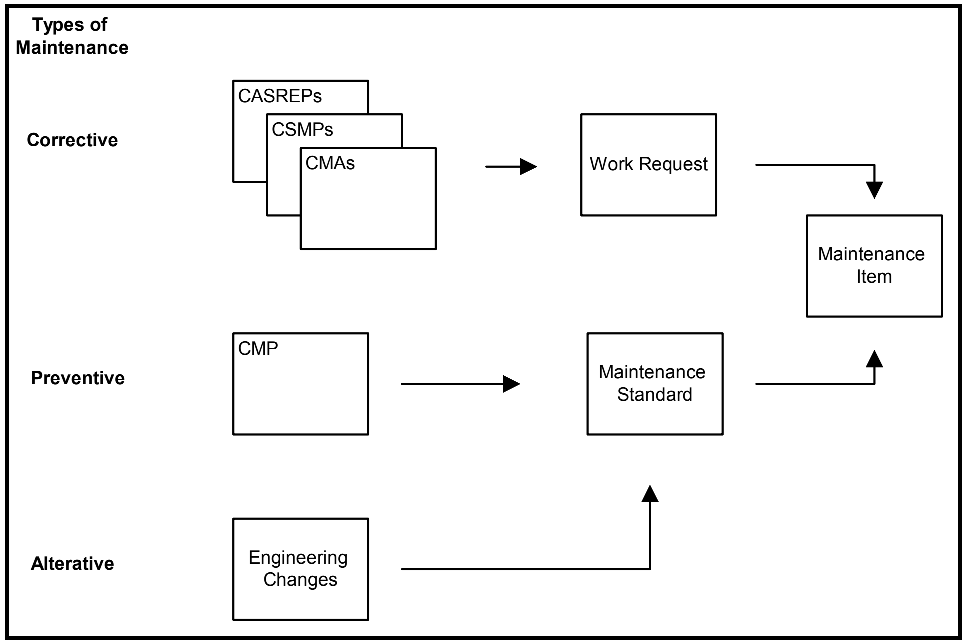

Figure 81-1: Vessel Logistics System Maintenance Management

7. All parts issued from unit inventories, that are not consumables, will be linked to configuration items and either CMA or Maintenance Task Executable records in CMplus. The linkage to VLS data is important in order to support the continuous improvement process for logistics and provide metrics used for decision support.

8. Change Control:

   a. The ELC will maintain current versions of organizational and intermediate level maintenance procedures that will allow for intranet access by any Coast Guard unit. The process will allow for customer input and ELC feedback. Emergent changes to maintenance procedures will additionally be promulgated via message

   b. VLS consolidates all maintenance requirements and allows changes to be made by any command within the Coast Guard if they have proper permissions. VLS provides a new dynamic environment for the entire maintenance organization. Effective maintenance management will require the creation of new roles and maintenance business rules. The ELC and MLCs will provide this information to G-SLI to support development and fielding of VLS.

   c. Anyone concerned with maintenance may propose a change to the CMP. Changes are routed to the Maintenance Branch of the ELC who will manage the CMP change process.

   d. If the proposed change meets the RCM rules for applicability and effectiveness, it will be prototyped on the classes to which it applies. After a successful prototype, configuration and supply data will be revised as necessary to support the procedure. Finally, the change will be promulgated to all applicable classes.

9. In addition to specific maintenance procedure changes, technical or logistically oriented trends in failure to complete PMS should be reported to the cognizant MLC. Examples include: Inability to obtain necessary parts, availability of special tools, lack of necessary training or extensive task effort requiring contractor or shipyard completion. Specific reporting procedures for PMS completion for cutters and standard boats are as follows:

    a. Cutters: PMS scheduling and completion feedback shall be tracked via CMplus. PMS completion data shall be reported in the cutter engineering report. Cutters with standard boats attached shall include standard boat PMS with auxiliary PMS.

    b. Standard Boats: PMS for standard boats shall be reported by division (i.e. main machinery, auxiliary, electrical, etc.) as a percentage complete per boat for the reporting period. (The servicing ESU/ESD is responsible for reporting electronics equipment PMS completion status to the Group.) Percentage complete is defined as the number of monthly, quarterly, semiannual and annual MPC completed, divided by the number of MPC scheduled for the reporting period. If scheduled PMS cannot be completed, or items are deferred two or more times, indicate the item and reason. Send the PMS completion information in the following format via message to the Group by the end of the first week in January, April, July and October:

BOAT NUMBER	MAIN MACHINERY	ELECTRICAL	AUX	DC
47XXX	_________	__________	________	________
49XXX	_________	__________	________	________

G. **<u>MAINTENANCE AND FINANCIAL PROGRAM</u>.** The Commanding Officer/Officer-in-Charge (CO/OIC) is responsible for the readiness of the cutter to perform its assigned missions. The most effective way to meet this responsibility is to have a well planned and aggressively pursued maintenance program with a financial program established that supports it. Units outfitted with CMplus shall use the automated functionality within CMplus to create, track and execute maintenance schedules, create work lists and identify and report problems with PMS.

1. <u>Cutter Program Requirements</u>. All OPFAC cutters 65 feet or longer are required to prepare and maintain maintenance and financial programs. The maintenance and financial programs must ensure that adequate maintenance and repair is accomplished to ensure all operational commitments can be met.

    a. As part of the overall maintenance program, each unit/cutter shall prepare periodic work lists showing each item scheduled for accomplishment during a specific period. The individual work lists should be prepared enough in advance to permit timely review, prioritization, and execution by the command.

    b. The financial program (AFC-30 budget) is a portion of the units AFC-30 funding, set aside for the accomplishment of PMS, repairs and planned improvements.

Each department shall prepare an AFC-30 budget to provide for effective utilization of the cutter's AFC-30 funding. The AFC-30 budget is also an effective tool to assist in justifying the requested AFC-30 funding level for follow-on years.

c. AFC-45 funds are Naval Engineering and administered by the respective MLC for major maintenance and repairs as defined in the Naval Engineering Annex of the MLC Standard Operating Procedures. Cutter classes are allocated a Standard Support Level (SSL) each Fiscal Year. SSL is not intended to be distributed equally across the cutter class but is to be used to address the maintenance needs for specific platforms in that class, as the annual DD/DS cycles and corrective maintenance (Casrep) requirements dictate. Where only a few cutters of a class exist or where it is determined to be more economical, cutters may be combined with other platforms (at the discretion of the MLCs) to form a larger class of cutters to maximize the flexibility and stewardship of funds during the availability cycle. The SSL shall not be distributed or transferred outside the designated cutter class or mission area without the concurrence of the Area Operational Commander(s). It is important that we communicate with, understand and apply the priorities of the Operational Commander in accomplishing maintenance actions.

d. The CMP shall be used when determining financial responsibility to complete any given maintenance task.

2. Boat Program Requirements.

a. Preparation of Work Lists. As part of the overall maintenance program, each unit shall prepare periodic work lists showing each item scheduled for accomplishment during a specific period. The individual work lists should be prepared enough in advance to permit timely review, prioritization, and execution by the command.

b. Boat Financial Program. Funding for boat operation falls under AFC-30, 42, and 45. AFC-30 provides for fuel, outfit replenishment, maintenance, engine overhaul, annual availabilities, boat replacement and boat allowance changes. AFC-42 provides for electronic equipment maintenance. AFC-45 funds major Engineering Change Requests (ECR) and casualty repairs resulting from fire, grounding, or collisions. The CMP shall be used when determining financial responsibility to complete any given maintenance task.

H. CUTTER AND BOAT FUNDING ACCOUNTS AND RESPONSIBILITIES

1. AFC-45 Funding. G-SEN, MLCA, MLCP, and ELC administer AFC-45 funds for the maintenance, repair, and alteration of all Cutters and Boats or for specific Naval Engineering programs that provide support to the fleet as described in the Financial Resource Management Manual, COMDTINST M7l00.3 (Series).

2. AFC-45 Distribution. While the overall AFC-45 funding source is the same, funding is distributed from G-SEN to each administering office to carry out specific ECONOP roles and responsibilities. For this reason, the AFC-45 account is further divided into six separate accounts; Standard Support Levels (SSL), SEN Base, ELC Base, Logistics Support Level (LSL), Standard Boats, and Re-capitalization. These accounts and corresponding organizational responsibilities are summarized in the following table:

AFC-45 Account	**Organizational Responsibility**
SEN Base	G-SEN
SSL	MLC Atlantic & MLC Pacific
ELC Base	ELC
Re-capitalization (World of Work)	ELC
LSL (Inventory)	ELC
Standard Boats	ELC

3. SEN Base. This account funds Naval Engineering IT programs, one-time special projects, and specific conferences or meetings. Additionally, G-SEN may maintain a contingency fund for the Naval Engineering program.

4. Standard Support Levels (SSL). Each Maintenance Logistics Command (MLC) receives funding based upon an annual fixed level per cutter. Expenditure of this funding is utilized to perform intermediate and depot maintenance actions in accordance with the CMP, which are above the specific cutter funding limits. Additionally, funding is expended to address high priority repairs and material requirements in support of individual Casualty Reports (CASREP). The SSL shall not be distributed or transferred outside the designated cutter class or mission area without the concurrence of the Area Operational Commander(s). It is important that we communicate with, understand and apply the priorities of the Operational Commander in accomplishing maintenance actions.

5. ELC Base. The ELC manages many "overhead" or support programs that are required for the overall success of Naval Engineering Program. Support programs include items such as ML21 initiatives, Damage Control programs/projects, Integrated Logistics Reviews (ILR), Integrated Logistics Support Plan (ILSP) development/maintenance, Ship Service Machinery Evaluation Boards (SSMEB), authorized Tiger Team support, and Core Engineering services (i.e. Flooding Casualty Control Software (FCCS), cutter stability data and testing, Automated Flex Hose log system, and failure analysis).

6. Re-capitalization. The ELC receives funding to process Naval Engineering-prioritized Hull, Mechanical & Electrical (HM&E) Engineering Changes (EC) through the concept, validation, development, and deployment phases in accordance with the NEM, Chapter 41. Re-capitalization funding shall be a minimum of 10% of the Naval Engineering base budget.

7. HM&E Logistics Support Level (LSL). The ELC receives funding to support "free-issue" HM&E spare parts. The level of annual funding is determined using a demand-based forecasting model. Note: ELC also maintains "Pay as You Go" AFC-45 inventory accounts. These accounts are designed to be self-sustaining.

8. Standard Boats. AFC-45 for boats is an emergency fund for major casualties caused by storm, grounding, ice, explosion, fire, or collision as specified in the CG Financial Resource Management Manual (FRMM), COMDTINST M7l00.3 (Series). In addition, ELC retains some funds for completing Engineering Changes on Standard Boats. These funds are typically for engineering change projects exceeding $500 per boat; however, each individual Engineering Change contains the responsible funding source.

I. NAVAL ENGINEERING RE-CAPITALIZATION (AFC-45).

1. Re-capitalization Process. Because of the intense competition for the limited AFC-45 funds between fleet maintenance, program support, and the need for equipment replacement/ upgrades, the Naval Engineering community developed a re-capitalization process. This process was designed to appropriately fund Engineering Changes in order to produce the greatest return on investment, while maximizing equipment standardization, minimizing life cycle logistics support costs, and maintain required operational effectiveness. This only applies to the AFC-45 funded HM&E items proposed as Engineering Changes.

2. Re-capitalization/World of Work (WOW) List Development. In accordance with Chapter 90, MLC's develop a Top Ten Issues List for each cutter class. Engineering changes identified on the MLC Top Ten Lists are the foundation for the development of the WOW. MLC Type Desk Managers (TDM) and ELC Type Support Managers (TSM) jointly determine the ECR disposition regarding assignment to the Re-capitalization/WOW List. This list of Top Ten platform issues will be evaluated and scored against several factors including fleet need, program need, safety, risk, number of platforms affected, and cutter class SSL. The resulting ranking determines the priority of the ECR against all other fleet needs. WOW issues are scored and submitted to the Naval Engineering Maintenance & Logistics Working Group (NEMLWG) to compete for funding. Although all approved ECR's are forwarded to ELC and entered into DARTS, only funded WOW items are processed in accordance with Chapter 041. Non-funded ECR's will be managed by ELC for future WOW consideration. The following timeline will be utilized to develop and approve the Re-capitalization/ WOW List.

Date	Action
1 March	MLC's develop Top Ten Lists and create ECRs with ELC.
15 March	ELC Type Support Manager (TSM) creates DARTS case files and scores all ECR projects.

1 April	ELC 01A consolidates Re-capitalization/WOW List for presentation to the NEMLWG.
30 April	ELC TSMs develop EC Project Plans, as required.
31 May	NEMLWG prioritizes and forecasts funding for all EC projects.
1 August	Proposed Re-capitalization List published by NEMLWG/G-SEN.
1 October	ELC begins project plan execution.

3. Re-capitalization Program Management. The Re-capitalization/WOW List will be managed by ELC 01 in accordance with the following business rules:

   a. ECR's will follow the NEM Chapter 41 Platform Engineering Change process.

   b. ECR's will be scored, ranked, and reviewed for possible funding consideration by the NEMLWG in accordance with paragraph 2 above. Funding to support Platform EC project plans shall consist of resources to support engineering/logistical analysis, equipment/ILS (i.e. TM, special tools, OBRP, training, depot level inventory, technical data) acquisition, and platform installation/removal.

   c. Once funded, the Platform EC will remain on the Re-capitalization/WOW List until fully completed/installed or until cancelled by the NEMLWG.

   d. Once initially funded, platform EC's shall be completed normally within one dry dock cycle or less. An installation timeline will be established by the NEMLWG.

   e. Funding associated with Re-capitalization/WOW installations will be managed by the ELC.

J. AFC-30 CUTTER FINANCIAL PROGRAMS.

1. Cutters are responsible for budgeting and managing their AFC-30 funds to ensure they complete the required AFC-30 maintenance as called for in their Preventive Maintenance System (PMS) and the CMP/Naval Engineering Project List (NEPL). The effectiveness of a cutter's AFC-30 financial program directly affects their operational readiness and efficiency. As with the AFC-45 financial program, the principal policy document used to determine both funding (e.g. AFC-45 or AFC-30) and periodicity of all recurring maintenance and corrective maintenance (e.g. CSMP and CASREPs) is the CMP.

2. Purchase of storeroom spare parts in accordance with cutter's Management Information for Configuration and Allowances (MICA) is an AFC-30 expense. Failure to maintain the required spare parts can negatively impact operational effectiveness and be detrimental to the AFC-45 accounts.

K. **AFC-42 ELECTRONIC FINANCIAL PROGRAMS.** AFC-42 funds are managed in accordance with COMDTINST M10550 series.

L. **CONFIGURATION MANAGEMENT CONCERNS.** Regardless of whether an item is AFC-30 or AFC-45 funded, all cutters shall follow policy contained in Chapter 041 of the Naval Engineering Manual (NEM), COMDTINST M9000.6 (series) regarding changes to platform, equipment or system configuration.

M. **CONFIGURATION MANAGEMENT CONCERNS.** Regardless of whether an item is AFC-30 or AFC-45 funded, all cutters shall follow policy contained in Chapter 041 of the Naval Engineering Manual (NEM), COMDTINST M9000.6 (series) regarding changes to platform, equipment or system configuration.

1. Cutter Program Requirements. All OPFAC cutters 65 feet or longer are required to prepare and maintain maintenance and financial programs. The maintenance and financial programs must ensure that adequate maintenance and repair is accomplished to ensure all operational commitments can be met.

   a. As part of the overall maintenance program, each unit/cutter shall prepare periodic work lists showing each item scheduled for accomplishment during a specific period. The individual work lists should be prepared enough in advance to permit timely review, prioritization, and execution by the command.

   b. Future operational capability of every cutter is dependent on the financial planning of the current CO/OIC and lead engineer. The financial program referred to here is that portion of the unit's AFC-30 funding that is set aside for the accomplishment of PMS, repairs and planned improvements. Each department shall prepare an AFC-30 budget to provide for effective utilization of the cutter's AFC-30 funding. The AFC-30 budget is also an effective tool to assist in justifying the requested AFC-30 funding level for follow-on years.

   c. AFC-45 funds are managed by the Naval Engineering program and are allotted to the MLCs in the form of SSL funding (see 81.H.4). These funds are administered by the respective MLC for major maintenance and repairs as defined in the Naval Engineering Annex of the MLC Standard Operating Procedures.

   d. The CMP shall be used when determining financial responsibility to complete any given maintenance task.

2. Boat Program Requirements.

   a. Preparation of Work Lists. As part of the overall maintenance program, each unit shall prepare periodic work lists showing each item scheduled for accomplishment during a specific period. The individual work lists should be prepared enough in advance to permit timely review, prioritization, and execution by the command.

   b. Boat Financial Program. Funding for boat operation falls under AFC-30, 42, and 45. AFC-30 provides for fuel, outfit replenishment, maintenance, engine overhaul, annual availabilities, boat replacement and boat allowance changes. AFC-42 provides for electronic equipment maintenance. AFC-45 funds support major Engineering Change Requests (ECR) and casualty repairs resulting from fire, grounding, or collisions. The CMP shall be used when determining financial responsibility to complete any given maintenance task.

N. MAINTENANCE DAYS. Facility Managers (operational commanders) negotiate with maintenance managers the number of days each year set aside for maintenance. Table081-2, Maintenance Days, shall serve as a guide for the MLCs and operational commanders in planning maintenance. The table is divided into 7 columns: Class, Proposed Frequency and Duration of Dry-docks and Docksides Availabilities, Annual Maintenance and Repair (M&R) required and Required Maintenance Days Per Year. This table currently only addresses cutters. Maintenance requirements for standard boats have yet to be developed and will be included in a future revision to this manual.

1. Required Maintenance Days Per Year reflect the average number of days historically required in a year to accomplish preventive maintenance (PMS), corrective maintenance (CSMPs, CASREPs), and alterative maintenance (Engineering Changes). MLC's and operational commanders should schedule the specified number of maintenance days throughout a unit's yearly operational schedule. When operational necessity requires that fewer maintenance days be scheduled, the maintenance days scheduled in the succeeding year should be increased so that the 2-year average of maintenance days for that particular cutter adheres to the required average.
2. Maintenance and Repair (M&R) Days refers to the necessary time dedicated to maintenance and repair that is not part of a scheduled dry-dock or dockside availability (and that is not interrupted by operational sorties). M&R days listed are the average days per year required for maintenance (not including a dry-dock or dockside) over the dry-dock cycle for that class. During this period, it is assumed that 90 percent of qualified maintenance personnel are on board. Weekend days are included, but major holidays such as Christmas, New Year's Day, and Easter are not.

3. MLC's will coordinate with Area/District operation planners to schedule additional underway maintenance days to support condition-monitoring tasks that can only be accomplished underway. Note: Days are in addition to those listed in table 081-2.

4. Table 081-2 shall be used as a guide for providing operational scheduling flexibility between maintenance and repair, dockside availabilities, and dry-dock availabilities. Maintenance days for DS and DD availabilities shall be consecutive. The detailed implementation of operations/maintenance schedules shall be the responsibility of the MLCs and operational commander. Area/District operations planners are responsible for ensuring that sufficient maintenance time is scheduled between deployments. There must be frequent, free-flowing information between Areas/Districts and MLCs to ensure operational and maintenance needs are met. Operational commanders and MLCs may increase or decrease the intervals between dry-docking and annual availabilities as may be dictated by operational or maintenance needs. MLCs shall ensure all shipyard availability schedules are posted and maintained on their respective intranet web sites.

Table 081-2: MAINTENANCE DAYS

Cutter Class	DD Interval (yrs)	DS within DD (ea)	DD Period (wks)	DS Period (wks)	M&R Annual (wks)	Total Maint/Yr (days)
WAGB 420	3	1	12	12	15.9	172
WAGB 400	3	1	12	8	17.2	172
WAGB 290	4	2	8	8	13.6	142
WHEC 378	4	2	8	8	13.7	143
WIX 295	4	1	8	8	10.9	109
WMEC 283	4	1	8	8	17.9	158
WMEC 270	4	2	8	8	13.7	143
WMEC 230	4	1	8	8	17.9	158
WMEC 210	4	2	8	8	13.7	143
WLB 225*	4	3	10	8	10.2	126
WLB 180	4	2	8	6	16.3	154
WLM 175*	4	3	10	6	11.7	126
WLI 100	4	1	6	6	9.3	91
WLI 65	4	1	5	5	8.8	84
WLI 100 (Pac)	2	0	7	0	8.8	91
WLI 65 (Pac)	2	0	7	0	7.8	84
WYTL 65	3	0	6	0	6.6	65
WLIC	4	1	7	4	7.5	77
WLR	4	2	7	4	6.8	79
WTGB 140	4	1	7	5	14.3	126
WTGB 140 (w/Barge)	4	1	8	5	14.0	126
WPB 110	3	2	6	4	13.6	133
WPB 87	3	2	6	4	13.6	133
WPB 82	3	2	6	4	13.6	133

* For WLB 225 and WLM 175, the maintenance days per year were increased above the numbers published in the ORD. This is to allow for the accomplishment of the post delivery retrofit work. After the retrofit is accomplished, these numbers may be adjusted downward as needed.

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CHAPTER 083. SUPPLY SUPPORT

A. **DEFINITIONS.** The following supply support documents; Combined Allowances for Logistics, Maintenance and Support (CALMS), Boat Outfit and System Support (BOSS) and Electronics Repair Parts Allowance Lists (ERPAL) are being replaced by Management Information for Configuration and Allowances (MICA). MICA covers the Hull, Mechanical, Electrical, and Electronic systems for cutters, boats and shore side support units. The Coordinated Shipboard Allowance List (COSAL) will continue to be the ordnance systems allowance document for cutters. MICA and COSAL are both technical and supply documents prepared for an individual cutter/unit. They define equipment's nomenclature and operating characteristics and list technical manuals and drawings. Also, they identify spare parts, special tools and quantities recommended to operate and maintain the cutter/unit for a specified period of time. All of these supply support documents will be electronically provided with a unit's specific Configuration Management Plus (CMplus) database.

B. **RESPONSIBILITY.** Administration and maintenance of the supply support programs are under the cognizance of Commandant (G-S), and the Engineering Logistics Center (ELC). Refer to the Supply Policy and Procedures Manual (SPPM), COMDTINST M4400.19 (series) for directions and responsibilities within the programs.

C. **APPROPRIATIONS.** Operating Material and Supplies (OM&S) and inventory items managed and stocked by the ELC are procured with Supply Fund (SF) or Appropriations Purchase Account (APA) funds. SF items are issued and charged to the requisitioning unit; however, APA items are free issue. APA items are characterized by relatively high cost consumables, long lead production/delivery time, subject to design or configuration controls, mission critical, and repairable. Refer to the (SPPM), COMDTINST M4400.19 (series) for further guidance.

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CHAPTER 085. COAST GUARD NAVAL ENGINEERING DRAWINGS

A. INTRODUCTION.

1. The community of drawings is presently composed of four, somewhat overlapping, types of drawings.

   a. Engineering Drawings (naval, ordnance and electronic engineering).

   b. Technical Publication & Manual Drawings (naval, ordnance & electronic engineering).

   c. Provisioning Drawings (logistics and procurement).

   d. Diagrammatic Drawings and Sketches (unofficial)

2. While the content of this chapter will focus on engineering drawings, it is important to recognize that a large amount of technical information can be obtained from the drawings provided as part of the provisioning process and drawings associated with the configuration review and engineering change prototype process.

B. DEFINITIONS.

1. Platform. As used in this chapter, platform means cutter, vessel and/or standard boat.

2. Platform Class. Platform class refers to a group of cutters, vessels and/or standard boats belonging to a specific class (i.e. 110' "C" Class WPB {110C-WPB}, 225' "B" Class Ocean Going Buoy Tender {225B-WLB}, 41' UTB {41-UTB}, etc.).

3. Engineering Drawings. Engineering drawings describe hull, mechanical, electrical (HM&E), ordnance and electronic systems and equipment installed on Coast Guard platforms. In general, the drawings were prepared by the Coast Guard or a shipbuilder as part of the platform design and construction process and then delivered to the Coast Guard. Once delivered, they are retained for purposes such as reference documentation, design alterations and maintenance. When appropriate, the drawings are revised throughout the platform's life cycle to reflect configuration changes. As used in this chapter, engineering drawings include both selected record drawings and non-selected record drawings (see paragraphs 085-B.10 and 085-B.11). Engineering drawings can be further broken down into four types:

   a. Platform class drawings. Platform class drawings are official engineering drawings that contain information on hull, mechanical, electrical, ordnance and electronic systems and equipment installed on a specific platform class. Generally speaking, platform class drawings will reflect "class" configuration. However, certain drawings may reflect individual platform variations when the configuration varies from the platform class standard configuration. Drawings that reflect individual platform variations shall be annotated to reflect the specific hull(s) the drawing applies to.

b. Fleet Drawings. These are official Coast Guard drawings that apply to more than one platform class. To avoid the high costs and labor intense practice of updating multiple platform class drawings, fleet drawings should be used when the drawing applies to more than one platform class unless local circumstances or other factors make their use impractical or specific class drawings exist.

c. Contract and Contract Guidance Drawing. Contract and contract guidance drawings are used in contract packages for new construction and major modifications to guide the contractor in developing the detail design. Once the detail design is completed and the platform constructed a new set of "as-built" engineering drawings becomes the accurate reflection of the details of the platform class.

d. Procurement, Equipment, Parts and Materials Lists. Under certain conditions, independent lists are generated separately from a drawing. Examples of these lists include:

   (1) Bill of Materials (BMs): A list of materials associated with a drawing.

   (2) Equipment List (EL): A list of equipment associated with a platform.

   (3) Parts List (PL): A list of parts associated with an equipment and/or system on a platform.

   (4) Procurement List (PR): Contains a list of item to be procured associated with the construction of or modification to a platform.

4. <u>Technical Publication and Manual Drawings</u>. These are drawings contained in technical publications and manuals and are generally constructed to a different, less stringent requirement than those for engineering drawings. However, in some cases a drawing in a manual or technical publication may be a part of or a reduced version of an engineering drawing. While this chapter will address updates to the drawings contained in technical publications and manuals, it is important to note that these drawings and sketches are not considered part of the engineering drawing set. However, if someone feels that a drawing provided in a technical publication or manual should be an engineering drawing, they should suggest this to ELC (05T).

5. <u>Provisioning Drawings (Logistics and Procurement)</u>. The Coast Guard receives a large body of information in many different forms to aid them in making provisioning determinations. This information is sometimes in the form of drawings, which must meet the requirements of MILT-31000. The Coast Guard then uses the information to provision a platform and build allowance documents. The drawing information provided as part of this process will sometimes be the same as or similar to the information contained in the engineering, technical publication and manual drawings.

However, in some cases these drawings will contain data not duplicated in other places. The requirements for this type of drawing are spelled out in Provisioning Manual For Major Systems Acquisitions, COMDTINST M4423.2 (series).

6. Diagrammatic Drawings and Sketches. Diagrammatic drawings and sketches are associated with the configuration review and engineering change prototype process. The drawings are "unofficial" drawings used to provide guidance only and are generally converted to "official" engineering drawings after the configuration review and change prototype process has been completed and the engineering change approved. This type of drawing will usually become part of the engineering drawing set or revise an existing engineering drawing, and should be developed in AutoCAD format IAW Naval Engineering, Automated Computer Aided Design Standards, COMDTINST M9085.1 (series).

7. Original Drawing. As used in this chapter, an original drawing is a drawing printed on mylar or vellum. The drawing serves as the "official" drawing of record. An authorized approving official must sign all original drawings. All original drawings will be managed by and stored at the ELC (05T), unless checked out for authorized revision.

8. Reproducible Copy. As used in this chapter, a reproducible drawing is a drawing contained on a reproducible media such as vellum or paper. Reproducible drawings shall not be printed on mylar or velum, only original drawings shall be printed on this material. Revision. A formal change to an existing engineering drawing. All revisions to an engineering drawing must be documented in the revision block of the drawing.

9. Selected Record Drawings. Certain engineering drawings contain important life cycle and configuration management information. These drawings are classified as selected record drawings (SRDs) and are required to be maintained up-to-date (revised) throughout the platform's service life. Drawing users are warned that even selected record drawings may not be 100 percent accurate. Accordingly, users should verify the accuracy of referenced drawings, especially if a drawing is used for contractual purposes, to avoid claims for faulty government furnished information (GFI).

10. Non-selected Record Drawings. All remaining drawings, which generally depict details of platform construction, but are not necessarily required to be kept up-to-date. The drawings are retained on file for informational purposes.

11. Dual Title Drawings. Vendor or other third party drawings that are converted to Coast Guard drawings and given a Coast Guard title block, effectively becoming a dual title drawing. However, the drawing shall be marked IAW paragraph 085-G.1.d to indicate that the Coast Guard is the current owner of record.

12. As-Built Drawings. Engineering drawings that reflect the as-built condition of a platform or group of platforms belonging to the same class (platform class drawings) or to several classes of platforms (fleet drawings).

13. Plan-Set (Number). All platform class drawings are assigned a specific plan-set number (i.e. 110-WPB, 110B-WPB, 400-WAGL, etc.). The plan-set number is incorporated into the drawing number (see paragraph 085-G.2) and identifies the platform class that the drawing pertains to. All fleet drawings are assigned to the plan-set number "FL."

C. GENERAL.

1. Drawing preparation and maintenance is very time consuming and expensive. Whenever possible, the number of engineering drawings should be kept to a minimum. This can be accomplished by applying one drawing to several platforms in the same class versus developing a drawing for each platform, or using fleet drawings when the same system or equipment is used across several platform classes.

2. To avoid the high cost of multiple drawing productions, a drawing can apply to several classes or sub-classes of platforms. If a drawing applies to more than one "class" of platforms, it shall be assigned a fleet drawing number. If a drawings is created that applies to more than one "sub-class" (i.e. 110 A, B and C class WPBs), a drawing number from the first plan-set issued within the platform sub-class (i.e. 110A WPB) shall be assigned. A drawing applicable to more than one platform class or sub-class shall clearly indicate to which classes, sub-classes, or specific platforms the drawing applies to on sheet 1 of the drawing. If necessary, consult with ELC (05T) for additional guidance.

3. All drafting work on drawings, whether done by AutoCAD or hand, shall be of such quality that reproduction/blow-backs can be made with suitable results.

D. MANAGEMENT OF ENGINEERING DRAWINGS FOR COAST GUARD PLATFORMS.

ELC (05T) is the sole authority for managing engineering drawings.

1. All original engineering drawings (both hard copy and AutoCAD) shall be retained on file at the ELC (02T) unless officially checked-out for revision.

2. Engineering drawings shall only be released to those commands with revision and signature authority as listed in Table 085-1. Original engineering drawings shall not be released to other parties unless specifically authorized by ELC (05T).

3. All engineering drawings will be checked out for revision through the Naval Engineering Technical Information Management System (NE-TIMS). Those drawings that exist in electronic format (i.e., AutoCAD) may be downloaded directly from NE-TIMS. For drawings that exist only in hard copy format, the original sheets must be requested from ELC (05T) after being checked out through NE-TIMS

4. The responsibility for revising or creating new engineering drawings rests with the program or command sponsoring the engineering change, modification, structural change, material upgrade or installation of a new system or equipment.

5. All affected selected record drawings shall be updated to reflect the current configuration.

6. All new drawings or existing drawings requiring extensive revision shall be completed IAW Naval Engineering, Automated Computer Aided Design Standards, COMDTINST M9085.1 (series).

7. All engineering drawings shall contain a number assigned by ELC (05T) in the appropriate section of the title block.

8. All requests for drawing numbers shall be directed to ELC (05T). When requesting a drawing number, the requester should include the complete drawing title, drawing plan-set, SWBS number, number and size of sheets and the name/organization of the requester in the request.

9. Indexes of all engineering drawings are maintained in an electronic database by ELC (05T). Copies of applicable indexes may be requested from ELC (05T).

10. Newly created drawings and revisions to existing drawings require the signature of a designated authority to become part of the official record. Signature authorities for new and revised drawings are listed in Table 085-1.

11. For new drawings, signature approval on sheet 1 of a multi-sheet drawing constitutes approval of all sheets of that drawing. Approval signatures are not required on subsequent sheets of the same drawing.

12. When a drawing revision is approved, the approval authority shall initial and date the revision block. The approval signature in the revision block on sheet 1 constitutes approval of all portions of that revision. In addition, the name and activity of the approving official shall be printed below the initials.

13. Unsigned drawings and revisions will not be accepted by ELC (05T).

14. For AutoCAD produced new and revised drawings, printed names (i.e. text) with the suffix designator "/s/" shall be substituted for drawing approval signatures.

15. Once approved, all new and revised drawings shall be submitted to ELC (05T) for format review and inclusion in the Naval Engineering Technical Information Management System. All revised drawings shall be checked in through NE-TIMS. Revised electronic drawing files can be uploaded directly to NE-TIMS, while revised original sheets of hard copy drawings must be sent to ELC (05T) after being checked in through NE-TIMS. Because electronic drawings require strict inventory management to prevent unauthorized revision, once an electronic drawing file has been submitted to ELC (05T) it shall be removed from all local hard drives.

TABLE 085-1 DRAWING REVISION AND SIGNATURE AUTHORITY

DRAWING TYPE	Original Issue Authority	Revision Issue Authority
Contract & Contract Guidance Drawings	Chief, Office Of Naval Engineering (G-SEN)	Chief, Office Of Naval Engineering (G-SEN)
All Others	Engineering Logistics Center, MLCs (v/t), Commanding Officer CG Yard, TISCOM, Deepwater SIPO, C2CEN or Project Resident Office. See Note 1.	Engineering Logistics Center, MLCs (v/t), Commanding Officer CG Yard, TISCOM, Deepwater SIPO, C2CEN or Project Resident Office. See Note 1.

NOTE: For the ELC, signature authority is the Branch Chief of the cognizant Equipment Management Branch. For operational and support units, signature authority is the cognizant MLC (v/t), Commanding Officer CG YARD, TISCOM, Deepwater SIPO, C2CEN or Project Resident Office.

E. DRAWING DISTRIBUTION.

1. Original Drawings. All original engineering drawings (hard copy and AutoCAD files) shall be retained on file at ELC (05T) unless officially checked-out for revision.

2. Reproducible Drawings. The ELC will provide each MLC with a reproducible copy of all new and revised drawings.

3. Aperture Cards. Aperture cards are now only used for historical purposes and all drawings will be distributed on CD-ROM.

4. CD-ROMs. Engineering drawings will be distributed by ELC (05T) in electronic form on CD-ROMs for viewing on SWS-III. ELC (02T) will provide each platform, 65' or greater in length, MLCs, CG YARD and NESUs with CD-ROMs. Upon request, MLCs will be provided with sufficient CD-ROMs for further distribution to industrial support facilities, groups and stations for vessels less than 65' in length. Once received, all units shall be responsible for maintaining the appropriate CD-ROM set(s).

5. Naval Engineering - Technical Information Management System (NE-TIMS). All units with SWS-III and access to the Coast Guard Intranet (CGDN+) will be provided

with access to the NE-TIMS database via the Intranet. Access to the database will provide operational and support unit's real-time access to engineering drawings.

F. **SELECTED RECORD AND NON-SELECTED RECORD ENGINEERING DRAWINGS.** Some engineering drawings depict general features of the platform which remain important over the platform's service life while other drawings show particular areas in the large amount of detail needed only for design, construction and fabrication purposes. Accordingly, only a relatively small part of the design and construction produced engineering drawings need to be kept up-to-date to satisfy engineering program functional needs throughout the platform's life-cycle.

1. Non-Selected Record Drawings. Non-selected record drawings (NSRDs) normally do not serve an important function; therefore, no attempt should be made to keep them current. In some cases, NSRDs are consulted for certain data and thus are retained on file. If for any reason, it becomes necessary to revise a non-selected record drawing, the drawing shall be revised in accordance with the standard drawing revision practices outlined in this chapter.

2. Selected Record Drawings. Selected record drawings (SRDs) are needed for normal engineering program execution purposes and thus must be kept current. As a minimum, the following types of selected record drawings shall be maintained current:

   a. All Standard Boat Drawings. Due to stringent configuration control requirements, all drawings for standard small boats are considered selected record drawings and shall be kept up-to-date.

   b. Booklet of General Plans. This is a collection of especially useful drawings, bound together for user convenience and assigned a separate USCG drawing number. The booklet of general plans usually includes: 1) Outboard profile, 2) Inboard profile, 3) Deck, platform and level arrangements, and 4) Typical structural sections. To avoid duplication of effort, if a plan-set contains a booklet of general plans and the same drawings are duplicated but carrying separate drawing numbers, only the booklet of general plans will be kept up-to-date.

   c. Docking Plans.

   d. Piping and HVAC Diagrams. Manufacturer makes and model number data that might be shown on diagrams will not be updated.

   e. One-Line Electrical Drawings.

   f. Propulsion Shafting Arrangement Drawings. This includes all general arrangement, shaft, shaft bearing, strut, seals and support structures and the table of bearing reactions and influence numbers.

   g. Underwater Body Appendage Drawings. Such as rudder, rudder stock, bow propeller, fin stabilizer, bow thruster, sonar dome, strut bearing, grid coolers, etc.

h. Structural Drawings. Including drawings (such as watertight hatch drawings), which depict features of watertight integrity.

i. Mast Arrangement Drawings.

j. Shell Expansion Drawings.

k. Weight Handling System Drawings. Such as boat handling arrangements, boom/crane arrangements, rigging for integrated tow, spud/spud well arrangements, etc.

l. Navigation Light Arrangement and Details.

m. Antenna Arrangement Drawings. Sometimes included as part of outboard profile drawings.

n. Ordnance Benchmark Drawings.

o. Tank Capacity Tables.

p. Machinery Arrangement Drawings. Normally included in the booklet of general plans.

q. Propulsion and Electric Plant Control System Diagrams.

r. Fueling-At-Sea Arrangement Drawings.

s. Draft Marks Drawings.

t. Compartment Air Testing Diagrams.

u. Stability and Loading Data Book, Inclining Experiment Reports and other stability-related documents.

v. All Fleet Drawings.

w. Visual ID. Sometimes shown on outboard profile drawings.

x. Curves Of Form Drawings.

y. Steering Gear Arrangement Drawings.

z. Interior Communication (IC) Block/Elementary Wiring Diagrams.

aa. Flight Deck Marking Drawings.

bb. Propeller and Propulsor Drawings.

G. DRAWING TITLE BLOCKS AND NUMBERING SYSTEM.

1. Coast Guard Title Blocks.

   a. Coast Guard title blocks are required on all engineering drawings with the exception of the cases noted below:

      (1) Coast Guard drawing numbers and title blocks are not typically required on vendor standard drawings and similar drawings not specifically prepared for Coast Guard use. However, Coast Guard drawing numbers and title blocks must be applied to such drawings or a package of such drawings in order to make them part of the official record.

      (2) Coast Guard drawing numbers and title blocks may be assigned to vendor drawings or similar third party drawings by creation of a cover drawing sheet with an index of attached (related) drawings, or by creation of a dual title drawing (see 085-G.1.d).

      (3) Under certain situations, with ELC (05T) approval, a Coast Guard drawing number may be assigned to a drawing without a Coast Guard title block (i.e. Platforms with related drawing received from the Navy). If a Coast Guard number is assigned to a drawing without a Coast Guard title block, it shall be obvious to the drawing reader that the Coast Guard is responsible for the drawing content.

   b. Drawing title blocks shall follow ASME/ANSI Y14.1 or Y14.lM documentation format practices, with the following exceptions and specific requirements:

      (1) Block A. Activity. "UNITED STATES COAST GUARD" shall be in the upper left corner, "WASHINGTON, D.C. 20593" shall be in the upper right corner, and "OFFICE OF NAVAL ENGINEERING" shall be centered on the second line in a larger type face.

      (2) Block B. The Drawing Title; This block and the overall height of the title block shall be increased in height to accommodate four separate lines of drawing title text.

      (3) Block C. Drawing Number; The length of this block shall be increased to accommodate a Coast Guard drawing number of eighteen alpha/numeric characters.

      (4) Block D. CAGE Code; This block shall read "81340"

   c. Questions concerning Coast Guard drawing numbers and title blocks, including use and need, should be referred to ELC (05T).

   d. Under certain conditions it may be beneficial to add a Coast Guard title block to an existing third party drawing. To add a title block to an existing drawing, the drawing shall be extended ahead of the existing drawing title block and number to add the Coast Guard title block and number and to create a dual title drawing.

(1) The new drawing panel shall include a Coast Guard title block, a single Coast Guard signature approval block, and a revision block. The original drawing title block shall be hashed out to indicate that it is no longer applicable, but it shall remain legible. The revision block shall note the appropriate revision level and words "ADDED USCG TITLE BLOCK AND DRAWING NO.", plus an explanation of the reason and/or authority for doing so.

(2) The appropriate approving official shall sign the signature block.

2. Drawing Numbering System.

a. Coast Guard drawing numbers must be a prominent part of the Coast Guard drawing title block.

b. Drawing numbers shall be structured as follows:

Plan-set Number Consisting of:				
Platform Length	Platform Sub-Class	Vessel Class	Ship Work Breakdown Structure (SWBS)	Serial Number
110	A	WPB	521	001
	Drawing Number: 110A-WPB-521-001			

NOTE: The plan-set number (Platform Length, Platform Sub-Class and Vessel Class) for new platform classes or platforms undergoing major renovation shall be assigned by ELC (05T).

H. ELECTRONIC (AutoCAD) FILE LABELING CONVENTION.

1. There are several entities needed to uniquely define and identify electronic (AutoCAD) files. In addition, strict file labeling convention must be used to allow drawings to be entered into storage and management databases such as the Naval Engineering - Technical Information Management System (NE-TIMS).

2. All electronic AutoCAD files shall be labeled as follows:

   a. Engineering Drawings. Each sheet of engineering shall be placed in a separate electronic file. Each electronic file shall be labeled with six unique entities, each separated with an underscore:

   <Plan-set>_<SWBS>_<Serial>_<Sheet>_<Insert Sheet>_<Revision>.dwg

Examples

DRAWING NUMBER	ELECTRONIC FILE NAME
378-FRAM-E-0243-002, Sheet 5A, Rev. D	378-FRAM-E_243_2_5_A_D.dwg
76-TE-9811-001, Sheet 5, Rev. -	76-TE_9811_1_5_-_-.dwg

   Note 1: All fields are mandatory.

   Note 2: If the sheet is not an insert sheet, use dash in the insert sheet field.

   Note 3: Use dashes in the revision field to indicate an original, non-revised sheet.

   Note 4: Do not use leading zeros in any field (i.e. SWBS 0243 = 243).

   Note 5: .dwg indicates file extension (type).

   b. Procurement, Equipment, Parts and Materials Lists. Each sheet of this type of drawing shall be placed in a separate electronic file. Each electronic file shall be labeled with five unique entities, each separated with an underscore:

   <Plan-set>_<PR/BM/PL/EL-Number>_<Sheet>_<Insert Sheet>_<Revision>.dwg

Examples

DRAWING NUMBER	ELECTRONIC FILE NAME
378-FRAM-E, BM-004, Sheet 5, Rev. A	378-FRAM-E_BM-004_5_-_A.dwg
76-TE, EL-750, Sheet 3A, Rev. -	76-TE_EL-750_3_A_-.dwg

Note 1: All fields are mandatory.

Note 2: If the sheet is not an insert sheet, use dashes in the insert sheet field.

Note 3: Use dashes in the revision field to indicate an original, non-revised sheet.

Note 4: Do not use leading zeros in any field (i.e. SWBS 0243 = 243).

Note 5: .dwg indicates file extension (type).

I. NEW DRAWING PREPARATION.

1. New drawings should be created (with a new drawing number) when the data to be presented involves an entirely new system, equipment or cannot otherwise be appropriately integrated (by revision or by suppression) into the existing drawing.

2. New drawings shall be prepared in accordance with Naval Engineering, Automated Computer Aided Design Standards Manual, COMDTINST M9085.1 (series). It includes diagrams and figures of drawing format requirements. The technical point of contact for Naval Engineering Automated Computer Aided Design Standards Manual, COMDTINST M9085.1 (series) is ELC (05T). Drawing format shall follow ASME/ANSI Y14.1 or Y14.1M documentation format practices.

J. DRAWING REVISIONS.

1. Standard Revision Practices. The following standard drawing revision practices shall be observed. These practices are generally in accordance with MIL-T-31000 Technical Data Packages, General Specifications and DOD-STD-l00. Additional information may be found in those documents or commercially prepared compilations of those documents for industry use. For specific questions and assistance, contact ELC (05T).

   a. Drawings should be revised if the extents of drawing changes are minor and the old data can be easily retained as explained in 085-J.1.c. Adding additional sheets to a drawing (see 085-J.1.e) applies here.

   b. Revise Original Engineering Drawings Only. Only original engineering drawings shall be revised. Revising a re-producible copy results in the generation of a duplicate drawing and leads to endless confusion. If it becomes necessary to prepare a draft revision on a duplicate drawing, the drawings shall be clearly marked in large letters "UNOFFICIAL DRAWING: FOR DRAFT REVISION PURPOSES ONLY" immediately adjacent to the title block.

   c. Retaining Historical Data. Revisions shall be prepared retaining as much of the previously shown data as possible. Ideally, it should be possible to reconstruct the previous version of the drawing simply by undoing the changes described in the revision column. Thus the revision column itself should detail every change made, using wording that describes the change as accurately as possible, such as "ADDED DETAIL 9-F", "DELETED REF 16", or "RV-7 SET PRESS WAS 60 PSI". Note in the last case that it would be redundant to say "CHANGED RV-7 SET PRESS FROM 60 TO 75 PSI", because the body of the drawing already shows the set pressure as 75 PSI. Data should be hashed-out (not erased, unless the revision column will document the previous data) and redrawn in another place. It is important to retain the previously shown data because it may be years before an engineering change is actually accomplished aboard a platform, and the operational and maintenance commands must have information that depicts their actual platform configuration in the interim.

d. Give Reason for Revision. The revision column should begin by documenting the reason for the revision, such as "TO SUIT ENGINEERING CHANGE (number if known) TO REPLACE BEARING MATERIAL XXX".

e. Add Additional Sheets. An effective way to revise a drawing is to add new sheet(s). This approach is especially effective when large portions of a drawing must be re-drawn. The old portions are simply hashed out, and the new sheet(s) can then be drawn in AutoCAD. This approach also retains the old data for historical purposes.

f. Show Revision Status.

(1) On drawings that consist of more than one sheet, it is common practice for each sheet to carry its own revision designator (i.e. all sheets of the drawing do not necessarily carry the same revision), so that only the affected sheets need to be issued when revised, not all the sheets. Sheet one of all drawings will always contain the highest revision character of the drawing as well as any subsequent sheets that contain a revision block, while each remaining sheet carries the revision character associated with the last revision that happened to affect that particular sheet. The revision character on any sheet (except sheet one and subsequent sheets containing revision blocks) can therefore skip letters, such as from D to G.

(2) Accordingly, the first sheet of a multi-sheet drawing shall have a revision status table, which shall indicate the revision character of each sheet of the drawing. A revision status table shall be added if needed to all multi-sheet drawings whenever the drawing is revised for other reasons. With each revision to any part of the drawing, the revision status of sheet 1 and any subsequent sheets that contain a revision block shall be updated to the next sequential letter. Likewise, the revision character of each affected sheet shall be updated to the same character as sheet 1, and finally the revision status table shall be updated. The revision character of unaffected sheets shall not be changed.

(3) The revision designator for a drawing shall be identified by an upper case letter or letters. “A”, the second revision by “B”, and so forth, shall identify the first revision. Successive changes shall use the next sequential letter, except that the letters "I", "O", "Q", "S", "X", and "Z" shall not be used. Upon exhaustion of the alphabet, the next sequential revisions shall be "AA", "AB", etc., and then "BA", "BB", etc.

(4) Where numbers have been used instead of letters for revision designators, the use of numbers shall be continued.

g. Revision Block.

(1). All revision notes for a multi-sheet drawing shall be placed in one revision block or column, beginning on sheet 1 and continuing to other sheet(s) as needed for space. In addition to revision details, the revision note shall identify the sheet number and applicable panel. However, if existing revisions to a drawing have been noted on the individual sheets that practice may continue as long as a bold print note on sheet 1 identifies that "REVISION NOTES ARE DETAILED ON INDIVIDUAL SHEETS". This latter practice shall not be used for revisions to new or previously un-revised drawings.

(2) A triangular revision symbol or identifier shall be placed adjacent to all revised areas, except where the entire sheet has been added by revision. The triangular symbol shall contain the appropriate revision character. Where multiple items are being revised under the same revision, each item or group of items shall be identified with a superscript number outside the revision symbol that relates to the revision notes in the revision block.

2. Multi-Cutter Drawing Applicability. Drawings applicable to more than a single platform may be revised only if changes made do not result in the loss of information describing other platforms. Drawings may include alternative details applicable to different platforms if the applicability is clearly indicated and no alternative detail applicable to any other platform is erased or crossed out.

K. REVISION PROCEDURES FOR SPECIAL SITUATIONS.

1. Revision Of Drawings Associated With Engineering Changes (Ship/Boat).

a. The question of when to revise an engineering drawing frequently arises during the course of platform Engineering Change development. Changes are occasionally not approved as originally conceived. Thus, if the engineering drawing has been extensively revised before the change is disapproved or redirected, "un-revising" the engineering drawing to its original form is extremely difficult. For this reason, engineering drawings shall not be revised for prototyping purposes.

b. Accordingly, an engineering drawing shall not be revised until a Configuration Control Board (CCB) has reviewed and approved the change. If a CCB has not been held, or is not planned to be held, ELC (05T), in concert with Commandant (G-SEN) as appropriate, must give approval before starting to revise an engineering drawing.

(1) Engineering Changes. In general, drawings issued with or referenced by changes will be the minimum necessary to effect the modifications. In some cases, a sketch included in the change package may be all that is required. If SRDs are affected by the change, then the drawings shall normally be revised to suit by the time the change is issued. If a drawing showing details of the modification is needed for proper change execution, then revision of the applicable detailed drawing will be accomplished by the time the engineering change is issued. Unless specifically called for in the change, no additional drawing revisions shall be made at the time of change accomplishment.

(2) Engineering Changes for standard boats. Because it is intended that all standard boat drawings be kept up-to-date, all drawings affected by an engineering change will be revised before the change is issued.

c. In most cases, a diagrammatic drawing or sketch, per paragraph 085-B.6 should be made with red pencil on a print for checking purposes before proceeding with the revision to the master tracing. Using AutoCAD for DRAFT prototype design purposes is acceptable. Any DRAFT revision drawing should have a suitable note added, per paragraph 085-J.l.b.

2. Master Drawing Not Yet Available. This situation arises for example when master engineering drawings have not yet been received from the shipbuilder, and changes need to be made to certain systems.

a. A new engineering drawing for each appropriate drawing shall be created for the purpose of documenting needed changes. The new drawing will be created in the appropriate SWBS and assigned a number that does not duplicate numbers issued to the contractor(s). This new master engineering drawing will be retained by ELC (05T) and will be available for depicting various changes until the complete master engineering drawings are received from the shipyard.

b. The title of the new master engineering drawing shall reflect the appropriate title to incorporate the changes.

c. This master engineering drawing shall be used to depict the needed changes in the most practical manner, by recreating only as much of the (absent) system drawing as necessary to understand the modification(s) that is to be made.

L. SUPERCEDING A DRAWING.

1. Drawings should be superseded if extensive revisions are required or if the quality of the existing original engineering drawing is poor (torn, faded, smeared, etc.). If a drawing is superseded, the following steps shall be followed:

a. The title block of the superseded (old) engineering drawing shall be hashed out and the following statement entered in bold characters near the drawings title block "THIS DRAWING IS SUPERSEDED BY USCG DWG (S) YYY."

b. The new (superseding) engineering drawing shall carry a new USCG drawing number as assigned by ELC (05T). The superseded drawing title, approval names (text format) and approval dates shall be carried over to the new drawing. The new drawing shall be a "clean" drawing; i.e. revision symbols, cross-outs, and the revision block from the old superseded drawing shall not be reconstructed on the new drawing. The following statement entered in bold characters shall be placed immediately adjacent to the title block "THIS DRAWING SUPERSEDES USCG DWG XXX." The original issue of this drawing shall be REV "-", and the revision column shall be annotated as follows "THIS DRAWING WAS CREATED BECAUSE (give reason)." If redrawn with substantive change from what was shown on the superseded drawing, describe the changes and the reason for the changes in the revision column as per normal revision practices. The new drawing's revision block shall be signed in accordance with paragraph 085-D.12.

c. The superseded drawing, with the title block hashed out and superseded statement entered next to the title block, shall be returned to ELC (05T) and retained in the active file and in the drawing index for the affected platform(s) for historical information purposes.

M. <u>CANCELING A DRAWING</u>. If a drawing no longer contains useful or applicable information, such as an entire system being removed from a platform, the drawing shall be cancelled. Hash mark out the title block and place the following bold face note immediately adjacent to the title block "THIS DRAWING HAS BEEN CANCELLED." Give the reason for the drawing cancellation in the revision column. The cancelled drawing, with the title block hashed out and cancellation statement entered next to the title block, shall be returned to ELC (05T) and retained in the active file and in the drawing index for the affected platform(s) for historical information purposes.

N. <u>TECHNICAL PUBLICATION DRAWINGS</u>.

1. Drawings in technical publications may require revision after accomplishment of engineering changes to reflect the updated system configuration. Drawings are revised and new prints issued to technical publication holders by technical publication amendments.

2. Revisions to technical publication drawings that have an assigned Coast Guard drawing number are accomplished by revising the engineering drawing located in ELC (05T) and republishing the revised drawing(s) as an amendment to the technical publication.

3. Revisions to technical publication drawings that do not have an assigned Coast Guard drawing number shall be accomplished as follows:

a. Changes that are "moderate to major" in nature require that an engineering drawing be created. This drawing can be prepared by: 1) photographic production of a mylar or a suitable print or, 2) production of an electronic copy of the drawing by digital scanning or digitizing to AutoCAD, revising as required, and plotting the new engineering drawing. The new drawing shall contain the original manufacturer's title block, revision block, notes and list of references. The new engineering drawing shall also be given a standard Coast Guard title block and a new revision block for documentation of Coast Guard revisions. These drawings shall be assigned a Coast Guard drawing number and become a part of the engineering drawing file.

b. Changes that are "minor" in nature can normally be accomplished without creating a new engineering drawing. In such cases, make pen-and-ink changes to the drawing contained in the master technical publication and document these changes in the revision block.

CHAPTER 086. TECHNICAL PUBLICATIONS

A. **NAVAL ENGINEERING TECHNICAL PUBLICATIONS. ELC (05T)** is the sole authority for promulgating Naval Engineering Technical Publications (TPs) and issuing amendments that apply to them. ELC (05T) maintains a "Master Library" of all TPs. These publications provide technical information and data concerning certain cutters and boats and the equipment that is installed on board them.

1. Publication Listing and Index. The Engineering Information Data Base (EIDB) is no longer active. In its place, the Naval Engineering Technical Information Management System is now maintained by ELC-05T. Use http://1038.16.120:1088/NE-Tims?index.html to access Technical Publication information. This database allows the user to create a report of current TPs and their amendments by vessel plan set. It includes the proper ACN necessary to order TPs and amendments from the stock system. Obsolete Technical Publications will not appear in the listing.

2. Publication Distribution and Ordering. ELC (05T) determines the distribution of TPs when assigning TP numbers. All commands may contact ELC (05T) for the addition to or removal from distribution. TPs that are not stored at the ELC warehouse will not be issued stock numbers. TPs without stock numbers may be downloaded directly from NE-TIMS or from the CD Roms furnished by ELC 05T annually. TPs with assigned stock numbers may still order TPs and amendments using the MIL-STRIP requisitioning system and the routing identifier ZNC.

3. Publication Issuance. ELC (05T) assigns numbers to Technical Publications and will determine which equipment or systems are included. Initial TP proposals shall be forwarded to ELC (05T) for approval, promulgation, and compilation into final format, printing and distribution. Proposals submitted by Coast Guard commands, shipbuilding facilities and equipment manufacturers, under contract to the Coast Guard, will be reviewed by ELC (05T).

4. Change Proposals. Recommended changes to existing TPs shall be submitted to ELC (05T), via the appropriate MLC, for review and approval by the appropriate branch of the Equipment Management Division (02). Changes to the equipment and to parts, provided by equipment manufacturers and vendors in the format of bulletins, notices, and information data, will be sought out, identified and reviewed at ELC (02) to determine its applicability to the Coast Guard fleet, and forwarded, as appropriate, to 05T to implement.

5. Amendments to Technical Publications. In conjunction with ELC (05T), ELC (02) will review the circumstances and determine if an amendment to a Technical Publication should be issued, whenever a requirement exists to:

   a. Change the physical characteristics or composition of any piece of equipment.

b. Alter the operational characteristics or procedures for any equipment.

c. Change the parts or part numbers of any equipment component in sufficient detail to require proper review and evaluation by ELC (02T).

d. ELC (05T) will issue Technical Publication Amendments when indicated by ELC (02). Such amendments will be entitled “Coast Guard Amendment Number__.” Amendments shall be issued in a consecutively numbered series for each Technical Publication. Each amendment will be assigned a unique stock number, separate from the stock number of the original TP.

B. **NAVAL ENGINEERING JOB AIDS**. Job Aids encompass a range of technical information that does not easily fit into a standard technical publication. These include videotapes that outline specific maintenance procedures and Electronic Performance Support Systems (EPSS) which provide information on a particular duty, system or procedure. Job aids will be referenced in preventive maintenance manuals and/or technical publications to which they pertain. Because Job Aids are maintained at various locations throughout the Coast Guard and the Coast Guard Intranet, a consolidated listing of all Job Aids will be kept in the Naval Engineering Technical Information Management System (NE_TIMS). This listing will provide users with information on where and how to obtain a copy of a specific Job Aid.

CHAPTER 088. PERSONNEL

A. <u>NAVAL ENGINEERING SHORE-BASED SUPPORT TEAMS</u>. In recent years, changes in mission profiles, increased tempo of operations, and reduced cutter manning levels have occurred. As a result, it has become increasingly difficult to achieve adequate shipboard HM&E and ordnance maintenance and training. To improve the overall reliability of the Coast Guard fleet and provide enough technical expertise and flexibility to adequately support Coast Guard unique systems and equipment as well as Navy-owned ordnance, four types of naval engineering augmentation and support teams have been established. These teams are: the Maintenance Augmentation Team (MAT), the Advanced Ship System Instruction and Support Team (ASSIST), Centralized Supply/CMplus Assistance Team, and the Weapons Augmentation Team (WAT).

1. <u>Maintenance Augmentation Teams (MAT)</u>.

    a. <u>Purpose</u>. A MAT is a group of engineering technicians assigned to a NESU for a chartered or group of chartered, customer cutters. A chartered cutter is one that has been designated by COMDT (G-SEN) as a cutter that will be supported by a MAT. The sole purpose of the MAT is to augment shipboard engineering personnel in the accomplishment of routine HM&E preventive and corrective maintenance. Because MATs are an integral part of chartered cutters' organizational maintenance effort, each MAT must be included in the mobility planning of the cutters it supports. This is especially true for cutters that will not receive additional Navy maintenance resources in time of national emergency or mobilization. The program will not achieve its objectives unless the full resources of MATs are used for the accomplishment of shipboard preventive and corrective maintenance. When the MAT schedule permits, the MAT shall be made available to render routine shipboard maintenance assistance to non-chartered cutters or boats. MATs are not to be considered as a source of TAD personnel to replace cutter personnel during at-sea periods, with the exception of the CGC HEALY MAT.

    b. <u>MAT General Routine</u>. The MLC shall issue instructions describing the procedures for MAT utilization, work item submission, and documentation. Provisions shall be included in these procedures for recording feedback on MAT performance. Workforce hours expended by MAT personnel will be recorded in "Interim Time Accounting System (ITAS)" the CG Standard MAT Work Tracking System. Since the MATs work under the direction and supervision of the NESU commanding officer, the NESU shall establish the daily routine of the MATs that best supports its chartered cutters and other customers.

    c. <u>Training</u>. Formal MAT training shall be consistent with the requirements of the cutter class supported per the Cutter Training and Qualification Manual, COMDTINST M3502.4 (series).

2. <u>Advanced Ship System Instruction and Support Teams (ASSIST)</u>.

    a. <u>Definition of ASSIST</u>. ASSISTs are groups of highly skilled and technically qualified engineering technicians assigned to the Naval Engineering Divisions of the MLCs. They perform inspections and provide mobile technical support and instruction to cutter and boat personnel. This support is available to units at their homeport, inport at other locations, or underway. It is designed to promote the expected level of organizational maintenance and repair of fleet machinery, equipment, and systems. Particular emphasis is placed on maintenance of more advanced and complex systems, infrequent or unusual casualty repairs, or casualty repairs that are beyond the current technical capability of unit personnel. It is not intended that ASSISTs perform or compete with projects or work that normally should be attended to by unit engineering personnel. Rather, by assistance and supervision, ASSISTs instruct and train unit personnel to perform preventive and corrective maintenance expected at the unit level. For maintenance or repair actions normally beyond unit-level capability, ASSISTs shall be made available to provide training and support. ASSISTs are an integral part of the MLC naval engineer's technical resources and, as such, must be included in the MLC naval engineering mobilization plan.

b. Duties of ASSIST. The MLCs are responsible for promulgating the duties of the ASSISTs. As a minimum their duties shall include the following:

1. Conduct Engineering Technical Assessments.
2. Provide MK, EM, DC rate training and technical support aboard units.
3. Conduct specialized condition assessments using NDT techniques such as thermographic analysis and vibration analysis of all units that require assistance. Provide training in the use of such assessments for condition-based maintenance.
4. Assist in the preparation of Preventive Maintenance System (PMS) and Instruction Manuals for major equipment not covered by other technical publications.

c. ASSIST General Routine. The MLCs shall issue instructions describing the details of ASSIST utilization, work request submission, and documentation of their use.

3. Centralized Supply/CMplus Assistance Team. MLC naval engineering staff conducts periodic visits to cutters to evaluate storeroom inventory accuracy, review status of CMplus and provide configuration, maintenance and supply module training to cutter personnel.

4. Weapons Augmentation Teams (WAT). The purpose, organization and operational guidelines for WATs are contained in Ordinance Manual, COMDTINST M8000.2 (series).

B. **FORCE MANAGEMENT.** G-SEN assists G-SRF in the oversight of the Naval Engineering Program's segment of the Coast Guard Military workforce (i.e., the FN, DC, EM, and MK enlisted ratings; the ENG, MAT, and WEP warrant officer specialties; and the 52XXX and 53XXX Series OBC commissioned officer specialties). This requires forward thinking to ensure all ratings and grades evolve to accommodate new technology, equipment and missions. This includes monitoring and providing input to the following:

1. Pyramid structural concerns for rating/grade size and billet distribution.
2. Location of billets.
3. Setting of performance standards.
4. Content of training.

C. **ENGINEER OFFICER IN TRAINING (EOIT) PROGRAM**. The primary goal of the EOIT program is to prepare junior officers for duty as Engineer Officers (EO) afloat. Completion of this program also provides an officer with an excellent foundation for future assignments in technical, logistical, and operational specialties. Specific qualification requirements of this program are outlined in the Engineer Officer in Training (EOIT) Personnel Qualification Standard, COMDTINST M3502.11 (series). Amplifying guidance is contained in Chapter 6 of the Cutter Training and Qualification Manual, COMDTINST M3502.4 (series).

D. **NAVAL ENGINEERING POSTGRADUATE (PG) AND ADVANCED TRAINING (NET) PROGRAMS.** These programs provide an opportunity for officers to receive advanced specialized training to meet Naval Engineering specialty requirements while considering the applicant's capabilities, interests, and personal goals for achievement. The details of these programs are described in the Training and Education Manual, COMDTINST M1500.10 (series). Specific educational requirements for the postgraduate program are outlined in Advanced Education Opportunities Sponsored By Systems, COMDTNOTE 1500. Published each spring, this document also contains a list of required and recommended courses for universities to which the Naval Engineering program sends its students.

E. **DUTIES OF SHORE UNIT ENGINEERING PERSONNEL.** While it neither practicable nor desirable to list the duties of all engineering personnel, the duties of some specific shore personnel are such that direction is required. These are:

1. Group Engineer. The Group Engineer is the head of the Engineering Department and is responsible to the Group Commander for all Naval Engineering matters within the Group. In addition to those duties prescribed in United States Coast Guard Regulations 1992, COMDTINST 5000.3 (series) for the department, (such as assigning evaluation marks, counseling subordinates, and recognizing outstanding performance), the Group Engineer provides technical and logistical support to outlying units, afloat and ashore. The Group Engineer, assisted by the appropriate subordinates is responsible to:

    a. Review and respond to CASREP's from Group Units as per established guidelines. Provide counsel to Group operations department and command level personnel concerning effect of casualties on cutter and boat mission readiness and any recommended restrictions.

b. Review Engineering Change requests (cutter and boat) from group units
c. Review and maintain copies of all reports from Group units pertaining to or concerning engineering matters, such as Current Ships Maintenance Projects (CSMP) forms and standard boat reports, to ensure that data is accurate
d. Attend technical, maintenance and compliance inspections for group units
e. Participate in Acquisition Team process
f. Perform duties of Contracting Officer's Technical Representative (COTR)
g. Review and or develop contract specifications
h. Coordinate Availability for boats
i. Make regular inspections of all cutters and standard boats assigned to the Group
j. Serve as a member of the Ready For Operations/Sea (RFO/RFS) evaluation team.
k. Maintain up-to-date Group OM&S spare parts inventory
l. Comply with CFO Audit requirements
m. Administer the Group Engineering budget
n. Draft and review messages
o. Supervise Reserve engineering personnel
p. Maintain direct interaction with EPOs including relief process, training and mentorship.

2. Shore Unit Engineer Petty Officer (EPO). The Shore Unit EPO is the head of the Engineering Department and is responsible to the CO/OIC for all Naval Engineering matters within the unit. In addition to those duties prescribed in United States Coast Guard Regulations 1992, COMDTINST 5000.3 (series) for the head of a department, (such as assigning evaluation marks, counseling subordinates, and recognizing outstanding performance), the EPO, with the appropriate subordinates, is primarily responsible to:

a. Ensure completion of PMS
b. Conduct DEMPS/Full Power Trials on boats
c. Submit Boat Inspection Report, Quarterly PMS feedback report and other required reports.
d. Maintain Boat Record, PMS records, hull history, machinery history, deviation record and required engineering logs
e. Conduct unit readiness drills/STRs (SPM)
f. Participate in Acquisition Team process
g. Coordinate boat availabilities
h. Review and develop specifications and provide feedback
i. Conduct contract inspections
j. Maintain OM&S Inventory and comply with CFO Audit requirements
k. Administer Engineering Department budget
l. Conduct material inspections
m. Properly care for, stow, and use fuels and lubricants not assigned to other departments
n. Train and qualify departmental personnel including coordination and submission of requests for short-term training from outside resources.
o. Qualify as Boat Engineer and keep qualifications current

p. Participate in Boat Crew qualification process and serve as an active member of the unit Boat Crew Examining Board
q. Maintain technical library
r. Draft and file department correspondence
s. Draft Messages and CASREPS
t. Conduct Organizational level repairs
u. Make arrangements for the repair of casualties beyond unit capabilities
v. Initiate and manage CSMPs, PMS changes, Engineering change requests, BOSS/MICA changes.
w. When assigned, collateral duties and responsibilities such as the operation, maintenance and repair of unit utilities, machinery, piping systems, interior communication systems, and electric and electronic devices not specifically assigned to other departments.
x. Conduct quarterly self audit of standard boat(s) to ensure boat(s) are "fully mission capable" in accordance with U. S. Coast Guard Boat Operations and Training (BOAT) Manual, Volume I, COMDTINST M16114.32 (series).

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CHAPTER 090. INSPECTIONS, RECORDS, REPORTS, AND TESTS

A. GENERAL. This chapter summarizes the records, inspections, reports and tests that the Commandant requires for maintaining certain equipment under the cognizance of G-SEN.

1. Reports and Records. The records and reports discussed throughout this chapter are considered essential to a well-administered engineering department. Nothing in this chapter is meant to prohibit the use of locally prepared reports and records to assist in department administration. Constructive comments concerning any particular record or report are invited. Units with Configuration Management Plus (CMplus) installed shall follow the reporting procedures and format in the CMplus user's and operation manuals.

2. Applicability of Naval Ships Technical Manual (NSTM). The requirements set forth in NSTM, Chapter 090, do not apply to the Coast Guard.

B. GENERAL INSPECTIONS AND TESTS. This section describes the minimum requirements concerning inspections.

1. Routine or periodic Inspections. Commanding Officers/Officers-in-Charge (CO/OIC) are required to conduct frequent inspections of shipboard spaces and machinery to ensure the proper equipment operation, maintenance of material readiness and watertight integrity. These inspections are normally carried out weekly while underway and bi-weekly in port. The usual frequency of physical inspections applicable to occupied spaces, storerooms, and other frequently entered spaces is not practical for double bottoms, cofferdams, voids, or tanks, and special precautions are necessary before entering into or working in such spaces. Such precautions are described in later paragraphs. Unless specifically required elsewhere, no report of these inspections need be made. Necessary repairs indicated by these inspections shall be entered in the Current Ships Maintenance Projects (CSMP).

2. Double Bottoms, Voids, and Ballast Tanks. Ballast tanks, except those used for fuel oil, unused double bottom tanks, accessible voids and cofferdams shall be inspected annually. Special inspections may be necessary because of unusual conditions or suspected unsatisfactory conditions of these spaces. Specific attention should be given to inspecting tank sounding tubes and striker plates. In some cases, the sounding bob has worn a hole first through the striker plate, then through the hull plating. Where corrosion is present apply a rust converter in accordance with Coatings and Color Manual, COMDTINST M10360.3 (series), Paragraph 9.E. A rust converter will be applied only as a short-term solution, until a coating system (or other long term protection system) can be reapplied. The affected area shall be inspected no more than 90 days later to ensure that corrosion has not recurred. Corrective measures beyond ship's force capability should be documented and included for the next maintenance period. For ballast tanks, cleaning is only required if the present condition would inhibit proper use of the ballast system. For Voids and Double Bottoms cleaning is not normally required.

3. Inspection of Safety Devices. Mechanical, electrical, or electronic safety devices, installed for the protection of machinery, equipment or personnel, shall be inspected in accordance with PMS or at suitable regular intervals and whenever warranted by unusual circumstances or conditions. PMS cards will be identified as involving safety devices in the card title. Whenever practicable the inspection shall include operation of the safety device while the equipment or unit is in actual operation.

4. Thermo graphic Inspection. Thermo graphic inspection of electrical systems has proven to be a useful preventive maintenance tool. These inspections are an effective way to identify loose connections and high resistance grounds on switchboards, load centers and other distribution equipment. MLCs shall schedule and conduct periodic thermo graphic inspections (surveys) for cutters and boats within their respective AOR. Inspection results shall be entered into Machinery History or the maintenance module in CMplus for CMplus equipped cutters, .

5. Fresh Water and Reserve Feed Tanks. Double bottoms and tanks ordinarily filled with fresh water and their check valves in overflow piping, sounding tubes, striker plates, and air escape terminals shall be inspected annually or when emptied and opened for any other purpose. Any pertinent information regarding material condition of these tanks shall be entered in the Hull History. Upon completion of the inspection, tanks shall be sterilized in accordance with instructions contained in Water Supply and Wastewater Disposal, COMDTINST M6240.5 (series). Cutters shall maintain a status sheet showing dates and results of all tank inspections.

6. Fuel Tanks. The instructions for the detailed inspection of fuel oil tanks are contained in the vessel's CMP. Sounding tubes, tank level indicator transmitters, and striker plates should be checked during tank inspections. Cutters shall maintain a status sheet showing dates and results of all tank inspections. Cleaning and preservation shall be conditional, based upon the condition found during inspection. When preservation is not required, cleaning shall only be scheduled if the existing condition poses a risk to the fuel transfer system or the equipment using the fuel, i.e. a light coat of dirt will not normally require tank cleaning.

7. Corrosion. When corrosion of a serious nature is discovered, apply a rust converter in accordance with Coatings and Color Manual, COMDTINST M10360.3 (series) Paragraph 9.E. A CSMP shall be submitted as soon as possible.

C. HULL HISTORY, MACHINERY HISTORY, RESISTANCE TEST RECORDS, AND CURRENT SHIP'S MAINTENANCE PROJECTS (CSMP).

1. Hull History. All cutters 65 feet in length and greater are required to maintain a Hull History. Composite cutters, such as 75-foot WLIC class, shall maintain a separate Hull History for pusher and barge. Units equipped with CMplus shall maintain their Hull History utilizing corrective maintenance actions and PMS entries in CMplus. Coast Guard Regulations Manual, COMDTINST M5000.3 (series), charges the First Lieutenant with the responsibility of maintaining a cutter's Hull History.

a. Contents of Hull History. The Hull History consists of Hull Board Results, Hull Surveys, and separate data cards for the following cutter subdivision:

(1) Each compartment and compartment subdivision.

(2) Each weather deck, deck house, and other deck appurtenances.

(3) Hull above/below the waterline.

(4) Major hull equipment systems not otherwise listed in the Machinery History, such as ground tackle, boats, life rafts, and related material.

b. Hull History. The Hull History is an important record for planning and reference. Only concise data that has value should be entered. In general, entries should cover repairs, alterations, maintenance, semiannual visual inspections, leakage inspections of compartments, tanks, and voids, tank cleanings, painting, rearrangements and casualties. Hull History entries shall be made as soon as practical following the event. For underwater inspection and maintenance, refer to Chapter 997 of this manual.

c. Records. Cutters equipped with CMplus shall maintain Hull History using the CMplus maintenance module and maintain a folder with copies of any Hull Board results, Underwater Body Inspection Reports, and Hull Potential Surveys until these reports are incorporated into CMplus. Units not equipped with CMplus shall maintain Hull History on Hull History Form, CG-3765 or electronic equivalent.

2. Machinery History. All cutters 65 feet and longer shall maintain a Machinery History. Composite units, such as the 75-foot WLIC class, shall maintain a separate Machinery History for pusher and barge. Units equipped with CMplus shall maintain their Machinery History utilizing corrective maintenance actions and PMS entries in CMplus.

a. Contents of Machinery History. The Machinery History serves as a method of recording important maintenance information on all machinery installed aboard a cutter. It is the prime means of preserving the continuity of the operational history of a piece of equipment. A factual and complete Machinery History is excellent background for the preparation and submission of an alteration or repair request. The Machinery History loses its effectiveness if filled with non-essential data. On the other hand, it should contain all pertinent information concerning the equipment. For example, whenever a piece of machinery is altered from the standard shown in a manufacturer's instruction book or a plan, such as sleeving, installation of oversized bearings or material substitution, that information should be entered in the Machinery History. Important part numbers should be entered when parts are renewed. Information concerning ball bearings, packing sizes and similar data should be entered. Whenever a large amount of data is to be entered in the History, such as after an engine overhaul, it is permissible to enter the main facts in the Machinery History and file the remainder of the data elsewhere. Machinery safety device deficiencies should always be entered in the machinery log.

b. Records. Cutters equipped with CMplus shall maintain Machinery History using the CMplus maintenance module. Units not equipped with CMplus shall maintain Machinery History on Machinery History Form, CG-2929 or electronic equivalent

3. Resistance Test Records. The Resistance Test Record card, NAVSHIPS Form 531, which is used to record resistance measurements of electrical equipment, is a part of the Machinery History. However, it is not necessary to file these cards with the main body of the Machinery History. They may be filed together and should be readily available for review.

4. Current Ship's Maintenance Project (CSMP) File.

a. The CSMP file is an administrative method of tabulating all outstanding repairs and alterations. Each MLC shall develop detailed guidance for the submission and tracking of CSMPs for cutters within their purview.

b. Cutters equipped with CMplus shall maintain CSMP files in the CMplus maintenance module. Units not equipped with CMplus shall maintain CSMP files in paper or electronic equivalent.

c. Maintenance of CSMP File. The Engineer Officer/Engineer Petty Officer (EO/EPO) is responsible for maintaining the CSMP file for a cutter. The various department heads are responsible for the preparation of file cards for items under their cognizance. The station engineer is responsible for maintaining the file for all boats without permanent crews.

5. OPNAV Form 4790/2K Ships Maintenance Action Form. All maintenance assistance requests to the Navy must be accompanied with an OPNAV Form 4790/2K or the computer/CMplus equivalent OPNAV Form 4790/2Q.

a. Due to the large percentage of ordnance maintenance actions forwarded to the Navy for action, all assistance to complete backlogged ordnance maintenance or document completed ordnance maintenance actions shall be submitted on OPNAV Form 4790/2K or the 4790/2Q as detailed in Ordnance Manual, COMDTINST M8000.2 (series).

b. Backlogged HM&E maintenance actions that will be forwarded to the Navy shall be submitted on the OPNAV Form 479O/2K or 4790/2Q. Those HM&E maintenance actions to be completed by Coast Guard or commercial resources shall continue to be submitted on CG CSMP Form CG-2920 or equivalent.

c. Detailed instructions on how to fill out and process the OPNAV Form 4790/2K and 4790/2Q are contained in OPNAVINST 4790.4 and MLC promulgated instructions.

D. <u>ENGINEERING DEPARTMENT RECORDS AND ACCOUNTS</u>. This section describes the logs, operating records, accounts, worksheets, and other records that are basic to a well-administered engineering department of any afloat unit. All are important to the efficient operation and administration of any engineering department, whether large or small. Except where indicated, particularly in connection with the required records, the various records described in this chapter may vary in content, format, and other particulars, depending on the needs of the individual unit. Cutters with a high degree of automation may keep department records and accounts in electronic format. Individual/watchstander accountability must be maintained regardless of format. Accurate record keeping is a tool used to maintain an efficient, effective Engineering department.

1. <u>Machinery Log</u>. The Machinery Log is the complete set of daily records kept for shipboard machinery. It includes the Engineer's Bell Book and all operating logs, and it shall be bound together with the Machinery Log, Form CG-2616G, Sheet A. The completed Machinery Log is an official record. Retention and disposal shall be in accordance with the Information and Life Cycle Management Manual, COMDTINST M5212.12 (series). All cutters 65 feet long and longer are required to keep a Machinery Log.

   a. <u>Procedures for Keeping the Machinery Log</u>. The following procedures shall be followed in the preparation and maintenance of the Machinery Log:

      (1) The Machinery Log shall be written for each day, covering the period from 0000 to 2400. At sea, the Log shall be kept in 4-hour watches and signed by the Engineer Officer of the Watch (EOW). In port, the log shall be written in three periods: 0000 to 0900, 0900 to 1600, and 1600 to 2400. Each period shall be signed by the EOW. Machinery Log entries must be legible and in black ink.

      (2) The Watch Officer's remarks shall include the following:

         (a) The machinery status at 0000 and subsequent changes as they occur. A prefabricated check-off sheet with the 0000 plant status may be inserted into the machinery log to meet this requirement as long as it referred to in the first entry on the CG-2616G.

         (b) Abnormal operation of machinery.

         (c) Casualties within the engineering department.

         (d) Machinery out of commission.

(e) A brief general description of major work performed on all machinery.

(f) Any data pertinent to the operation of machinery that is deemed necessary by the Watch Officer or required by the EO/EPO.

(3) Page 2 of Form CG-2616G, Sheet A, shall be completed as applicable to the cutter's machinery installation.

(4) The Machinery Log shall be signed daily by the EO/EPO, with remarks as necessary. The Logs for one month shall be bound together and maintained aboard as required by current instructions concerning official records.

(5) The CO/OIC is not required but is encouraged to sign the Machinery Log.

2. Engineer's Bell Book. The Engineer's Bell Book, Form CG-2930, shall be kept on all cutters 110 feet and longer when bells in the engine room are answered in accordance with specific main propulsion speed/pitch/direction settings transmitted from the conning station. When a cutter is under pilothouse control, an entry to this effect shall be made in the Machinery Log, and no Bell Book need be kept.

a. Instructions for Keeping the Bell Book. Specific instructions for keeping the Bell Book are contained on the reverse of Form CG-2930. The following information is offered to supplement these instructions:

(1) The Bell Book is not required to be kept on days that the propulsion shafting is not turned.

(2) The records for each day must begin with a new sheet.

(3) Bell Book entries shall be made in ink.

(4) Alterations or erasures to this record are not permitted. Mistakes are to be lined through with a single line and initialed by the responsible individual.

(5) Upon relief, the assigned throttleman will sign the Bell Book immediately after the last entry. The EOW shall countersign the Bell Book on the line immediately following the signature of the throttleman. If the throttleman and the EOW are the same person, one signature will suffice. The throttleman for the next watch will begin his/her entries on the line immediately after the last signature of the previous watch.

(6) The completed Bell Book(s) for each day will be bound with the Machinery Log for that day.

3. Operating Record. The recording of data onto operating record forms ensures frequent observation of machinery and provides the basis for performance analysis. Such records should be examined by the EO/EPO as part of his routine examination

of the daily Machinery Log. Operating records are to be filed with the daily Machinery Log and bound into the monthly Machinery Log binder.

a. Required Operating Records. The following are the minimum operating records that shall be maintained by all cutters 65 feet and longer that are equipped with the applicable machinery:

(1) Main engine and auxiliary machinery operations.

(2) Boiler log.

(3) Evaporator log.

(4) Refrigeration equipment log.

(5) Auxiliary and emergency electrical power prime movers and systems.

b. Standard Forms. Forms CG 3186 - Operating Record Main Engines, and CG 3186A - Operating Record Main Propulsion (Combined Operation Diesel or Gas (CODOG) Plants) were developed for particular cutter classes and shall serve as the standard format in developing unit/class specific forms. Units currently using Forms CG 3186 and 3186A may continue to do so, or using these forms as a guide, develop operating records that reflect the requirements of the individual unit. Forms CG 3186 and 3186A may also be used as a pattern in developing operating records for auxiliary and electrical equipment that pertain to a specific cutter class. Cutters equipped with a MPCMS system can substitute computer printouts for hand written logs. Periodic review of these logs shall be conducted to ensure that all necessary information is being recorded and that superfluous information. is not being accumulated.

4. Fuel and Water Record. All cutters are required to maintain a daily record of the amount of fuel oil, lubricating oil, and water on board. Such records may be maintained on any suitable form, and the information is to be entered in the appropriate section of the Machinery Log, Sheet A. Reports of receipts, expenditures, and amounts on board must be made to those persons requiring such information.

5. Engineering Department Standing Orders. EO/EPO shall prepare, sign, and publish standing orders for the Engineering Department, with the approval of the command. In preparing the Standing Orders, the EO/EPO should be guided by the provisions of Coast Guard Regulations Manual, COMDTINST M5000.3 (series), the Cutter's Organization Manual, this instruction, CO/OIC's Standing Orders, NSTM where applicable, current Commandant Instructions and Notices, and the MLC SOP. Orders must be published for the following items, plus any others deemed necessary by the command:

a. Duties of the watchstanders in port and at sea, including the method and times of relieving the watch.

b. Instructions and the circumstances under which the EO/EPO is to be called.

c. For non-centralized shipboard supply cutters: Instructions on the issue, use, and replenishment of spare parts.

d. Instructions showing the division of responsibility for maintenance and repair of machinery and equipment under the cognizance of the Engineer Officer.

e. Instructions regarding the receipt and transfer of water, fuel oil, and lubricating oil, including transfer at sea and transfer between tanks within the cutter. Included should be a listing of personnel to be notified in each situation, stations for personnel engaged in the work, and safety precautions to be followed.

6. Night Order Book. The EO/EPO shall provide a Night Order Book to be read and initialed by the Engineer Officer of the Watch for each night, in port and at sea. The Night Order Book shall contain instructions regarding changes in machinery status, system alignment, or any other special instruction to be carried out during the night. For small cutters that do not have a regular in port engineering watch, CO's/OIC's may elect to have EO/EPO's utilize the Executive Officer's Morning Orders to pass specific instructions relevant to the engineering systems.

7. Steaming Orders. Steaming Orders shall be published well in advance of getting underway. These orders are the means by which the EO/EPO communicates to the EOW when to have the engineering plant ready to answer bells. The form normally includes the time at which the plant should be ready to answer bells, the destination, and the EOW and Engineering duty section responsible, and a copy of the Light-Off Schedule should be attached. These orders should be incorporated into the Machinery Log.

8. Lite-Off Schedule. A Lite-Off Schedule shall be prepared, consisting of a chronological check-off list of the key steps necessary to prepare the machinery plant for getting underway. The scheduled times of the respective steps relative to the time to report "ready" shall be printed on the form, and the corresponding clock times of accomplishment should be entered. The use of such a check-off list ensures that the operation is carried out according to a safe, effective, and proven schedule. It is to be used each time the machinery plant is prepared for getting underway, without regard to the experience of the individuals performing the actual work. The Lite-Off Schedule shall be incorporated into the Machinery Log as an attachment to the Steaming Orders.

9. Securing Schedule. The Securing Schedule is comparable to the Lite-Off Schedule, in that it is a chronological check-off list of the steps required to properly secure the machinery plant. The use of such a check-off list ensures that the plant is secured in

an orderly manner, and overcomes the tendency to secure too rapidly. This schedule should also list the auxiliary units to be used when moored or anchored.

10. Department Organization Chart. The preparation of an organization chart, showing the assignment of personnel in the Engineering Department by rank and rating, is recommended.

11. Personnel Training Records. The Engineering Department should establish a personnel training record for all personnel assigned to the Engineering Department. This record includes name, rank, service number, and information on advancement, training courses completed, schools attended, watch-standing qualifications, plus any other special qualifications or information concerning personnel assigned to the department.

12. Files and Publications. It is recommended the following files and publications be maintained by the Engineering Department.

    NSTM
    Coast Guard Technical Publications, as applicable to the individual unit
    Manufacturer's instruction books and service manuals, as applicable to the individual unit
    Drawings of cutter and machinery
    Allowance Documents, as applicable to the individual unit
    DC Books or Stability and Loading Data Booklet
    Current Commandant and MLC Naval Engineering Instructions and SOPs.

13. Watch. quarter. and Station Bill. The EO/EPO is responsible for the preparation and upkeep of the department Watch, Quarter, and Station Bill, in the format of CG-3485. Cutters maintaining the Watch, Quarter, and Station Bill manually shall keep them on the form; however, use of a computer generated equivalent is authorized. This Bill is a summary of the personnel assignments to duties and stations specified in each of the cutter's bills.

14. Engineering Casualty Control Manual (ECCM). The ECCM shall contain emergency procedures to be followed by personnel assigned to the various Watch Stations if a casualty or machinery derangement occurs. Specific instructions for the preparation of the ECCM are contained in Chapter 079 of this Instruction.

15. Gas Generator Log. A Gas Generator Log is a maintenance record furnished by a gas turbine manufacturer with each gas generator supplied. The Gas Generator Log is considered to be a part of the engine, and as such, should accompany the engine wherever the engine may go, for example, to an overhaul and repair facility. A record of all Service Bulletins must be kept in this log, along with all overhaul and repair data.

16. Equipment Operating Procedure. Each cutter is to develop and maintain the Equipment Operating Procedures for every machine and they shall be posted where they can be clearly visible to the operator.

17. Boat Records. Cutters with small boats attached shall comply with the reporting requirements in paragraph E of this Section.

E. REPORTS. Directives, Publications and Reports Index (DPRI), COMDTNOTE 5600, contains a list of reports required by higher authority and their frequency of submission and unit applicability.

1. Cutter Engineering Report. A Cutter Engineering Report, Form CG-4874 (Rev. 7-92) or CMplus equivalent, shall be completed and submitted by all cutters 65 feet in length and greater. This report shall be submitted annually covering a 12 month period ending 31 December.

   a. CO/OICs of the above cutters shall:

      (1) Submit this report no later than 31 January; if at sea at the end of the reporting period, submit the report upon reaching a port.

      (2) Submit the report to the MLC (v) via the chain of command with a copy for each intermediate command. One copy shall be retained on board for the cutter files. An informational copy, with enclosures, shall be forwarded to ELC (01).

      (3) Use Section VI, REMARKS, to explain any discrepancies evidenced in prior sections.

      (4) Provide the following information for each diesel engine center section overhaul (as defined in Chapter 233) completed during the reporting period:

         (a) Engine manufacturer and model

         (b) Completion date of Center Section Overhaul

         (c) Operating hours since previous Center Section Overhaul

         (d) Total operating hours on engine at time of Center Section Overhaul

         (e) Reason for overhaul, that is, oil analysis, trend analysis, recommended interval, failed component, etc.

         (f) If the reason for the overhaul is a failed component, state what caused the initial component to fail.

(g) If the reason for the overhaul is other than a failed component, was overhaul justified by condition of opened engine? If yes, what major deficiencies required correction?

(5) Provide the hours of operation since the last major overhaul for all diesel engines and gas turbines in Section VI of the report, REMARKS.

(6) In Section V of the report, Cutter Engineering Summary, provide the completion status of PMS by division; main propulsion, auxiliary, etc., in percent complete for the reporting period. Percent complete the number of monthly, quarterly, semiannually, annual, occasional (pertaining to a particular event) and hourly MPCs completed, divided by the number of monthly, quarterly, semiannual, annual, occasional, and hourly MPCs scheduled by the unit for the reporting period. Daily and weekly MPCs are assumed completed and are not included in the calculation. If scheduled PMS cannot be completed, or if individual MPCs are deferred two or more consecutive times, indicate the reason. Those cutters equipped with CMplus shall use the data provided by CMplus.

(7) Attach a copy of the Full Power Trial Report (refer to cutter PMS) for trials conducted during the reporting period. If a Full Power Trial has not been attempted for over two reporting periods as determined by cutter PMS, provide reasons in Section VI, "Remarks".

(8) In Section VII of the report, units shall list the 5 most significant Naval Engineering or Ordnance human performance issues (HPI) facing their command. An HPI is best described as an issue that could be improved by providing a training intervention, changing CG Policy, providing additional tools or equipment, changing technical publications or implementing program, workforce or process changes. NOTE: Units are authorized to attach Section VII until Form CG-4874 in Jetforms Filler and the CMplus created Cutter Engineering Report is updated.

b. Group and Section Commanders shall:

(1) Review copies of the Cutter Engineering Reports for all cutters assigned to their Group or Section.

(2) Enter comments concerning action intended toward discrepancies and problems reported that are within the scope and capabilities of the Group or Section to resolve.

(3) Forward the report within 7 days after receipt to the MLC (v).

c. The MLC Commander shall:

(1) Have authority to use blank spaces in the Cutter Engineering Report to have cutters report items relating to temporary requirement of the MLC. If additional items of a permanent recurring nature are believed required in the report, the MLC shall refer them to G-SEN for review and possible inclusion in the report.

(2) Review the Cutter Engineering Report and take appropriate action to correct discrepancies and to correct or resolve report problems as soon as possible. Engineering discrepancies beyond reasonable MLC capabilities shall be forwarded to G-SEN by letter or Engineering Change request.

2. Boat Inspection Report.

a. A detailed Boat Inspection Report, Form CG-3022, shall be submitted on all boats less than 65 feet long, except for those boats powered by outboard motors and non-powered boats. In addition, reports shall be submitted for all barges.

(1) Group, Section, District Commanders, and MLCs shall schedule a regular detailed boat inspection of each boat as defined above, at an interval not to exceed 1 year between inspections. A special inspection shall be conducted as described in Paragraph E.2.b. The inspection should be conducted by the most qualified personnel available in the Group, Section, or Command.

(2) The Inspection Report shall be submitted by the unit having custody of the boat, via the chain of command, to the MLC. Submission shall be made within 10 days after completion of the inspection.

(3) Each step in the chain of command shall review the report closely and take all action within their capabilities to effect repairs to discrepancies reported.

(4) If a problem develops that cannot be resolved within the MLC resources, or indicates widespread application, a letter description of the problem and associated amplifying data should be forwarded to ELC (01) for research and solution.

b. Special Boat Inspection Reports In case of boat transfer, a special inspection shall be completed. Detail all repairs and alterations pending CO/OICs comments. The comments shall also include the date the boat was transferred, the unit or cutter transferred to, and the date the boat records were forwarded to the unit or cutter. Upon disposal of a boat, indicate the survey number and date the boat was disposed of. For example, "Boat disposed of in accordance with approved Board of Survey No. ___ on (date)."

c. Completion of the Boat Report

(1) The persons conducting the inspection shall sign the report in the space provided and shall enter appropriate comments concerning unsatisfactory items under inspection team remarks.

(2) Prepare an original and two copies. One copy shall be retained by the unit, the original shall be forwarded to the MLC (vr), and one copy shall be forwarded to the Area/District boat managers.

(3) Completion of this report does not relieve units from the requirement and intervals for various inspections, tests, and checks as described in current directives. Specifically, fuel, tank, water, and sediment are to be checked during this inspection as a supplement to the normal daily or weekly interval for this check.

(4) After initial implementation of the Boat Inspection Report, inspection personnel shall use previous inspections used as a reference to more easily recognize items previously reported as unsatisfactory and not repaired in the interim. Unsatisfactory items unchanged from one inspection to the next should be indicated to bring them to the attention of responsible personnel for corrective action.

(5) All items on Form CG-3022 are self-explanatory. However, this instruction should be consulted for specific inspection methods wherever reference is made to it.

(6) The CO/OIC shall comment on all unsatisfactory items and list any other items deemed necessary, especially those requiring assistance by higher authority.

(7) MLCs may require additional information to be included at their discretion.

(8) MLCs shall establish the due dates and frequency of submittal of this Boat Inspection Report and the interval of inspection.

F. **NAVAL ENGINEERING CUTTER MATERIEL ASSESSMENT.** Maintenance and Logistics Commands will assess the materiel condition of each cutter within their respective AOR. A Materiel Assessment will be accomplished at least once during each cutter's scheduled drydock cycle. The maintenance actions resulting from the Materiel Assessment will be documented by the CSMP process and incorporated into the cutter's long range maintenance planning. The MLCs will work together to ensure that each MLC conducts the Materiel Assessment in the same manner. The process should be documented in the MLC Standard Operating Procedures.

G. **ADDITIONAL RECORDS.** In addition to those records and files required elsewhere in this chapter, the following records shall be maintained:

1. Oil History Log (Cutters only)

2. Degaussing Folder, where installed

3. Inventory of Spare Parts (CMplus if equipped)

4. Gyrocompass Service Record Book, where installed

5. Flexible Piping (HOSE) Logs (Cutters only)

6. File copies of reports

7. Engineering portion of the Routine Maintenance and Financial Program, for cutters 82 feet and over

8. PMS records (CMplus if equipped)

9. Completed and incomplete Engineering Changes for cutters and boats. (CMplus if equipped)

10. Copies of Engineering Watch Officer CertificationsRecord of tank inspections.

11. Zinc Log

H. **RELIEF OF THE ENGINEER OFFICER OR ENGINEER PETTY OFFICER (EO/EPO).** Coast Guard Regulations specifically require an administrative inspection to be conducted when the EO/EPO is to be relieved. The Regulations further require that a machinery trial be held during the relieving process if such a trial is possible. The purpose of conducting these evolutions is to familiarize the relieving EO/EPO with the status of the items for which he/she will be held responsible. A written report outlining the results of the inspection and trial is to be submitted in memo format to the CO/OIC. Figure 090-1 shows a sample letter of relief. It contains those items which, if applicable, shall be addressed. The sample should serve as a guide. Items not mentioned in the sample that are of current or potential importance should also be addressed in the relieving letter. The CO/OIC shall forward the letter of relief to the appropriate MLC. Figure 090-2 shows a sample forwarding letter. CO/OIC shall forward subject letter via their chain of command. Figure 090-5 and 090-6 contains suggested EO/EPO relief check lists for afloat and ashore respectively.

I. **MAINTENANCE OF BOAT RECORD FILES.** Shore based commands with boats attached shall maintain a separate boat record file for each boat assigned. Cutters with boats aboard shall incorporate their Boat Record Files as part of the Machinery History File. A shore based command's boat record file shall be maintained in a six-part folder as follows:

1. Part 1 - Boat Record Book (CG-2580). **Note:** this book includes pages for Hull and Machinery History. Additional pages will be produced by the unit and be added to this book as needed. The boat record book shall be maintained in accordance with the instructions in the front of the book. Once machinery is replaced, all entries

pertaining to that particular machinery should be removed from the machinery history and discarded.

2. Part 2 - Boat Inspection Reports. Only required to be kept for a period of three years. The current life raft inspection receipt and a copy of the current compass deviation table shall be kept until they are renewed each year. A copy of the STAN Material Inspection Discrepancy List shall be kept here until the next STAN visit.

3. Part 3 - CASREPS and CASCORS. Only CASREPS and CASCORS pertaining to the current fiscal year shall be kept in the boat record. All others should be kept in a separate file for an additional two year period then discarded.

4. Part 4 - Engineering Changes Pending (including a cover sheet listing the Change number, class, and description).

5. Part 5 - Engineering Changes Completed (including a cover sheet listing the Change number, class, description, and completion date).

6. Part 6 - Pending CSMPs. Completed CSMPs shall be removed and kept in a separate file for a three year period then discarded.

J. PROCEDURES FOR LISTS OF TOP TEN MAINTENANCE PROBLEMS.

1. Definition. The list of "Top Ten Maintenance Problems" details the ten most important problems for that cutter class. It is supplemented by the top ten ordnance problems and the top five problems from the perspective of MLC (v) regardless of class. It is intended to identify hardware problems on the cutters and provide an indication of the condition of the fleet. In addition, it will help the MLC, ELC and Commandant staffs to focus on the high priority problems of the fleet.

2. List Requirements. Top Ten Maintenance Problem lists (Figure 090-3) shall be submitted by the MLC for each cutter class and a single list for fleet ordnance. Each MLC shall ensure the respective Operational Commander is a partner in this process. Where more than one cutter size exists per class of cutter, a list shall be prepared for each length of the class, e.g. WLIC's: 75' WLIC's, 100' WLIC's, 160' WLIC's. Exceptions may be made where populations are too small to warrant a separate list. MLC (vr) shall make the determination of cutter class list divisions.

3. Format.

   a. Each MLC type desk shall prepare their top ten problems as outlined in Figure 090-3.

      (1) The title shall be limited to ten words.

      (2) Type desks shall prioritize their lists in decreasing order of importance.

b. For each new problem a supporting form shall be submitted on a separate page in accordance with the format outlined in Figure 090-4. This support form does not have to be provided for subsequent submittals of the same problem unless major changes have occurred which have not been communicated by other means.

(1) The title shall be limited to 10 words.

(2) Information provided in the DISCUSSION and RECOMMENDED ACTION sections should be kept brief, not to exceed 3 lines each. Additional information for these two areas should be provided by separate correspondence on an as needed basis.

(3) Use yes/no statements to identify the organization which has the proposed responsibility for action. In some cases, both MLC and Commandant may have action on a problem.

(4) Use yes/no statements to propose who will provide resources, if needed. The "MLC AFC-45 FUNDED" option means MLC AFC-45 base funds will be used to fund the solution. If Commandant funds are required, i.e. funding of the solution is not within the funding capability of the MLC, then indicate "yes" for "Commandant AFC-45 WOW".

4. <u>Submission Schedule</u>. MLC's shall submit their Top Ten Lists annually no later than 31 March to coincide with the AFC-45 World of Work (WOW) process.

5. <u>Submission Procedures</u>.

a. MLCs shall compile lists based on CER, CSMP and CASREP data and forward to ELC (01).

b. The ELC shall add comments as necessary and forward to G-SEN who will distribute the Top Ten lists to the following support partners at the end of April: G-OCU, G-OCS and G-SL.

c. The lists will be used to assist in developing priorities for WOW funding and RP's for recurring/non-recurring resources.

FIGURE 090-1

SAMPLE EO/EPO RELIEVING LETTER

MEMORANDUM

From: N. U. ENGINEER, 1234 — Reply to Attn of:
USCGC READY (WPB-710)

E. O. DEPARTING, 5678
USCGC READY (WPB-710)

To: Commanding Officer/Officer In Charge
USCGC READY (WPB 715)

Subj: RELIEF OF ENGINEER OFFICER/ENGINEER PETTY OFFICER

Ref: (a) US Coast Guard Regulations, COMDTINST M5000.3 (series), 4-1-17, 4-2-13
(b) Naval Engineering Manual, COMDTINST M9000.6 (series), 090, Figure 090-1

1. In accordance with references (a) and (b), the engineer officer and the relief conducted a joint inspectio material, equipment, and records of the engineering department, from dd Mmm yy to dd Mmm yy.

   a. An underway machinery trial was conducted with the following results.

      (1) All propulsion machinery satisfactorily operated, with the following exceptions:

         (a) No. 3 cooling pump. The pump motor has been removed for rewinding with an Estimated Repair (ETR) of 15 March.

         (b) No. 2 diesel engine. The control box for the governor is Out Of Commission (OOC). Esti Time of Arrival (ETA) of replacement unit is dd Mmm yy.

      (2) All auxiliary equipment satisfactorily operated, with the following exceptions:

         (a) The automatic start feature of the emergency generator. This problem surfaced during the it's solution is pending additional troubleshooting.

         (b) No. 1 lube oil purifier. Parts due on dd Mmm yy.

         (c) No. 2 sump heater. Scheduled for repair during the upcoming AA.

      (3) The following major repairs are pending:

         (a) Strengthen the No. 2 main motor foundation, scheduled for next AA, dd Mmm yy.

         (b) Replacement of tile, scheduled for next AA, dd Mmm yy.

   b. The inspection of compartment spaces and material was conducted with the following results:

FIGURE 090-1 (cont.)

SAMPLE EO/EPO RELIEVING LETTER (CONT.)

FIGURE 090-2

(b) No. 1 lube oil purifier. Parts due on dd mmm yy.

(c) No. 2 sump heater. Scheduled for repair during the upcoming AA.

b. The inspection of compartment spaces and material was conducted with the following results:

(1) No major discrepancies noted at the last semi-annual visual inspection.

(2) The compartment air testing program is three months behind.

c. The most recent inventory, dated dd Mmm yy, of the engineering department repair parts shows shortages amounting to $5000. The most critical items are:

(1) Main diesel engine blower assembly.

(2) Control System overload unit.

d. The department files, blueprints, and instruction books are in good order. CMplus is being used and is up to date for Preventive Maintenance, Corrective Maintenance Actions, Machinery History, CSMPs Cutter Engineering Reports and Shore Maintenance Projects. The Machinery History prior to CMplus is complete in paper form. All other records are in good order.

(1) The CSMP and Engineering Change Requests are current. The following Engineering Changes are outstanding:

(a) 350-A-10 Scheduled for AA in mm/yy.

(b) 350-C-19 Deferred pending receipt of materials.

e. The Preventive Maintenance System (PMS) percentages for last quarter: MP-92%, AUX-95%, EM-62%, DC-94%. A detailed record of accomplishment is contained in the last completion report.

f. A review of the adequacy of personnel assigned to the department revealed a shortage of one DC3.

2. N. U. Engineer has assumed custody of all accountable Personal Property, Operational Maintenance and Supply (OM&S) materials and keys for the engineering department.

3. There are no facts in dispute in this relief process.

4. As of 1600 dd mmm yy, N.U. Engineer has relieved E. O. Departing of the duties and responsibilities as Engineer Officer / Engineer Petty Officer aboard CGC READY.

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FIGURE 090-2

SAMPLE CO/OIC FORWARDING LETTER

MEMORANDUM

From:	I. M. COMMAND USCGC READY (WPB-715)	Reply to Attn of:

To: CG MLCLANT(v)(or MLCPAC(v))

Subj: ENGINEER OFFICER/ENGINEER PETTY OFFICER LETTER OF RELIEF

1. Subject letter of relief of E. O. DEPARTING by N. U. ENGINEER as Engineer Officer/Engineer Petty Officer is forwarded in accordance with reference (a).

2. The condition of the machinery, watertight integrity, Engineering department files and records, personnel shortages, spare parts shortages, and pending action as detailed in the letter are noted.

#

FIGURE 090-3

TOP TEN LIST (example)

378 WHEC **MLCPAC** **APR 1992**

1. OWS Reliability
2. IC Switchboard
3. Aviation Power Supply Deficiencies
4. Main Propulsion console design problems
5. MGT Maintenance and Supply Support
6. H, M, & E Supply Support
7. H, M, & E PMS
8. Machinery Readiness Bill
9. Doppler Speed Log Reliability
10. Technical Publications

FIGURE 090-4

NEW ITEM SUPPORT FORM (EXAMPLE)

140 WTGB	**MLCLANT**	**APR 1992**

OIL IN MDE EXHAUST SYSTEM

(1) DISCUSSION: Oil builds up in 140 exhaust system due to engine being operated under light loads. Stack fires result when engine load increased (higher exhaust temps).

(2) RECOMMENDED ACTION: Install blower bypass on engine (S/A request already forwarded). COMDT to authorize prototype installation; MLCLANT to install.

(3) RESPONSIBILITY FOR ACTION:

Commandant Action Required/Requested:	YES
MLC Action Required:	YES

(4) RESOURCES REQUIRED:.

MLC AFC-45 FUNDED	NO
AFC-45 WOW	YES
MLC AFC-45 WOW	NO

(5) MLC (vr) COMMENTS: Ship available this summer for prototype installation. Serious safety problem; one fire already this year.

(6) G-SEN COMMENTS: WOW approved for prototyping this FY.

FIGURE 090-5

EO/EPO RELIEF CHECKLIST
AFLOAT

1. Review Personnel Allowance List.
2. Review Departmental and Divisional Worklist.
3. Review Current Ship Maintenance Project (CSMP File).
4. Review Current Availability Package(S).
5. Review Previous Availability Report(S).
6. Review Engineering Changes
7. Review Long Range Maintenance Plan (LRMP) for planned improvements and equipment replacement.
8. Review Last Technical Assessment.
9. Review Old Relief Letter.
10. Review Preventative Maintenance System (PMS) Reports and Records.
11. Observe last time Maintenance Procedure Card (MPC) updates were submitted.
12. Review Machinery History (CG2929 computer generated equivalent is acceptable)
13. Review all Engineering Personnel Qualification Letters.
    A. Auxiliary Watch Inport.
    B. Auxiliary Watch Underway.
    C. Fuel, Oil and Water King.
    D. Throttle Watch.
    E. Engineering Officer of the Watch (EOW) Inport.
    F. EOW Underway.
    G. Electrical Safety Officer.
    H. Damage Control Petty Officers (DCPO's)
    I. Damage Control Assistant (DCA) Letter of Designation.
    J. Chemical, Biological and Radioactive (CBR) Letter of Designation.
14. Review Cutter Organizational Manual (COM) and Ship's Instructions for recent update.

15. Submit Short Term Training Request for MK-01 Engineering Administration Course

16. Review Last Underwater Body and Paint Report.

17. Review Diesel Engine Maintenance Program (DEMP).

18. Review Engine Lubricating Oil History.

19. Review Tag-Out Log.

20. Review Electrical Megger Cards.

21. Inventory General Purpose Property.

22. Review Full Power Trial Reports/Performance Analysis Report (PAR).

23. Review Boat Files and Boat Inspection Reports.

24. Cycle the sewage system in auto and manual modes.

25. Operate All Machinery.

26. Review Latest Material Inspection Reports.

27. Review EO Night Order Book.

28. Operate Small Boats.

29. Review Casualty Report (CASREP) File.

30. Review Pending Maintenance and Logistics Command (MLC) Contracts.

31. Review Logs Required in Chapter 090 of this Manual.

32. Review EO/EPO Standing Orders.

33. Review 2-Kilo File. (Navy Work Order System For Repairs Done In Navy Yards).

34. Review Unit Instructions For The Following.
    A. Unit Safety and Occupational Health Program.
    B. Respiratory Protection Program.
    C. Heat Stress Program.
    D. Potable Water Management Program.
    E. Hearing Conservation Program.
    F. Hazardous Material Control Program.
    G. Unit Pre Mishap Program.

H. Eye Protection.
I. Equipment Tag Out Procedures.
J. Electrical Safety Program.
K. Fire Watch and Hot Work Safety.
L. Helicopter Pre-Accident Plan.
M. Working Aloft or Over The Side.
N. Asbestos Management Plan.
O. Gas Free Engineering.
P. Confined Space Ashore Program.

35. Check Meter and Gauge Calibrations.

36. Check Calibration Log.

37. Review Ship's Maneuvering Instruction.

38. Review Ship's Standby Status Instruction.

39. Check Emergency Escape Breathing Device (EEBD) Status.

40. Review Training Files.

41. Review Departmental Budget.

42. Review Allowance Shortages.

43. Review Latest Configuration Management Plus (Cmplus)/Shipboard Computer-Aided Maintenance Program (SCAMPS)/Management Information For Configuration And Allowances (MICA)

44. Review Inventory.

45. Review Watch, Quarter and Station Bill.

46. Review Cutter Class Maintenance Plan (CCMP)

47. Determine CSMP Backlog.

48. Inventory Draeger Tubes.

49. Inventory Repair Locker.

50. Review DCPO PMS System.

51. Review Casualty Control Manual/Main Space Fire Doctrine.

52. Locate Original Copy Of Docking Plan.

53. Check Hydrostatic Testing of Compressed Gas Cylinders.

54. Review General Emergency Bill.

55. Review Ship's Bills.

56. Review Damage Control (DC) Closure Log.

57. Check For 2 Or 4 Man Airline Hose Mask (ALHM).

58. Review Repair Party Manual.

59. Inventory DC Plates and DC Central.

60. Inventory CBR Equipment especially injections and monitoring equipment.

61. Review DC Book.

62. Review Stability Book.

63. Review Rescue and Assistance (R and A) Bill.

64. Review Jettison Bill.

65. Review CBR Bill.

66. Inspect all Spaces.

67. Inspect Twin Agent Unit (TAU) or Single Agent Unit (SAU) System.

68. Review Metrology (Navy Inventory of CBR Equipment).

69. Review Hull History (CG3765, computer generated equivalent is acceptable).

70. Review Strip Ship Bill.

71. Obtain Compartment Checkoff List (CCOL) Master File.

72. Obtain pertinent floppy disks for your area of responsibility.

73. Obtain master copy of Standard Specifications.

74. Review training records for frequency of Basic Engineering Casualty Control Exercises (BECCE) and Damage Control Casualty Exercise Training (DCCET) Recorded Drills.

75. Locate Blueprint File Index.

76. Locate Aperture Card File.

77. Review completeness and entered changes of Naval Ships Technical Manual (NSTM) Library.

78. Review Fueling policy.

79. Determine DC Personnel Qualification Statements (PQS) Posture.

80. Review Watch List Rotation for Department.

81. Review SSMR File.

82. Review Last CART Discrepancy List

83. Review Unit Fuel Reports.

84. Review Cutter Engineering Reports.

85. Review Status of On-Board Training Teams.

86. Review Last Degaussing Range Results.

87. Review Machinery Log and Machinery Log Files.

88. Check Bell Book (110 Foot and above).

89. Review Lite Off Schedule.

90. Review Securing Schedule.

91. Review Boiler Water Treatment Procedures.

92. Review Jacket Water Treatment Program.

93. Review Fuel Treatment Procedures.

94. Obtain Department Keys.

FIGURE 090-6

EO/EPO RELIEF CHECKLIST ASHORE

1. Review Personnel Allowance List.
2. Review Departmental and Divisional Worklist.
3. Review Current Ship Maintenance Project (CSMP File).
4. Review Current Availability Package(s).
5. Review Previous Availability Report(s).
6. Review Engineering Change Files.
7. Review Last STAN/RFO Assessment.
8. Review previous Relief Letter.
9. Review PMS Reports and Records.
10. Review Machinery History (CG2929) (Computer generated equivalent is acceptable)
11. Review all engineering personnel qualification letters.
12. Review Group SOP, MLC Sops and Instructions
13. Review Diesel Engine Maintenance Program (DEMP).
14. Review Engine Lubricating Oil History.
15. Review Tag Out Log/Lock Out Program.
16. Inventory General Purpose Property.
17. Review Full Power Trial Reports/Performance Analysis Report (PAR).
18. Review Boat Files and Boat Inspection Reports.
19. Operate All Machinery.

20. Operate Small Boats.

21. Review Casualty Report (CASREP) File.

22. Review Pending Maintenance and Logistics Command (MLC) Contracts.

23. Review Logs Required As Per The Naval Engineering Manual Chapter 090.

24. Review EO/EPO Standing Orders.

25. Check Unit Instructions to include the following.
    a. Unit Safety and Occupational Health Program.
    b. Respiratory Protection Program.
    c. Hearing Conservation Program.
    d. Hazardous Material Control Program.
    e. Unit Pre Mishap Program.
    f. Eye Protection.
    g. Fire Watch and Hot Work Safety.
    h. Aircraft Pre-Accident Plan.
    i. Working Aloft or Over the Side.
    j. Asbestos Management Plan.
    k. Confined Space Ashore Program.

26. Review Training Files.

27. Review Departmental Budget.

28. Review Allowance Shortages.

29. Review Latest Configuration Management Plus (Cmplus)/Shipboard Computer-Aided Maintenance Program (SCAMPS)/Management Information for Configuration and Allowances (MICA)

30. Review Inventory/OM&S.

31. Review Watch, Quarter and Station Bill.

32. Determine CSMP Backlog.

33. Inventory Repair Locker.

34. Review original copy of Docking Plan.

35. Check hydrostatic testing of compressed gas cylinders.

36. Inspect all spaces.

37. Obtain pertinent floppy disks for your area of responsibility.

38. Obtain master copy of standard specifications.

39. Obtain blueprint file index.

40. Review completeness and entered changes of Naval Ships Technical Manual (NSTM) Library.

41. Review fueling policy.

42. Review unit fuel reports.

43. Review Lite Off Schedule.

44. Review Securing Schedule.

45. Review Jacket Water Treatment Program.

46. Review Fuel Treatment Procedures.

47. Obtain Recent Commanding Officer (CO)/Officer In Charge (OIC) Material Inspection Reports.

48. Discuss Duty Section Rotation for Department.

49. Review Shore Station Maintenance Program.

50. Submit Short Term Training Request for MK-01 Engineering Administration

51. Obtain Department Keys.

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CHAPTER 091. SURVEYS OF CUTTERS AND BOATS

A. **<u>SERVICE LIFE</u>.** The original expected service life of a cutter or standard boat is established by a number of factors. The most important of these is the hull's structural life. The structural life is primarily determined by assessing the fatigue life of the hull material and the effects of expected reduction in material thickness due to corrosion and sandblasting. For most structural materials, the repeated cycles of loading due to motions in waves and slamming will eventually reduce the stress level at which the material will permanently deflect. Design engineers determine the number of stress cycles expected over the life of a craft, and then design the structure so that the projected maximum stresses do not exceed the fatigue stress limits. Corrosion and sandblasting is expected to slightly reduce the thickness of metal structures over time. By estimating the amount of material lost per year, considering the corrosion protection and maintenance plans, the design engineer will also account for the effect of reduced material thickness on structural strength. Other factors in determining vessel service life include the life expectancy of associated major machinery and electrical systems, comparisons of actual service life achieved by similar type vessels, and the weight growth of a craft over time.

B. **<u>SHIP STRUCTURE AND MACHINERY EVALUATION BOARD (SSMEB)</u>.** The SSMEB is the prime source of information on the material condition and remaining service life of the cutter and standard boat classes. This information allows the Commandant to formulate cutter acquisition plans and modernization alternatives. A fundamental step in this planning cycle is to periodically evaluate the remaining service life of each cutter and standard boat class and compare this against the future mission requirements. The SSMEB thoroughly evaluates the material condition of the cutter or standard boat class and determines its remaining service life. Table 091-2 lists for each class cutter and boat the original design service life, extensions to service life, the date of the last and next SSMEB, and the expected remaining service life.

1. <u>Objective</u>. The Board's overall objective is to determine the condition and estimate the Remaining Service Life of the cutter or boat class and its component systems. The Remaining Service Life as determined by the Board can then be further evaluated by G-SEN and cutter/boat Facility/Program managers to determine what further life-cycle cost analyses may be necessary to facilitate overall asset management decisions. In addition, this Remaining Service Life estimate can be compared by Facility, Program and Support managers to forecasted future mission requirements to enable renovate versus replace decisions.

   a. <u>Definitions</u>. The term "Remaining Service Life" shall be defined as the time period during which no "major expenditures" will be required for hull and structural repairs or modernizations, nor for machinery or system modernizations based solely on the cutter's/boat's capability to meet existing mission requirements. The definition of "major expenditures" is currently being established by the Naval Engineering Program guidance team in concert with cutter/boat facility managers and will be promulgated by G-SEN in a future change to this manual. However, as guidance in the meantime, Boards shall consider the "cumulative" cost effect when finding individual or multiple systems equipments which require estimated, aggregate expenditures in excess of 50% of the cutter's or boat's annual Standard Support Level.

b. Purpose & Further Guidance. By highlighting these areas, the Board serves to advise G-SEN and HQ Facility Managers that further cost-benefit analysis may be necessary to more accurately evaluate the Remaining Service Life of the cutter or boat in light of keeping those highlighted systems/equipments operational, supportable and maintainable. Using input from the cutter or standard boat Facility Manager, the Board must identify the existing mission requirements and evaluate the material condition of the cutter or boat, determine if those existing mission requirements are being met and establish the Remaining Service Life. All assumptions and caveats made by the Board concerning this determination shall be clearly stated in the Findings and Recommendations section of the report.

2. Evaluation Interval. One or more cutters of each class shall normally be evaluated 10 years after commissioning of the lead ship of the class and at each 5-year interval thereafter during the commissioned life of the cutter. One or more of each boat class may be evaluated 10 years after the midtime construction of the class and at each 3-year interval thereafter. Earlier evaluations may be appropriate for certain boats and cutters because of unusual design, service, or other special conditions. An Operational commander may request that G-SEN convene a SSMEB at a time other than stated in this instruction by submitting a letter request stating the reasons for the SSMEB. If G-SEN concurs, ELC (01) shall convene a board.

3. Cutter Selection. G-OCU/G-SEN shall determine the cutter or cutters to be evaluated. Input from the operational commander and MLCs shall be used to determine candidate cutters as well as the date and place of the cutter's drydock availability. ELC (01) will fund all SSMEBs.

4. SSMEB Members. The SSMEB shall consist of at least four Coast Guard personnel. One of these members shall be designated as President and another as recorder. At least three of the members shall be experienced in naval architecture or marine engineering. Board membership shall include representatives from the Facility Manager, ELC (01), Maintenance and Logistics Command (MLC (v)), NESU, and the area or district operations as appropriate. The Facility Manager shall provide information on existing mission requirements consistent with current policies and shall provide guidance on prime mission equipment. Other members, such as ordnance or logistics specialists, may be included on the board as conditions warrant. MLC (v) shall recommend a board president to ELC (01). ELC (01) shall designate all board members in writing. The evaluation shall be conducted on the selected cutter or boat during shipyard availability at the time of a scheduled routine drydocking. ELC (01) shall maintain specific guidance on the planning and development of the SSMEB in addition to the following guidance:

a. SSMEB development is a 24 month process beginning with the G-SEN Planned Obligation Program (POP) two years prior to the SSMEB convening date.

b. At least 18 months prior to the SSMEB, ELC shall send invitations for board membership, identify a cutter or cutters for the evaluation and begin to compile work items for the availability contract.

c. Twelve months prior to the SSMEB, ELC shall submit a request to G-SEN for POP funding of the SSMEB. G-SEN will also request a Future Mission Determination from the Facility Manager and a Supportability Review from the ELC.

d. ELC will provide the cognizant MLC (v) with the finalized items to be included in the availability contract prior to the first A team meeting. The list will include removal of interferences such as insulation, ballast, built-in furniture, shell plating, and piping, gas freeing of tanks, ultra-sonic thickness testing, drawing tail shaft if not accomplished during the previous 6 years, and inspection of valves and machinery. G-SEN, ELC and the MLC (v) will conduct any fleet surveys and task outside engineering firms to complete research or developmental work items as necessary.

e. Once designated, the President of the SSMEB shall coordinate with G-SEN, the ELC and the MLC, all work to be performed by a shipyard, the ship's crew, Manufacturer's Technical Representatives and the Board.

5. Reporting Procedure. The President of the SSMEB shall prepare a report of each board using Form CG-3496 (Ship Structure and Machinery Evaluation Board). The President shall submit the SSMEB Report to MLC (v) who in turn will forward the report to the operational commander. The operational commander shall review and comment upon the findings by endorsement. The operational commander shall then forward the report to G-SEN for review, comment and approval. G-SEN shall forward a copy of the approved report to the Facility Manager, operational commander, ELC, MLC (v) and the cutter CO/OIC. If information on conditions uncovered and reported by individual boards is applicable to other cutter or boat classes, ELC will disseminate the information to the appropriate operational commander.

6. Completion of Report. Form CG-3496 consists of nine sheets. The sheets provide the criteria under which the cutter is evaluated, the findings of the component evaluations, and the summary of findings and recommendations. The sheets are listed in Table 091-1 and explained in the following paragraphs.

TABLE 091-1. SHEETS OF FORM CG-3496

Form	Purpose
CG-3496A	Index
CG-3496B	Board Members and Cutter Data
CG-3496C	Findings and Recommendations
CG-3496D	Main Propulsion Machinery Findings
CG-3946E	Auxiliary Machinery and System Findings
CG-3496F	Prime Mission Equipment Findings
CG-3496G	Inside Compartment Findings
CG-3496H	Exterior Deck Space Findings
CG-3496I	Hull Exterior in Drydock Findings

a. Sheet 3496A. Index. The board shall list the sheets and enclosures and their page numbers. Examples of enclosures, which must be listed in the index, are supportability documents from ELC, manufacturer's letters, and other supporting technical data.

b. Sheet 3496B. This sheet lists the board members, previous SSMEBs, major mechanical and structural repairs and alterations, and primary mission data. The primary mission data is obtained from the Program Manager and forms the basis on which the cutter is evaluated. This mission data must represent present requirements and must be as definitive as possible.

c. Sheet 3496C. This is a summary of the findings sheets. It consists of two sections: Section 1, Findings and Section 2, Recommendations. In Section 1, the material fitness for the cutter's mission is determined and amplified by the summary of conditions and work list. The determination that the cutter is fit will be made on the premise that the urgent work list items will be accomplished as soon as practicable. If the cutter is determined to be materially unfit, the reason for this determination must be explained in Section 2. In Section 2, Part A, the board will predict the remaining service life of the four ship components: main propulsion, auxiliary, prime mission equipment, and ship's structure. In determining these values, the board must consider the present mission requirements, the material condition, and the supportability of the machinery. In Section 2, Part B, the board will provide the amplifying data on the minimum service life. If the cutter was determined unfit in Section 1, this shall be reflected as zero remaining service life and the reasons given for that condition. It must be noted that it is not the intent of this board to determine future suitability. The board must restrict its evaluation to material condition and supportability to meet present mission requirements.

d. Sheet 3496D. This sheet documents the condition and supportability of the main propulsion components. The condition will be determined from the examination of the machinery and from trends of full power trials. The condition shall be expressed in subjective terms such as “excellent," "poor," etc. The machinery supportability consists of the availability of parts and technical expertise. The board will receive input from the ELC on the supportability items before the evaluation. The board may augment or refine the ELC's determinations as necessary. The supportability items will be expressed in years. From this findings sheet, the board will input the cutter's present condition and will be able to estimate the main propulsion remaining service life.

e. Sheet 3496E. This sheet documents the condition and supportability of the auxiliary machinery. The same instructions (3496D) shall apply. Besides the listed auxiliary machinery the board may include other machinery and systems. The determination of which equipment is included must be based on replacement or modernization cost estimates. If the modernization cost is considered "major" (per para B.1.a) or requires Program Manager's funding, that cost estimate shall be included in the evaluation.

f. Sheet 3496F. This sheet documents the condition of the prime mission equipment. Mission essential equipment is that equipment specifically required to perform the cutter's mission. The equipment that is inherently necessary for the transportation and habitability of the crew is considered to be main propulsion and auxiliary equipment. Because of the variation in equipments, this sheet is generalized. The board shall list the equipment, its condition, and its supportability.

g. Sheet 3496G. One sheet shall normally be prepared for each deck between primary transverse watertight bulkheads. Compartments extending through more than one deck, such as engine rooms, need only be reported on one sheet. If a given sheet includes more than one compartment, the compartments shall be listed in the space provided.

h. Sheet 3496H. One sheet shall normally be prepared for each exterior deck, including superstructure decks.

i. Sheet 3496I. With the cutter in drydock, one sheet shall normally be prepared to document the hull exterior condition.

7. Machinery Evaluation Boards (MEB). To address overall supportability conditions for a class, ELC will schedule an MEB, approximately 6 years after commissioning of the lead cutter. The actual scheduling of the board will depend on logistic feedback information provided by the cutters, operational commander and the MLC. The MEB will conduct its evaluation like the SSMEB, except that forms CG-3496G, 3496H and 3495I, dealing with interior compartments, exterior deck spaces, and hull conditions, will not be completed. In special situations, special-case MEB's may be convened to evaluate only one major piece of machinery or HM&E system (for example, MDE's, main gas turbines, propeller control systems, CPP's, etc.). Reporting procedures for the MEB, including special case MEB's, are the same as for SSMEBs.

8. Ship Structure Evaluation Boards (SSEB). When the machinery supportability and condition of a cutter's installed equipment is not in question, a SSEB may be convened to determine the soundness of the cutter's structural members. The actual scheduling of the SSEB will depend on information provided by the units and the district. A board may be convened on a cutter of any age to document the condition of its hull structure. The SSEB will conduct its evaluation like the SSMEB, except that forms 3496D, 3496E, and 3496F, dealing with machinery and equipment will not be completed. Reporting procedures for SSEBs will be the same as for SSMEBs.

C. BOARDS OF SURVEY FOR BOATS. This section provides supplementary instructions for operational commanders and commanding officers of Headquarters units for the conduct and processing of Boards of Survey for boats. This information supplements the Property Management Manual, COMDTINST M4500.5 (series).

1. Discussion. In general, boats are the most costly item handled by a Board of Survey. Boats present problems not encountered in other surveys. Decisions must be made as to whether operational requirements for a particular boat justify repairs, and in some cases, as to which of two or more boats of a type in a district can most economically be repaired. If a boat is to be removed from service, a determination must be made on the following matters: (1) whether the need for salvageable equipment justifies the cost of removal and repair of certain major components, (2) whether a boat shall be disposed of as surplus or scrap, or destroyed. Considerations involving Federal law governing disposal of excess property versus public safety are involved.

2. Appointments of Boards or Survey. Operational Commander Operational commanders and commanding officers of headquarters units shall ensure that one or more members of a Board of Survey have adequate knowledge and experience to accurately arrive at a list of defects and required repairs. The convening authority shall ensure that the Board of Survey is given assistance as available and needed for arriving at estimated cost of repairs. Surveyed boats, if offered for further use, may be subject to inspection pursuant to 46 CFR Subchapter T, Parts 175 to 187 prior to their use and certification under Title 46, United States Code, section 390. To save time, Boards of Survey shall include a Marine Safety Office Representative when considering a boat that might be subjected to current inspection laws if offered for further use. In such cases, compliance with paragraph C.7 of this chapter is required. The convening authority shall assist the Board of Survey as necessary in determining the condition of the boat.

3. Action Required of Boards of Survey. In making surveys and preparing the record of action, Boards of Survey for boats shall be guided by the appropriate sections of the Property Management Manual, COMDTINST M4500.5 series, and appropriate sections of this Instruction. The boat shall, if operable, be operated underway before or after hauling for inspection. The Board of Survey shall make maximum use of probing, drilling, and non-destructive testing in performing the inspection.

4. Action Required of Operational Commander. When a Board of Survey report recommends disposal of a boat, the operational commander shall ensure that the Board recommendations are reviewed with careful consideration of the best interest of the government and public safety. Note that the end results are different when a boat is destroyed, that is, burned or cut into sections, and when it is scrapped. Boats placed on a scrap pile are frequently removed by other parties and eventually placed into use by private owners. Generally a boat will be disposed of in the district where it is surveyed. Therefore, when disposition is recommended, consideration shall be given to local conditions. Unfortunately, this matter cannot be simplified by destroying all boats that are surplus to Coast Guard needs. Boats having further usefulness are required by law to be offered to other government agencies for use or donation. Those determined to be surplus and not donated are required to be sold. Whatever the means of disposal, all documents associated with the transfer of the surveyed boat shall display the notice shown in para C.6.c as applicable.

5. Delegation of Authority. The operational commander's endorsement on Boards of Survey for boats shall not be delegated below Chief of Division level for powered boats, and Chief of Branch level for non-powered boats.

6. Additional Information Required on Survey Reports. The Board of Survey finding shall include:

   a. Specific Information.

      (1) Engines: Manufacturer, Model, Date installed and Hours of operation since last overhaul.

      (2) Maintenance cost for current and preceding fiscal year. (Hull and Machinery)

      (3) Hours of operation for current and preceding fiscal year.

      (4) List of repairs and estimated cost of each item to place the boat in sound operating condition. These repairs are those that good, economical maintenance practice would require to put the boat in condition for normally expected operations. The list shall not be made with the purpose of completely restoring the boat to like new condition. Repairs shall be grouped under headings of hull, machinery, electrical, and electronic.

      (5) Condition code of engine as outlined in Simplified Acquisition Procedures Handbook, COMDTINST M4400.13 (series).

   b. Opinions. The Board may, at its discretion, include opinions related to how suitable the boat is for its present usage and how feasible repairs are for retaining the boat at its present assignment or for reassigning it.

   c. Inspection Under Subchapter T. When a boat is to be offered for further use and such use may be as a passenger vessel of any sort, an inspection pursuant to Subchapter T regulations shall be accomplished. This inspection need only be made until one or two serious deficiencies are discovered. The finding of such deficiencies shall cause the Board to issue the following notice on the survey documents:

NOTE: This boat has been inspected pursuant to 46 CFR Subchapter T, Parts 175 to 187, and does not comply with those regulations pertaining to vessels carrying passengers subject to Title 46, United States Code, section 390.

7. Inspection Procedure for Boats.

   a. General Procedures. The following general procedures are applicable to inspections made of steel, aluminum or plastic boats:

      (1) Obtain a construction plan of the boat for general guidance in making the inspection. Study the plan to determine the areas where major deterioration is probable.

      (2) Have miscellaneous portable equipment and outfit removed from the boat.

      (3) Have all manhole and access covers, hatches, and plates removed, as well as all removable sections of deck and deck plating. The Board shall first confer with the convening authority; if it's necessary to gain access to a compartment for inspection by removing any permanent structure or section.

      (4) In making the inspection, pay particular attention to the structural members on which the basic structural soundness and seaworthiness depend. These main strength members, when damaged, are normally expensive items to repair. In addition, if deterioration is serious, these members must be repaired if the boat is to remain in service. These items usually determine whether restoration and continued use of the boat are economically justifiable, although a great number of less critical repair items may also make repairs uneconomical.

   b. Guidance Checklist for Inspection of Steel Boats. A preliminary visual inspection will expose defects such as deep pitting, excessively thin edges on structural shapes, fractures, bands or belts of corrosion across bottom plating that may indicate heavy working, and marked local corrosion. Sounding of the hull with a hammer will be indicative of condition only by comparison of one hull section to an adjacent one. An audio-gauge or equivalent device may be used to rapidly measure thickness at many locations. No penetration of steel is required but it may be necessary to remove the paint where the small sonic transducer is held to get an accurate reading. Gauging shall be accomplished whenever hull condition is marginal and a final determination must be made as to seaworthiness and the economics of repair. Gauging consists of drilling holes in the metal and measuring the thickness of the metal with a caliper or micrometer designed for the purpose. The following specific areas shall be inspected:

      (1) Inspect all dissimilar metal joints, including all aluminum-to-steel connections.

(2) Where the vapor barrier is destroyed or insulation is loose, cut away the insulation and inspect, especially in bilge areas.

(3) Inspect all hull fittings for corrosion regardless of the fastening method.

(4) Inspect all underside areas.

(5) Inspect rudder carriers and rudder posts.

(6) Inspect shaft log, struts, stern tubes, sea chests and waster pieces.

(7) Inspect all other hull inlet and outlet pieces.

(8) Inspect all bearing and bearing pieces.

(9) Inspect hull interior and exterior, particularly in flat areas for cracking with high intensity lighting.

(10)Inspect all framing, and stiffeners, particularly webs and underside of flanges. Special note shall be taken of any tripping or buckling.

(11)Inspect all machinery for condition and operation, including steering and wiring.

(12)Inspect all bottom areas for evidence of overstress or failure, generally indicated by dishing, cracks in weld or plate, or bands of corrosion.

c. Guidance Checklist for Inspection of Plastic Boats. The easiest and simplest method of inspecting plastic boats is visually. Many flaws can be detected during a visual inspection, particularly when transmitted light can be seen through the laminate. On most boats, however, the exterior resin coat is pigmented, making detection of interior flaws difficult. However, when inspected with transmitted light, a good laminate will appear uniformly translucent. Some variations may appear due to changes in gel coat thickness or pigmentation, laminate thickness, or overlaps in reinforcement. These light variations do not necessarily indicate flaws. Surface flaws in fiberglass laminates may generally be detected without difficulty. Particular attention shall be paid, therefore, to the inside areas that are hard to see and reach. The workmanship in these areas is indicative of the overall quality of the structure, since great care and attention to detail are essential to the production of a sound laminate. Sound is an important non-destructive testing method. A good laminate will, when tapped with a hard object such as a coin or a small hammer, produce a clear hard sound. A dull or muffled sound indicates that substantial quantities of air bubbles may be present, that delamination has occurred, or that the resin has not been cured properly. Before inspecting any boat, a thorough study shall be made of construction plans, if available. Familiarization with the structural details of the boat and possible hard spots, etc., will save time and minimize the danger of overlooking an important area. Inspections shall start with an overall look at the exterior surface, observing the following:

(1) Stress concentrations due to holes, hard spots in flexible panels, abrupt changes in shape, and inadequate thickness.

(2) Fatigue cracking, particularly on high speed boats subjected to repeated wave impact loading.

(3) A secondary bond failure is a connection made between separate members after the primary cure of the resin in the basic members. Examples are the connections between hull and longitudinals, hull and bulkheads, and transverse and longitudinal framing. These bonds must be made carefully during construction; they have been the source of more failures in fiberglass boats than any other cause.

d. Secondary Bonds. The longitudinal framing system of a plastic boat generally uses fiberglass hat sections, the top of which serve as support for the inner bottom.

(1) Possible sources of difficulty include failure of the stiffener-to-hull bond due to insufficient bond area, failure of the inner bottom-to-stiffener connection due to either bonding or mechanical fastening and collapse of the stiffener sides due to insufficient thickness. Stiffener-hull delamination is difficult to detect unless it is sufficiently well-advanced to permit observation of bottom shell movement relative to the stiffener flange. Failure of the inner bottom-stiffener connection will result in persistently loose fasteners. In extreme cases of bond failure, an apparent flexibility of the bottom will be evident when the boat is supported at bow and stern when out of the water. Stiffener wall collapse will be indicated by unusual flexibility of the inner bottom. Any of these failures will produce unusual flexure of the bottom with the boat running in waves.

(2) The best means of inspecting secondary bonds is by mechanical probing. This will frequently require the removal of interferences to gain access to the connection. In an unpainted laminate, white areas will be the first indication of weakness. Using a screwdriver or a paint scraper, the inspector shall attempt to probe between the two members and separate them by prying. If they are not securely bonded, they can be readily separated. A crack or separation, once started, will tend to continue along the joint. Continued flexing and vibrating in service will aggravate the condition.

e. Guidance Checklist for Inspection of Aluminum Boats. Before the inspection, the surveyor shall become familiar with the class of vessel by studying the general plans and construction data available. If possible, he/she shall interview personnel who know the particular boat or class regarding any known inherent problems, deficiencies, accident history, etc.

(1) Visual inspection is the primary method of surveying aluminum boats. However, aluminum construction lends itself to problems that may not be

visually perceptible to the surveyor. If doubts or problems arise, more sophisticated methods such as portable X-Ray, air or water (pressure) testing, or audio-gauging may be used to advantage. Dye penetrant testing of welds is also effective.

(2) Welds, structural members and bulkhead connections shall be inspected, with particular attention to the complete bottom structures of SAR boats. Particular attention shall be paid to areas prone to deterioration by electrolyte and corrosive action. Composite joints (connections) such as aluminum to steel and aluminum to fiberglass shall be closely examined.

f. Guidance Checklist for Inspection of Rigid Hull Inflatable Boats. Inspect inflatable hulls by a visual and pressure check of the hull. Check visually for:

(1) Apparent damage to the hull such as scrapes cuts or cracks. Note the number, location and condition of hull patches.

(2) Condition of hull anti-fouling gel coat.

(3) Damage or blockage of inlet and outlet holes in the ballast system.

(4) Condition of transom.

(5) Signs of mildew on the fabric.

(6) Conditions of floorboards and any other wooden pieces of the boat.

(7) Ability to perform scheduled PMS satisfactorily.

(8) Condition of steering and control cables.

(9) Conditions of associated fittings such as inter-communicating valves, navigation light systems, and lifting slings.

g. A pressure check shall be made on the hull to determine air tightness of all pressure compartments. Pressure shall be checked using a calibrated pressure gauge. The boat shall be inflated to the prescribed test pressure and monitored for the time recommended by the boat manufacturer. Small leaks, detectable by a loss of pressure over the test period, can be located by a soap and water test. The rigid fiberglass reinforced plastic portion of the boats shall be inspected in accordance with paragraph C. 7.c.

TABLE 091-2

SSMEB SCHEDULE AND REMAINING SERVICE LIFE

VESSEL CLASS	COMMISSIONED	DESIGN S/L	S/L EXTENSIONS	LAST SSMEB	NEXT SSMEB	REMAINING S/L*	
420' WAGB	1999	30 Years	None	None	2010	30 Years	Note 1
400' WAGB	1976	30 Years	RIP	2002	2008	4-7 Years	Note 2
378' WHEC	1967	30 Years	FRAM 1989	1999	2004	10 Years	Notes 1,3,4
295' WIX	1936	Unknown	None	2000	2003	10 Years	Note 2
290' WAGB	1944	30 Years	None	1990	None Planned	18 years	Note 2
282' WMEC	1972	30 Years	1999	Unknown	2009	9 Years	Note 1
270' WMEC	1983	28 Years	None	1999	2004	12 Years	Notes 1,3
230' WMEC	1942	30 Years	None	2000	2005	10 Years	Note 2
225' WLB	1996	30 Years	None	None	2007	27 Years	Note 1
213' WMEC	1944	30 Years	None	1992	2004	10 Years	Note 2
210' WMEC	1965	30 Years	MMA 1987	1998	2003	10 Years	Notes 1,3,5
180' A Class WIX (Gentian)	1942	30 Years	SLEP 1984 REN 1998	1995	2006	5 Years	Note 1
180' C Class WLB	1944	30 Years	MAJ REN 1978	1995	None Planned	5 Years	Note 1
175' WLM	1997	30 Years	None	None	2008	28 Years	Note 1
160' WLIC	1976	30 Years	None	2002	2008	8 Years	Note 2
140' WTGB	1977	30 Years	None	2001	2008	6 Years	Note 2, 6
123' WPB	2004	15 Years	None	None	2005	15 Years	Note 6, 11
110' A Class WPB	1986	25 Years	None	2001	2007	6 Years	Note 6, 11
110' B Class WPB	1989	25 Years	None	2003	2009	9 Years	Note 6, 11
110' C Class WPB	1991	25 Years	None	2000	2006	11 Years	Note 6
100' WLI	1964	30 Years	None	2001	2007	3 Years	Note 2
87' WPB	1998	25 Years	None	None	2009	19 Years	Note 6
75' WLR F Class	1991	30 Years	None	None	2006	20 Years	Note 1
75' WLR	1964	30 Years	None	2001	2007	3 Years	Note 2
75' WLIC	1962	30 Years	None	2000	2006	3 Years	Note 2

TABLE 091-2 con't

SSMEB SCHEDULE AND REMAINING SERVICE LIFE

VESSEL CLASS	COMMISSIONED	DESIGN S/L	S/L EXTENSIONS	LAST SSMEB	NEXT SSMEB	REMAINING S/L	
65' WYTL	1962	30 Years	None	2002	2008	3 Years	Note 2
65' WLR	1960	30 Years	None	2000	2006	3 Years	Note 2
65' WLI	1946	30 Years	None	2001	2007	10 Years	Note 2

BOAT CLASS	COMMISSIONED	DESIGN S/L	S/L EXTENSIONS	LAST SSMEB	NEXT SSMEB	REMAINING S/L	
55' ANB	1976-1987	25 Years	None	2002	2006	0 years	Note 1,10
49' BUSL	1999-2002	25 Years	None	None	2008	20 - 23 Years	Note 1, 6
47' MLB	1994-2003	25 Years	None	None	2008	15 - 24 Years	Note 1, 6
44' MLB	1961-1972	25 Years	None	Not Avail.	None Planned	0 years	Note 1, 6
41' UTB	1973-1983	25 Years	None	2001	2004	2 Years	Note 1, 10
30' SRB	1982-1986	20 Years	None	Not Avail.	None Planned	2 Years	Note 1, 6
26' MSB	1995-1997	15-20 Years	None	None	None Planned	10 - 12 Years	Note 1, 6, 8
25' TPSB	1998 - 2004	10 Years	None	None	None Planned	4-10 Years	Note 1, 6
25' RB-HS /RB-S	2003 - ?	15	None	None	2009	14 Years	Note 1, 6
23' CB-OTH	2001 - 2003	10	None	None	None Planned	7-9 Years	Note 1, 6

NON-STANDARD BOATS	COMMISSIONED	DESIGN S/L	S/L EXTENSIONS	LAST SSMEB	NEXT SSMEB	REMAINING S/L	
72' LCM	1952	not avail	None	None	None Planned	0	Note 1
64' ANB	1997-1998	30	None	None	None Planned	23-24	Note 1
63' ANB	1975	20 Years	None	None	None Planned	0	Note 1
56' LCM	1942	not avail	None	None	None Planned	0	Note 1

52' MLB	1956-1962	25 Years	None	Unkown	2004	0	Note 1, 9
45' BU	1957-1962	not avail.	None	Unkown	None Planned	0	Note 1

NOTE: **(1) Remaining Service Life is projected from January 2004.**

(2) Remaining Service Life is projected from last SSMEB report date.

(3) Machinery Service Life was re-evaluated in 2003 Sustainment Conference.

(4) Structural evaluation, SSEB, scheduled to be performed during October 2004.

(5) Side Scan/UT of approximately 50% of hull accomplished in December 2003 - February 2004

(6) Remaining Service Life based on Design S/L.

(7) 15 year design Service Life extended to 25 years on 110' WPBs with ShipAlt 110-A-021.

(8) Stablity Study conducted 2003, 23' CB-OTH designed as fleet replacement

(9) SSMEB Scheduled for 2004 to determine remaining service life and plan for service life extension overhaul.

(10) Remaining service life is based on recommendations of the last SSMEB

(11) Latest SSMEB repots indicated the vessel is reaching the end of service life faster than expected

TABLE 091-2

SSMEB SCHEDULE AND REMAINING SERVICE LIVE

VESSEL CLASS	COMMISSIONED	DESIGN S/L	S/L EXTENSIONS	LAST SSMEB	NEXT SSMEB	REMAINING S/L*	
420' WAGB	1999	30 Years	None	None	2010	30 Years	Note 1
400' WAGB	1976	30 Years	RIP	2002	2008	4-7 Years	Note 2
378' WHEC	1967	30 Years	FRAM 1989	1999	2004	10 Years	Notes 1,3,4
295' WIX	1936	Unknown	None	2000	2003	10 Years	Note 2
290' WAGB	1944	30 Years	None	1990	None Planned	18 years	Note 2
282' WMEC	1972	30 Years	1999	Unknown	2009	9 Years	Note 1
270' WMEC	1983	28 Years	None	1999	2004	12 Years	Notes 1,3
230' WMEC	1942	30 Years	None	2000	2005	10 Years	Note 2
225' WLB	1996	30 Years	None	None	2007	27 Years	Note 1
213' WMEC	1944	30 Years	None	1992	2004	10 Years	Note 2
210' WMEC	1965	30 Years	MMA 1987	1998	2003	10 Years	Notes 1,3,5
180' A Class WIX (Gentian)	1942	30 Years	SLEP 1984 REN 1998	1995	2006	5 Years	Note 1
180' C Class WLB	1944	30 Years	MAJ REN 1978	1995	None Planned	5 Years	Note 1
175' WLM	1997	30 Years	None	None	2008	28 Years	Note 1
160' WLIC	1976	30 Years	None	2002	2008	8 Years	Note 2
140' WTGB	1977	30 Years	None	2001	2008	6 Years	Note 2, 6
123' WPB	2004	15 Years	None	None	2005	15 Years	Note 6, 11
110' A Class WPB	1986	25 Years	None	2001	2007	6 Years	Note 6, 11
110' B Class WPB	1989	25 Years	None	2003	2009	9 Years	Note 6, 11
110' C Class WPB	1991	25 Years	None	2000	2006	11 Years	Note 6
100' WLI	1964	30 Years	None	2001	2007	3 Years	Note 2
87' WPB	1998	25 Years	None	None	2009	19 Years	Note 6
75' WLR F Class	1991	30 Years	None	None	2006	20 Years	Note 1
75' WLR	1964	30 Years	None	2001	2007	3 Years	Note 2
75' WLIC	1962	30 Years	None	2000	2006	3 Years	Note 2

TABLE 091-2

SSMEB SCHEDULE AND REMAINING SERVICE LIVE

VESSEL CLASS	COMMISSIONED	DESIGN S/L	S/L EXTENSIONS	LAST SSMEB	NEXT SSMEB	REMAINING S/L	
65' WYTL	1962	30 Years	None	2002	2008	3 Years	Note 2
65' WLR	1960	30 Years	None	2000	2006	3 Years	Note 2
65' WLI	1946	30 Years	None	2001	2007	10 Years	Note 2
BOAT CLASS	**COMMISSIONED**	**DESIGN S/L**	**S/L EXTENSIONS**	**LAST SSMEB**	**NEXT SSMEB**	**REMAINING S/L**	
55' ANB	1976-1987	25 Years	None	2002	2006	0 years	Note 1,10
49' BUSL	1999-2002	25 Years	None	None	2008	20 - 23 Years	Note 1, 6
47' MLB	1994-2003	25 Years	None	None	2008	15 - 24 Years	Note 1, 6
44' MLB	1961-1972	25 Years	None	Not Avail.	None Planned	0 years	Note 1, 6
41' UTB	1973-1983	25 Years	None	2001	2004	2 Years	Note 1, 10
30' SRB	1982-1986	20 Years	None	Not Avail.	None Planned	2 Years	Note 1, 6
26' MSB	1995-1997	15-20 Years	None	None	None Planned	10 - 12 Years	Note 1, 6, 8
25' TPSB	1998 - 2004	10 Years	None	None	None Planned	4-10 Years	Note 1, 6
25' RB-HS /RB-S	2003 - ?	15	None	None	2009	14 Years	Note 1, 6
23' CB-OTH	2001 - 2003	10	None	None	None Planned	7-9 Years	Note 1, 6
NON-STANDARD BOATS	**COMMISSIONED**	**DESIGN S/L**	**S/L EXTENSIONS**	**LAST SSMEB**	**NEXT SSMEB**	**REMAINING S/L**	
72' LCM	1952	not avail	None	None	None Planned	0	Note 1
64' ANB	1997-1998	30	None	None	None Planned	23-24	Note 1
63' ANB	1975	20 Years	None	None	None Planned	0	Note 1
56' LCM	1942	not avail	None	None	None Planned	0	Note 1
52' MLB	1956-1962	25 Years	None	Unkown	2004	0	Note 1, 9
45' BU	1957-1962	not avail.	None	Unkown	None Planned	0	Note 1

NOTE:

(1) Remaining Service Life is projected from January 2004.
(2) Remaining Service Life is projected from last SSMEB report date.
(3) Machinery Service Life was re-evaluated in 2003 Sustainment Conference.
(4) Structural evaluation, SSEB, scheduled to be performed during October 2004.
(5) Side Scan/UT of approximately 50% of hull accomplished in December 2003 - February 2004

TABLE 091-2

SSMEB SCHEDULE AND REMAINING SERVICE LIVE

(6) Remaining Service Life based on Design S/L.
(7) 15 year design Service Life extended to 25 years on 110' WPBs with ShipAlt 110-A-021.
(8) Stablity Study conducted 2003, 23' CB-OTH designed as fleet replacement
(9) SSMEB Scheduled for 2004 to determine remaining service life and plan for service life extension overhaul.
(10) Remaining service life is based on recommendations of the last SSMEB
(11) Latest SSMEB repots indicated the vessel is reaching the end of service life faster than expected

CHAPTER 094. FULL POWER TRIALS

A. FULL POWER TRIALS FOR CUTTERS. The full power trial is a periodic test of a cutter's propulsion plant operated at maximum rated power. The report of the trial results advises operating personnel and cognizant area, district, ELC, and Headquarters personnel of the cutter's current full power performance capabilities and characteristics.

1. Specific Trial Requirements and Reporting Procedure. Specific trial requirements and reporting procedures for each cutter class shall be in accordance with their respective PMS. A satisfactory Report of Full Power Trial shall be forwarded to ELC (01) at the following times:

    a. Within the first 6 months after the Coast Guard accepts a new cutter.

    b. Within the 6 months of completion of engineering changes that affect the full power capabilities of a cutter.

2. Reviewing Authority. The MLC(v) is the reviewing authority for full power trials. Trial data shall be compared with original or updated test or operating standards as applicable, and the cutter's capability determined with regard to the appropriate standard.

3. Corrective Action. In the event of an unsuccessful full power trial, the CO/OINC shall initiate action to correct deficiencies as soon as possible. Deficiencies beyond the unit's capabilities to correct shall be identified via CASREP for resolution.

4. Availability of Forms. Full Power Trial Log Summary forms for cutter classes required performing full power trials are located in SWII Form Filler or can be obtained from MLC or the ELC.

5. U.S. Navy Trial Requirements. Cutters under the operational control of the Navy shall perform any required full power trial according to the provisions of their respective Coast Guard PMS.

B. Full Power Trials for Standard Boats. Coast Guard standard boats are required to comply with a PMS requirement to verify the ability of the boat's power plant to function properly throughout its full rated range of operation. Specific requirements for these trials are outlined on the respective Maintenance Procedure Cards. Completion of this PMS shall be reported per Chapter 081. There is no requirement for a separate report of these results.

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CHAPTER 097. STABILITY TESTS

A. GENERAL.

1. The intent of this chapter is to prescribe the policy for stability tests performed on Coast Guard cutters and standard boats. The results of the stability test will determine the cutter's light ship center of gravity (KG) and displacement. The Stability Test Report documents the stability test and presents the data for all required loading conditions.

2. ELC (02) and G-SEN are aware of the ASTM Guide for Conducting Stability Tests and have carefully reviewed the first edition. The guide already has two annexes with several exceptions and contains several errors. For simplicity and clarity, it was decided to include inclining procedures herein and not refer to the ASTM guide at the present time.

B. STABILITY TEST FREQUENCY AND SCHEDULE.

1. G-SEN will determine which cutters receive a stability test. ELC (02) will be responsible for maintaining files on all stability tests. When a stability test is required, ELC (02) will notify the proper authority (MLCLANT, MLCPAC) at least 12 months in advance.
2. Cutters will be scheduled for a stability test per the following schedule:

    a. At least one designated cutter of a class shall have a stability test once every ten years except as stated in the following paragraph.

    b. For cutters which either cannot accept increases in KG or whose KG increases require close monitoring - at least one designated cutter of a class shall have a stability test once every five years.

    c. All new construction cutters and existing cutters, which undergo a major overhaul such as SLEP, MAJOR REN, MMA, RIP, or FRAM, shall have a stability test as follows:

        (1) Within 60 days of completion of the availability or before the vessel is deployed for an operational mission, whichever occurs first.

        (2) The first two cutters of a class delivered from the same shipyard shall undergo a stability test. Stability tests of subsequent cutters shall be decided by G-SEN based on evaluation of the results of the first two.

        (3) ELC may recommend to G-SEN to waive a stability test as required above if weight and moment monitoring data or other circumstances permit.

C. TEST PERSONNEL.

1. The Commanding Officer/Officer-in-Charge (CO/OIC) shall be responsible for preparing the cutter/boat for the stability test.

2. The MLC representative shall be present during the stability test to ensure the stability test is performed in accordance with the contract specifications.

3. Stability tests shall be witnessed by a G-SEN/ELC (commandant representative). The Commandant representative shall be given four weeks notice before the stability test.

4. The Commandant representative will verify the acceptability of the stability test arrangements and procedures. The Commandant representative shall notify the MLC representative and CO/OIC of any discrepancies noted before and during the stability test that may adversely affect or jeopardize the outcome of the stability test.

5. The Stability Test Officer (STO) is the person designated by the contractor having overall responsibility for the preparation for the stability test, the conduct of the stability test, and the presentation of accurate test data. The MLC Representative is responsible to ensure the STO performs the stability test properly. The STO shall have experience in conducting stability tests.

D. STABILITY TEST REPORTS: REVIEW AND APPROVAL.

1. Stability Test Reports shall be prepared by the STO per the specifications for the stability test. Computer programs used to prepare the Stability Test Report shall be pre-approved by ELC (02).
2. The STO shall verify that all data used in the Stability Test Report correspond to the test data and have been correctly incorporated into the report. Within four weeks of the stability test, the STO shall forward a draft of the Stability Test Report to ELC (02) via the MLC Representative for review. ELC (02) will provide comments on the draft report within four weeks of receipt.
3. The final Stability Test Report shall be approved by ELC (02).

4. Stability tests which were not required by ELC (02) shall not be used for updating any stability documentation.

E. STABILITY TEST PROCEDURES.

1. Stability test procedures shall be in accordance with Appendix 1 of this manual entitled "Coast Guard Cutter Stability Test Procedures". There shall be no deviation from or modifications of these standard procedures without ELC (02) approval.
2. Prior to departing the cutter, the STO, the MLC representative, and the Commandant representative shall initial each sheet of the stability test record to indicate their concurrence with the acceptability of the stability test conditions and performance. These initials do not pre-approve the Stability Test Report that is to be developed and submitted by the STO and finally approved by ELC (02).

CHAPTER 110. BOAT STRUCTURE

A. **GENERAL**. In order to keep cutters abreast of the latest improvements in repair techniques, MLCs shall promulgate and maintain standard specifications for fiberglass (reinforced plastic), laminated wood, and rigid inflatable boats. Specific manufacturer's instructions shall be followed when provided.

1. Repair of Fiberglass Reinforced Plastic Structures. Damaged sections of reinforced plastic structures can be repaired by patching with materials similar to those used in the construction of the structure itself. The repair process involves preparation of the damaged section and application of a patch, consisting of glass reinforcing material and liquid polyester resin compatible with the OEM lay-up schedule.

2. Repair of Boats of Laminated Wood construction. The stem, stern posts, shaft logs, and in some cases, the keels of certain older type boats are made of laminated wood. Construction consists of layers of wood glued together under pressure and planking consisting of two filleted (usually diagonal) layers with, light canvas in between. All are laid in glue, clamped under pressure, and cured in a heated chamber. The repair of damage to laminated craft is difficult. Units should contact MLC for technical guidance and assistance.

3. Repair of Rigid Inflatable Boats. Manufacturer supplied or manufacturer recommended repair kits should be used in the repair of inflatable hulls.

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CHAPTER 233. INTERNAL COMBUSTION ENGINES

A. **<u>JACKET WATER TREATMENT PROGRAM</u>**. The guidance and policies cited here are provided for the purpose of; Lending guidance toward the selection of suitable cooling system corrosion inhibitor products for Coast Guard internal combustion engines. Lending guidance for maintaining and testing internal combustion engine coolant.

1. <u>Applicability</u>. The jacket water treatment program applies to all internal combustion engines on cutters and boats that use closed loop jacket water cooling systems.

2. <u>Requirements for an Effective Treatment Program</u>. To be effective, the cooling system treatment program must meet the following conditions:

   a. The cooling system should be clean so that the inhibitor will be able to act on the bare metallic surfaces of the water jacket.

   b. The coolant must be checked periodically for contaminants and inhibitor concentration. The inhibitor must be maintained at the concentration specified by its manufacturer.

   c. Make-up Water Requirements: Water required for final flushing, fresh filling, topping off cooling systems, or for mixing chemicals for addition to a cooling system, shall be checked for chloride concentration (ppm) and conductivity prior to adding it to the engine. The requirements for acceptable Make-up Water quality (as defined above), shall be as follows:

      (1) Conductivity shall not exceed 150 µmohs/cm. Conductivity measurements shall me conducted in accordance with S9086-GX-STM-030/CH-220V3R2, NSTM CH 220, Vol 3, paragraph 220-42.7. (See paragraph 11 for information regarding conductivity meters).

      (2) Chloride Concentration shall not exceed 60 ppm. This test can be done in a similar manner to the Chloride test conducted for NALCOOL 2000 and water (NSTM CH 220, Vol 3, paragraph 220-44.10, with the following exceptions:

         (a) In step 3, using the 10 ml graduated cylinder pour (3) 10 ml quantities of sample into a 50 ml beaker.

         (b) Skip steps 4,5 and 6. Cupric sulfate is not needed for measuring the chloride concentration of make-up water, therefore these steps aren't required.

   In general, make-up water shall NOT be added to an engine's cooling system unless it is tested and meets the conductivity and chloride concentration requirements provided above. There may be circumstances in wh ich a Coast Guard Vessel that is underway has to replenish or top-off with water and can't meet the above requirements. An example of such a circumstance would be a cutter with a single pass R/O system, underway in the midst of a mission. If they needed to add water to an engine while underway, it would presumably come from the R/O unit upstream of the brominator connection. Depending on the temperature and salinity of the ambient seawater, the product from the R/O may be well above the limits provided above. Where this is the case, the conductivity and chloride concentration of make-up water shall be measured and recorded in the Engine Cooling Water Treatment logbook prior to adding it to the engine. Where the make-up water exceeds 100 ppm chlorides and/or 150 µmohs/cm conductivity, and the quantity added exceeds 25% of the capacity of the system, it is recommended that the unit flush and refill the engine as soon as possible. In general, all units shall use portable ion exchange units, shipboard distilling plants, pierside or shipboard demineralizers etc., to produce make-up water that meets the conductivity and chloride concentration requirements listed above. Where, a Coast Guard vessel is involved in an availability that includes maintenance that requires engine jacket water to be changed or replenished, the cognizant MLC shall include in their availability specification a line item for the Shipyard to provide demineralizers of sufficient throughput to provide enough demineralized water to completely recharge (from empty to full) the largest affected engine in less than 2 hours.

For the 270 WMEC's currently with single pass R/O units, it is highly recommended that an Engineering Change be enacted to add a 2nd R/O "polishing stage" or a permanently installed ion exchange type demineralizer.

d. The primary cooling system must be mechanically tight to prevent excessive leaks of coolant out of the system or leaks of combustion gasses or air into the system.

3. Jacket Water System Maintenance.

a. Units shall perform all cooling system routine maintenance in accordance with the applicable PMS manual.

b. In addition to performing required PMS the following general system practices should be followed:

(1) Ensure the airtight integrity of the engine water pump and all external piping and joints.

(2) Maintain the jacket water system vents clear to allow continuous venting of all vapors.

(3) Maintain jacket water pump packing glands tight enough to prevent excessive loss of coolant.

(4) Inspect the jacket water passageways periodically and thoroughly to determine how effective the jacket water treatment program is in preventing corrosion and erosion. Whenever major work is done on an

engine, it is recommended that at least one cylinder liner be removed and the adjacent jacket water areas of the engine block be carefully examined.

c. System Corrosion. Any engine experiencing corrosion, erosion, scaling, or sludging conditions should be thoroughly examined to determine the cause. Commanding Officers and Officers-in-Charge should report the facts to the Maintenance and Logistics Command (MLC). The MLC(v) should take whatever steps are necessary to determine the cause and assist in corrective action.

d. Analysis. Analysis should be conducted to assist in identifying the cause of an adverse condition. The Engineering Logistics Center (ELC) Code 01 (Platform Division) should be kept advised of all instances where the jacket water treatment program is not effective.

e. System Cleaning. If it is necessary to ACID CLEAN the cooling system of any internal combustion engine, the Commanding Officer or Officer-in-Charge should request the assistance of the MLC(v). Inhibited hydrochloric acid is generally used for cleaning badly scaled engine cooling systems; however, the use of such chemicals is authorized only for repair facilities, shipyards, or contractors specializing in this service.

f. Special Treatment. MLC's are authorized to provide additional water treatment instructions in areas of adverse water conditions. ELC (01) shall be kept advised of all such instances.

g. Safety Precautions. Engine jacket water systems shall never be directly connected with the potable water supply. Most corrosion inhibitors and chemical reagents used to test engine coolant contain acids or alkalis and are toxic. In light of this, personnel should avoid any contact of the skin or eyes with corrosion inhibitors, antifreeze or testing chemicals. If the inhibitor, antifreeze or testing chemicals come in contact with the skin, the affected areas should be washed immediately with soap and water. Seek immediate medical attention if eye contact or ingestion occurs.

(1) Handling Procedures. Wear rubber gloves, a face shield, and an apron when handling inhibitors, inhibitive antifreeze, or testing chemicals. Inhalation of ethylene glycol vapors from hot coolant treated with antifreeze shall be avoided.

(2) Alkalis. PH buffering in corrosion inhibitors contain strong alkalis. If alkalis contact the skin, flush the affected area with cold water until the slippery feeling disappears. If a burning or itching sensation persists, seek medical attention. If alkali comes in contact with eyes, flush with large amounts of potable water and seek immediate medical attention. All alkalis must be stored separately from acids.

(3) Acids. Cupric sulfate pentahydrate is a strong acid. It is used as a reagent in the chloride test for coolant treated with MIL-A-53009 inhibitor, NALCOOL 2000, PENCOOL 2000, NALCOOL 3000 and PENCOOL 3000, some inhibited antifreezes and in general all products that utilize the yellow metal inhibitor TTZ. If acids contact the skin, flush the affected skin area with cold water. If a burning or itching sensation persists or a rash develops, seek medical attention. If this or any other acid comes in contact with the eyes, flush with large amounts of potable water and obtain immediate medical attention.

(4) Poisons. All the test and inhibitor chemicals are poisons having varying degrees of toxicity. Isopropyl alcohol is different from ethyl alcohol. Small amounts of isopropyl alcohol, if swallowed, can cause serious illness. Sodium chromate is poisonous by ingestion, inhalation, or skin absorption and is irritating to the eyes, skin, and mucous membranes. Inhibitive antifreeze consists primarily of ethylene glycol, which is toxic by ingestion. Its vapors are also toxic. MIL-A-53009 inhibitor PENCOOL 2000, NALCOOL 2000, PENCOOL 3000, NALCOOL 3000, and NALFLEET 9-111 are toxic by ingestion. Cupric sulfate pentahydrate is toxic and is irritating to the eyes, skin, and mucous membranes. Phenolphthalein, when not used medicinally as a laxative, is a poison.

4. Specific Treatment Requirements. The following paragraphs describe the Jacket Water additive treatment requirements used in Coast Guard shipboard diesel engines. Frequent references are made in this paragraph and its sub-paragraphs to paragraphs and Tables in NSTM Chapter 220 Volume. For this revision of the Coast Guard Naval Engineering Manual the applicable version of the NSTM is S9086-GX-STM-030/CH-220V3R2, dated 1 April 2002.

a. Jacket Water Corrosion Inhibitor Treatments. The following paragraphs briefly describe the various inhibitor treatments approved for use in Coast Guard shipboard diesel engines. Frequent references are made in this paragraph and its subparagraphs to NSTM Chapter 220, Volume 3.

(1) NALCOOL 2000 and PENCOOL 2000: These products consist of a blend of inhibitor chemicals in aqueous solution. The major components are: Sodium nitrite, sodium tetraborate, sodium silicate, sodium mercaptobenzothiazole (MBT) and tolytriazole (TTZ). Sodium nitrite aids in the formation of a protective oxide layer on ferrous surfaces. This helps prevent cylinder liner pitting and cavitation. Sodium tetraborate is used for PH buffering. Specifically, it neutralizes acidic byproducts resulting from the products of oxidation. One cause of this is blow-by gasses leaking into the coolant. Sodium silicate forms a silicate film on anodic metal surfaces. MBT and TTZ form thin film protective layers on copper and copper alloy surfaces. While this coolant includes sodium silicate its concentration is not high enough to effectively protect

aluminum components. **Therefore, the use of NALCOOL 2000 and PENCOOL should be limited to engines that don't have wetted aluminum surfaces or components in the cooling system.**

(2) NACOOL 3000 and PENCOOL 3000: These products are similar to those described in 4.a.(1.) in that they adequately protect against cylinder liner pitting and cavitation, protect both ferrous and copper alloy surfaces and has a powerful PH buffering agent. However, NALCOOL 3000 and PENCOOL 3000 also contain compounds that adequately prevent the formation of precipitates and gel deposits. Typically the formation of these deposits is caused by (1) High concentrations of salts in aqueous solution resident in a corrosion inhibitor combining with corrosion inhibiting chemicals resident in antifreeze to form precipitate(s), or (2) salts resident in hard water combining with chemicals in aqueous solution resident in the corrosion inhibitor or antifreeze to form precipitate(s). **As is true with NALCOOL 2000 and PENCOOL 2000, NALCOOL 3000 and PENCOOL 3000 should not be used in engines with wetted aluminum components in the cooling system. It is preferable to use these products in lieu of NALCOOL 2000 and PENCOOL 2000 when make-up water is harder than prescribed limits, or when combining with antifreeze.**

(3) MIL-A-53009 Corrosion Inhibitor: MIL-A-53009 corrosion inhibitor for diesel engine jacket water systems is available in the national stock system. The use of MIL-A-53009 corrosion inhibitor is limited to engines that are not prone to cylinder liner cavitation and do not contain wetted aluminum parts or components in the cooling system. MIL-A-53009 inhibitor utilizes the chemicals sodium metaborate, potassium silicate and mercaptobenzothiazole (MBT). Sodium Metaborate is an alkaline buffer which neutralizes acid by products from blow by gases leaking into the coolant. Potassium silicate forms a silicate film on metal surfaces which provides good corrosion protection for mixed metal systems. MBT is an effective corrosion inhibitor for yellow metal surfaces (copper, bronze, cu-ni, etc). This product contains no sodium nitrite, and thus is not effective at preventing cylinder liner pitting and cylinder liner cavitation.

(4) NALFLEET 9-111 Inhibitor: NALFLEET 9-111 is an effective inhibitor for cooling systems with aluminum wetted surfaces. This is due to the high concentrations of sodium silicate. The likelihood of silicate drop-out occurring when using this product is higher then when using the other inhibitors discussed in this section. In light of this, **this inhibitor should never be mixed with anti-freeze. This inhibitor should only be used in engines with wetted aluminum surfaces in the cooling system.** Nalfleet 9-111 contains sodium nitrite, sodium hydroxide and sodium silicate. Sodium nitrite protects ferrous metal surfaces, sodium hydroxide is a strong base used for maintaining PH, and sodium silicate

primarily protects aluminum surfaces from attack.

(5) A-A-52624 TYPE I Inhibited Antifreeze: A-A-52624 Type I inhibited antifreeze is an ethylene glycol-based inhibitive antifreeze that is available through the stock system. A-A-52624 TYPE I inhibited antifreeze replaces MIL-A-46153 which was cancelled. Mixtures of A-A 52624 Type I, used with NALCOOL 2000, PENCOOL 2000, NALCOOL 30000 or PENCOOL 3000 is authorized for engines prone to cavitation, that don't contain wetted aluminum surfaces that require freezing protection.

(6) Caterpillar Extended Life Coolant 50/50 Premix: This coolant/inhibitor is approved for all Caterpillar engines. Caterpillar 50/50 premix is a premixed 50/50 solution of ethelyne glycol in de-ionized water. CAT ELC includes carboxylates (Ferrous metal and aluminum protection), nitrites (Ferrous metal protection), tolytriazole (yellow metal protection), and silicates (aluminum protection).

(7) Corrosion Inhibitor for 87 ft CPB Main Diesel Engines: MTU has provided a list of acceptable corrosion inhibitors in the MTU Fluids and Lubricants Specification, A001061/23E. Corrosion inhibitors used in the 87 ft CPB main engines shall be in accordance with this document. The inhibitor used in most of the 87 WPB main engines is Glysacorr G93, produced by BASF. This is an inhibited antifreeze.

(8) Cutters may request to use corrosion inhibitors other than the ones listed above. Requests to use other corrosion inhibitors shall be submitted to the cognizant MLC (v). MLC (v) will forward the request to ELC (01) for consideration. These requests must be accompanied by written testimonial from the engine manufacturer. Testimonials must explicitly state that the corrosion inhibitor is suitable for use in a specific model or line of engines and will not cause or contribute to cooling system corrosion, cavitation, or damage to the engine.

5. Guidance Regarding the Use of Antifreeze.

a. Antifreeze shall be used on:

(1) All boats less than or equal to 65 ft in length.

(2) All engines that utilize keel coolers.

b. The use of commercial antifreeze is authorized, pending approval of the cognizant ELC type support desk. Different brands are formulated with different corrosion inhibitors. Not all ethelyne-glycol coolant corrosion inhibitor packages provide adequate protection for a given engine. Avoid mixing different brands/types of antifreeze. The different inhibitor packages may be incompatible with each other.

6. Engine Coolant Testing: In general jacket water testing and maintenance shall be in accordance with the applicable PMS cards. This paragraph and its sub paragraphs are provided as supplemental guidance to the PMS cards. The engine coolant procedures cited below are in accordance with S9086-GX-STM-030/CH-220V3R2, NSTM, CH 220, Volume 3, dated 1 April 2002. At minimum, jacket water should be tested monthly and whenever jacket water, inhibitors or antifreeze are added.

a. Nalcool 2000 and Water, PENCOOL 2000 and Water, NALCOOL 3000 and Water, and PENCOOL 3000 and Water: Tests for these inhibitors in water shall include:

(1) Chloride Concentration Tests: Chloride concentration should not exceed 100 ppm.

(2) Nitrite Concentration Tests: Nitrite concentration should be 1000-1500 ppm.

(3) Test: Tests for these inhibitors in water shall be in accordance with NSTM, CH 220, Volume 3, paragraphs 220-44.9, 220-44.10 (Chloride Test), 220-44.11 (Nitrite Test).

(4) Test Kits: Supply information for Nalcool 2000, Nalcool 2000 test kits and test apparatus can be found in NSTM, CH 22O, Volume 3 Table 220-44-2. The test kits and test apparatus listed in CH 220, Volume 3 Table 220-44-2 also apply to PENCOOL 2000, PENCOOL 3000 and NALCOOL 3000.

b. MIL-A-53009 Inhibitor: Tests for MIL-A-53009 inhibitor shall include:

(1) MBT Level Tests: MBT levels should be 100 to 500 ppm.

(2) Reserve Alkalinity: 6 RA units (Minimum).

(3) Chloride Concentration: 100 ppm (Maximum).

Tests for MIL-A-53009 Inhibitor treatment shall be in accordance with NSTM 220 Volume 3, paragraphs 220-43.9, 220-43.10 (Chloride Test), 220-43.11 (MBT Test) and 220-43.12 (Reserve Alkalinity Test). Supply information for test kits and testing apparatus for MIL-A-53009 inhibitor can be found in NSTM, CH 220, Volume 3, Table 220-43-1.

c. Nalfleet 9-111: When using Nalfleet 9-111, tests for nitrite level, ph, chloride concentration and free silica (SiO_2) are recommended. The acceptable levels are as follows:

(1) PH: Should range between 8.3 and 11.

(2) Nitrite Level: Should be 1050-1500 ppm.

(3) Chloride levels: 100 ppm (Maximum).

(4) Silica: Free SiO_2 should be between 70 and 190 ppm.

(5) Test: The recommended tests for Nalfleet 9-111 includes Nalfleet p/n MO 246A, (Test kit for Chloride level, Nitrite level, and PH), and a test kit for measuring free silica. The Nalfleet test kit (Nalfleet p/n MO 246A) consists of potentiometric titrations for nitrite and chloride concentrations and test strips for PH. Of the available test kits for measuring free silica, one that is recommended is the Hach Pocket Colorimeter for measuring SiO_2, Hach p/n 46770-34. This is a filter photometer designed and calibrated specifically for measuring the concentration of SiO_2 content in solution. The principal of operation is as follows; a sample is mixed with three different reagents (citric acid, molybdate, and a mixture of sodium chloride and sulfamic acid). The sample is then capped and placed in a colorimeter. A light source is directed through the sample and absorbance level is measured at wavelengths characteristic of SiO_2. The readout is in mg SiO_2/liter of solution. For Nalfleet 9-111 in water this is equivalent to ppm SiO_2. Thus, for example, a read-out of 80 mg/liter on the colorimeter display translates to 80 ppm SiO_2. Supply information for Testing NALFLEET 9-111 inhibitor is provided in NSTM 220 Volume 3, Table 220-47-4. (See paragraph 11. for more information on the Hach SiO_2 pocket Colorimeter.)

d. A-A-52624 TYPE I Inhibited Antifreeze: When using A-A-52624 Type I Inhibited Antifreeze the following tests are performed:

(1) Reserve Alkalinity: 6 RA units(minimum).

(2) Chloride concentration: 100 ppm (maximum).

(3) Antifreeze Concentration: Between 40%-50%

Test procedures for A-A-52624 Type I inhibited antifreeze are provided in NSTM, CH 220, Volume 3, paragraphs 220-45.8, 220-45.9 (Chloride Test), 220-45.10 (Reserve Alkalinity Test), and (220-45.11 (Freezing Protection Test). Supply information for A-A-52624 TYPE I inhibited antifreeze testing apparatus can be found in NSTM, CH 220, Volume 3, Table 220-45-2.

e. Combination Treatment MIL-A-53009 inhibitor and A-A-52624 TYPE I Inhibited Antifreeze: When using this combination treatment the following tests are recommended:

(1) MBT concentration: Between 300 and 500 ppm.

(2) Reserve Alkalinity: 6 RA units (minimum).

(3) Chloride level: 100 ppm (max).

(4) Antifreeze concentration by volume: 35%-40%.

Test procedures for combination treatment of MIL-A-53009 inhibitor and A-A-52624 TYPE I inhibited antifreeze are provided in NSTM, CH 220, Volume 3, paragraphs 220-43.10 (Chlorides), 220-43.11 (MBT), 220-43.12 (Reserve Alkalinity), and 220-45.11 (Freezing protection).

f. Combination Treatment of NALCOOL 2000, PENCOOL 2000, NALCOOL 3000 or PENCOOL 3000 and A-A-52624 TYPE I inhibited antifreeze: The tests used when running with this combination treatment are as follows:

(1) Nitrite Level: Should be 1000-1500 ppm.

(2) Chloride Level: 100 ppm (Max).

(3) Antifreeze Concentration: Concentration should be maintained between 30%-45%.

(4) Test procedures: All procedures for these inhibitors shall be in accordance with NSTM 220 Volume 3, paragraphs 220-44.10 (Chloride Test) and 220-44.11 (Nitrite Test) and 220-45.11(Freezing Point Test).

g. Caterpillar Extended Life Coolant: Caterpillar has recently developed commercially available test kits for this inhibited antifreeze. The unit has the option of performing these tests monthly or submitting a coolant sample monthly to participating Caterpillar dealers or laboratories for CAT SOS level 1 coolant analysis. When testing this product the following parameters are checked:

(1) Carboxylates (organic acid inhibitor): Should be at or above 85% of the original concentration.

(2) Nitrites: Should be above 200 ppm.

(3) Percent Antifreeze: Should be between 45-45% antifreeze by volume.

(4) Carboxylate Test: It's recommended that Caterpillar Part number 172-8851 be used. This is a pass/fail field test for carboxylates concentration.

(5) Nitrite Test: It's recommended that Caterpillar part number 8T-5296 be used.

(6) Percent Antifreeze: Just about any refractometer or hydrometer can be used. Caterpillar part number 1U-7297 is a refractometer that can be used.

(7) Chloride Concentration test: Use the procedures outlined in NSTM, CH 220, Volume 3, paragraph 220-45.9. These are the procedures used for testing A-A-52624 Type I inhibited antifreeze.

(8) Caterpillar level 1 SOS Coolant Analysis: In lieu of using the test kits referenced above units may submit samples on a monthly basis for level 1 Caterpillar SOS coolant analysis. For level 1 analysis the unit will submit samples monthly and the lab will check for carboxylate, nitrite, molybdate and antifreeze concentration. In addition, the unit shall request that chloride concentration be measured. This is not part of the standard level 1 test package, however some of the SOS labs will do this for an additional fee. The SOS lab provides results along with accompanying recommendations to the unit.

7. Actions for Out of Limit Results: Actions for out of limit results for NALCOOL 2000 in water, inhibitor MIL-A-53009, A-A-52624 Type I inhibited antifreeze, combination treatment of inhibited antifreeze and inhibitor MIL-A-53009, combination treatment of inhibited antifreeze and NALCOOL 2000, and NALFLEET 9-111 shall be in accordance with NSTM, CH 220, Volume 3. For inhibitors not addressed in NSTM, CH 220, Volume 3, consult with the inhibitor manufacturer for recommendations regarding out of limit results.

8. Disposal of Spent Test Samples, and Spent Coolant: Shall be in accordance with the latest revision of NSTM, CH 593, Appendix D.

9. Exchanging Corrosion Inhibitor: When one corrosion inhibitor is exchanged for another, the jacket water system shall be flushed and cleaned before the new inhibitor is added.

10. Conductivity Meters: The following conductivity meters are recommended for use in determining the adequacy of Make-up Water:

a Orien 105A+ Portable Conductivity Meter: Features are as follows: LCD display, intuitive menu driven operation, automatic temperature compensation feature, adjustable temperature compensation factor, provides an easy method for calibrating the conductivity cell K factor with the use of standard solutions that can be purchased.

b Orien 115A+ Portable Conductivity Meter: Features are as follows: LCD display, intuitive menu driven operation, automatic temperature compensation feature, adjustable temperature compensation factor, provides an easy method for calibrating the conductivity cell K factor with the use of standard solutions which can be purchased, can log data and transmit data to a printer or computer.

Conductivity Meters can be purchased from:

Thermo Electron Corporation, 166 Cummings Center, Beverly, MA, Phone: 978-

232-6000, Fax: 978-232-6015

11. Free Silica Measuring Pocket Colorimeter: All units using Nalfleet 9-111 are now required to check free silica concentration levels as part of their periodic jacket water testing program. An instrument that can be used for doing this is the Hach Pocket Colorimeter for Measuring free Silica (SiO_2) concentration, p/n 46770-34. This instrument is packaged as follows:

    a. Pocket Colorimeter, Hach p/n 46770-34, (2) 10 ml sample cells, Acid reagent powder pillows, Molybdate reagent powder pillows, citric acid powder pillows, (4) AAA alkaline batteries, (1) plastic case and (1) manual. For this particular instrument, the measuring range is 0- 100 mg/l of SiO_2. The acceptable range of free SiO_2 in the jacket water is 70-190 mg/l. In light of this, add 5 ml of distilled water to 5 ml of jacket water sample to both cells (vials) when testing. The acceptable range as read out on the instrument display should be 35-95 mg/l. If you add 5 ml of distilled water to 5 ml of sample, the actual concentration of $Si0_2$ will be twice that shown on the instrument display. For more information on the Hach Pocket Colorimeter for measuring free SiO_2 levels contact:

    b. Hatch Company, P.O. Box 389-0389, Loveland CO, 80539, Phone: 970-669-3050, Fax: 970-669-2932.

B. DIESEL ENGINE MAINTENANCE PROGRAM - OVERHAUL GUIDANCE. This section provides overhaul guidance for the diesel engine models listed in Table 233-1. The diesel engine maintenance program for boats shall be performed in accordance with the prescribed maintenance procedure card. Marine diesel engines not covered by Table 233-1 or PMS shall be maintained according to the applicable Technical Publication or manufacturer's instruction book.

1. Background. The Coast Guard Diesel Engine Maintenance Program provides cost-effective maintenance by renewing engine components near the end of their useful lives without incurring an unacceptable risk of in-service failure. Various engines lend themselves to different methods of determining the time to overhaul, that is, oil analysis, condition monitoring, accumulated hours, full power trials, trend analysis, etc. Many factors affect the permissible operating interval between overhauls. Among these are:

    a. Design and quality of components installed originally or during subsequent overhauls.

    b. Operation of the engine at the rated power versus speed curve and variations in the load and speed during operations.

    c. Operation in abrasive (airborne sand) and corrosive (salt water spray) environments.

    d. Quality of workmanship during an overhaul.

e. Operating procedures such as maintaining engine system temperature and pressures within specified limits.

2. Periodic Inspection or Overhaul. To provide a basis for planning maintenance time, budgeting engine remanufacture/repair, orderly acquisition of parts, on-the-job training, and a high quality overhaul, the hourly intervals listed in Table 233-1 shall be used as guidance for planning center section overhauls. Center section overhauls shall be done based on the condition of the engine and not solely based on engine hours. This is especially true for the larger medium speed diesels engines used by the Coast Guard such as CAT 3608's and Fairbanks-Morse. The condition of the engines shall be determined by, but not limited to: DEMP readings and the trends they indicate, full power trial results, condition based monitoring programs such as CAT CAMPAR testing, boroscope inspections and in some cases, continuous monitoring by an online monitoring system. Before the engine reaches the hours in table 233-1, each engine shall be evaluated by the cutter or station EO or EPO and the MLC to ascertain whether the condition warrants overhaul. If the conditions do not warrant an overhaul, the MLC may authorize a delay in overhaul up to 20% of the overhaul hours listed in 233-1. Delays shall be requested from the cognizant MLC (v) via the unit's chain of command. The unit shall continue to perform full power trials and DEMP performance monitoring (as required) at their required periodicity during the overhaul extension period, to monitor possible degradation in engine performance. Successive extensions to OVH's may be granted by the MLC as engine conditions warrant. This includes canceling top end overhauls or performing top end overhauls in place of center section overhauls if conditions warrant. The MLC's response to requests for overhaul extensions shall include a new projected date of overhaul and a reminder to continue PMS procedures (including DEMP and full power trials as required) at the required periodicity.

3. Center Section Overhaul Feedback. To optimize the intervals of the required period maintenance, the overhaul experiences of afloat units must be collected, analyzed, and disseminated. To this end, any major inspection or overhaul on a diesel engine center section shall be reported as specified in Chapter 090.

4. Overhaul Kits. Traditional time-based overhauls, on ALCO 251 main diesel engines, have been replaced with the DECM Program that only replaces components when they actually need to be replaced. This new maintenance approach no longer meshed with the all-encompassing top end and center section overhaul kits ELC stocked for the ALCO 251s. Instead of performing an entire center section overhaul, an ALCO work package may now, for example, only consist of replacing a jacket water pump, two heads, one power pack, and the turbocharger. The next condition assessment might require a whole different set of components be replaced. In order to support the DECM Program, the overhaul kits had to be reconfigured to support individual component and assembly replacement.

a. The ELC has 45 kits that are used for the installation of individual components and assemblies: pumps, turbochargers, over speed trips & cam bushings, exhaust manifolds, main bearings, power assemblies, control linkages, fuel doors, after coolers, governor drives, & acceleration cylinders. These kits, just as with the original top end and center section overhaul kits, contain primarily soft parts such as gaskets and consumable piece parts. Hardware components are typically still ordered separately.

b. Table 233-2 lists the stock number, noun name with vessel application, and kit part numbers for each of the new kits. Since the stock numbers are ACN's (Activity Control Numbers) and not NSN's (National Stock Numbers) they are not part of the stock system visible to the fleet.

TABLE 233-1 ENGINE APPLICATION TABLE

Engine Make and Model	Overhaul Interval Hours *	Oil Analysis	Compression and Firing Pressures	Crankcase Vacuum	Inlet Air Pressure	Exhaust Pressure	Lube Oil Consumed
ALCO**							
CATERPILLAR							
D-311	12,000	X		X	X	X	X
D-318	12,000	X		X	X	X	X
D-330	12,000	X		X	X	X	X
D-333	12,000	X		X	X	X	X
D-343	12,000	X		X	X	X	X
D-348	12,000	X		X	X	X	X
D-353	20,000	X		X	X	X	X
D-375	16,000	X		X	X	X	X
D-379	20,000	X		X	X	X	X
D-398	16,000	X		X	X	X	X
D-398-TA	20,000	X		X	X	X	X
D-399	16,000	X		X	X	X	X
3304	10,000	X		X	X	X	X
3412	20,000***	X	X	X	X		X
3406	10,000	X		X	X	X	X
3406B	12,000	X		X	X	X	X
3516		X		X	X	X	X
TOP END	6,000						
MAJOR	6,000						
3508		X		X	X	X	X
TOP END	11,000						
MAJOR	22,000						
3608		X	X	X	X	X	X
TOP END	20,000						
MAJOR	40,000						
CUMMINS							
V 12-525M	8,000	X		X	X	X	X
VT12-600M	8,000	X		X	X	X	X
VTA12-700M	8,000	X		X	X	X	X
VT 903M	5,000			X	X	X	X
NT-8565-G2	20,000	X		X	X	X	X
PAXMAN							
16RP200M		X	COMPRESSION ONLY	X	X		X
TOP END	9,000						
MAJOR	18,000						

FAIRBANKS-MORSE

38D 8 1/8	16,000	X	X	X			X
38TD8 1/8	16,000	X	X	X	X	X	X

Engine Make and Model	Overhaul Interval Hours *	Oil Analysis	Compression and Firing Pressures	Crankcase Vacuum	Inlet Air Pressure	Exhaust Pressure	Lube Oil Consumed
DETROIT							
6V53	12,000			X	X	X	X
6V92	3,000			X	X	X	X
GENERAL MOTORS							
8-645	20,000	X	X	X	X	X	X
12-567	12,000	X	X	X	X	X	X
12-278	10,000	X	X	X	X	X	X
8-278	10,000	X	X	X	X	X	X
8-268	10,000	X	X	X	X	X	X
6-268	10,000	X	X	X	X	X	X
3-268	10,000	X	X	X	X	X	X
6-110	10,000	X	COMPRESSION ONLY	X	X	X	X
12-V-71	10,000	X	COMPRESSION ONLY	X	X	X	X
8-V-71	10,000	X	COMPRESSION ONLY	X	X	X	X
6-71	12,000		COMPRESSION ONLY	X	X	X	X
4-71	12,000		COMPRESSION ONLY	X	X	X	X
2-71	12,000		COMPRESSION ONLY	X	X	X	X
MTU							
8V396TE94	14,000	X	X	X	X	X	X

NOTES:

***** **See additional guidance in paragraph B.2**.

****** **ALCO engines on 210/270 WMEC and 400 WAGB cutters have been converted from a time-based overhaul program to the Diesel Engine Condition Monitoring (DECM) Program – an integrated condition-based monitoring program. Oil analysis and DEMP procedures are detailed in cutter-specific maintenance procedure cards and tech pubs.**

******* **CATERPILLAR D-3412 engines on the 82' WPB shall be overhauled at 11,000 hours.**

TABLE 233-2 AVAILABLE ALCO OVERHAUL KITS

	STOCK NUMBER	KIT NAME	KIT PART NUMBER
1	2990-01-F00-3026	210 A, 210B LO PUMP INSTALL	LOP210AB
2	2990-01-F00-3035	270 LO PUMP INSTALL	LOP270
3	2990-01-F00-3005	400 SSG LO PUMP INSTALL	LOP400SSG
4	2990-01-F00-2993	400 MDE L.O.PUMP INSTALL	LOP400MDE
5	2950-01-F00-3027	210A TURBO INSTALLATION KIT	TURBO INSTALL210A
6	2950-01-F00-3034	210B TURBO INSTALLATION KIT	TURBO INSTALL210B
7	2990-01-F00-3036	270 TURBO INSTALLATION KIT	TURBO INSTALL270
8	2950-01-F00-3006	400 SSG TURBO INSTALLATION KIT	TURBO400SSG
9	2950-01-F00-2994	400 MDE TURBO INSTALLATION KIT	TURBO400MDE
10	2990-01-F00-3028	210 A & B OVERSPEED TRIP & CAM BUSHING KIT	OVSP TRIP & CAM210AB
11	2990-01-F00-3007	400 SSG CAM & OVERSPEED TRIP KIT	OVSP TRIP & CAM400SSG
12	2990-01-F00-2995	400 MDE TURBO INSTALLATION KIT	OVSP TRIP & CAM400MDE
13	2990-01-F00-3011	210 & 400 EXHAUST MANIFOLD KIT	EXHAUST MAN210AB400
14	2990-01-F00-3037	270 EXHAUST MANIFOLD KIT	EXHAUST MAN270
15	2990-01-F00-3002	210A, 270, 400 MDE C/C EXH INSTALL KIT	CCEXH210A270400MDE
16	2990-01-F00-3008	400 SSG C/C EXH INSTALL KIT	CCEXH400SSG
17	2990-01-F00-3001	POWER AY REBUILD KIT	POWERASSY ALL251
18	3110-01-F00-3029	210A MAIN BEARING KIT	MAINBEARING210A
19	3110-01-F00-2990	210B MAIN BEARING KIT	MAINBEARING210B
20	3110-01-F00-3038	270 MAIN BEARING KIT	MAINBEARING270
21	3110-01-F00-3009	400 SSG MAIN BEARING KIT	MAINBEARING400SSG
22	3110-01-F00-2996	400 MDE MAIN BEARING KIT	MAINBEARING400MDE
23	2990-01-F00-3031	210A & B CONTROL LINKAGE KIT	CONT LINK210AB
24	2990-01-F00-3045	270 CONTROL LINKAGE KIT	CONT LINK270
25	2990-01-F00-3046	FUEL DOOR MINOR REBUILD KIT (ALL)	FO PUMP MINOR ALL251
26	2990-01-F00-3050	270 FO DOOR MAJOR REBUILD KIT	FO PUMP MAJOR270
27	2990-01-F00-3000	400 (ALL) FO DOOR MAJOR REBUILD KIT	FO PUMP MAJOR400
28	2990-01-F00-3051	210 , 270 J W PUMP KIT	JWPUMP210270
29	2990-01-F00-3052	210, 270 RW PUMP INSTALL	RWPUMP210270
30	2990-01-F00-2997	400 JW (or RW) PUMP KIT	JWRWPUMP400
31	2990-01-F00-3030	210 AFTERCOOLER INSTALL KIT	AFTCOOLER210
32	2990-01-F00-3039	270 AFTERCOOLER INSTALL KIT	AFTCOOLER270
33	2990-01-F00-3010	400 SSG AFTERCOOLER INSTALL KIT	AFTCOOLER400SSG
34	2990-01-F00-2998	400 MDE AFTERCOOLER INSTALL KIT	AFTCOOLER400MDE
35	3110-01-F00-3032	210A FO BOOSTER PUMP DRIVE KIT	BPDRIVE210AFO
36	2990-01-F00-2991	210B FO BOOSTER PUMP DRIVE KIT	BPDRIVE210BFO
37	2990-01-F00-3040	270 FO BOOSTER PUMP DRIVE KIT	BPDRIVE270FO
38	2990-01-F00-3033	210A RW PUMP DRIVE KIT	RWPUMPDR210A

	STOCK NUMBER	KIT NAME	KIT PART NUMBER
39	2990-01-F00-2992	210B RW PUMP DRIVE KIT	RWPUMPDR210B
40	2990-01-F00-3047	270 RW PUMP DRIVE KIT	RWPUMPDR270
41	2990-01-F00-3048	210A & B, 270 GOVERNOR DRIVE KIT	GOVDRIVE210AB270
42	2990-01-F00-2999	400 MDE GOVERNOR DRIVE KIT	GOVDRIVE400MDE
43	2990-01-F00-3025	400 SSG GOVERNOR DRIVE KIT	GOVDRIVE400SSG
44	2990-01-F00-3049	210A & B, 270 OVERSPEED GOV DRIVE KIT	GOV OVER SP DRI210AB270
45	2990-01-F00-3053	270 ACCELERATION CYLINDER KIT	ACCCYL270

C. **DIESEL ENGINE MAINTENANCE PROGRAM - PERFORMANCE MONITORING.**

1. The condition of the engine, can be estimated by the effective use of the following aids:

   a. Full power trials.

   b. Observation of engine operating characteristics.

   c. Periodic spectrochemical analysis and trending of the lubricating oil.

   d. DEMP Performance Monitoring - observation and analysis of the trends of certain engine operating parameters.

   e. Physical inspection of engine components.

   f. Performance testing other than DEMP and full power trials. An example of this is CAT CAMPAR testing.

   g. Diesel Engine Condition Monitoring (DECM) Program. The DECM Program is an integrated condition-based maintenance program that incorporates a full power groom, electronic signature analysis, periodic physical diesel engine component inspections, an expanded DEMP program, full power trials, oil analysis, and some time-based component replacement. The program has been applied to all ALCO engines and is in the process of being adapted to Fairbanks Morse opposed piston engines on 378 WHEC cutters. Details are given in class-specific maintenance procedure cards and supporting tech pubs.

   h. On-line monitoring systems - These systems can be used to detect anomalies and degradation in engine performance.

2. Reliance on these analytical tools for the determination of the internal condition of an engine's center section is the substance of the “performance monitored” maintenance system. It is important that each of these aids be continuously monitored. If repair or overhaul is indicated by any of these programs before the

periodic overhaul required by Table 233-1, appropriate maintenance action shall be taken.

3. DEMP Performance Monitoring Indicators/Trending monitoring requires an input of several readings, taken at specified intervals of operating time, and considered as a group and in comparison with the previous values. Seven (or more) basic readings are required on engines under this program. Different parameters are relevant indicators for different engine designs. Table 233-1 designates the appropriate readings for each major engine type in the Coast Guard. These parameters are:

   Cylinder compression pressure
   Cylinder firing pressure
   Cylinder exhaust temperature
   Crankcase vacuum
   Intake manifold pressure
   Exhaust back pressure
   Lube oil consumption.

   The requirement for monitoring exhaust temperatures is not shown in Table 233-1. If exhaust pyrometers are currently installed on each engine cylinder, their exhaust temperatures shall be monitored. If only a combined exhaust pyrometer is installed, then combined exhaust temperature shall be monitored.

   a. Cylinder Compression and Firing Pressures. Cylinder compression and firing pressures provide a good indication of the relative power balance between cylinders, the efficiency of the combustion space, and the total power output. For engines equipped with fittings that allow cylinder compression and firing pressure readings to be observed, both individual and average cylinder readings shall be recorded in tabular form and compared with previous readings for apparent trends. Under normal conditions, these values will remain nearly constant until the engine is approaching the time of overhaul, then the values will start to fall off. If both firing and compression pressures drop noticeably at about the same point, this is an indication that the rings are sticking, broken, or beginning to wear; valves, if applicable, are not functioning properly; the liner is beginning to score; or possibly a piston has cracked. A significant change in crankcase vacuum, scavenging air pressure, or exhaust back pressure may isolate the source to the ring/liner interface, intake valves, if applicable, or exhaust valves, if applicable, respectively.

   b. Exhaust Temperatures.

      (1) A drop in the exhaust temperature and firing pressure only would indicate a problem in the fuel system. If the drop is isolated to a small number of cylinders, the problem may be in the injectors. If the drop is reflected in all cylinders, the problem is more likely in the low-pressure pump or distribution system.

(2) Carboning of exhaust ports or valves may cause a rise in exhaust temperatures. This may be reflected in the exhaust backpressure at the same time. A faulty injector occasionally causes a high exhaust temperature. More often, high exhaust temperatures indicate that the fuel control system is sticking or the overall condition of the engine has deteriorated so that excess fuel is being fed to the engine to bring it up to speed at a standard load setting.

(3) An abnormal temperature with no accompanying changes in the other indicators may be attributable to a faulty pyrometer. The pyrometer in question should then be carefully inspected and tested before any other inspections or adjustments are accomplished. Values of exhaust temperature should be recorded in tabular form for those engines fitted with appropriate pyrometers.

c. <u>Crankcase Vacuum</u>. Assuming proper functioning of the various crankcase ventilating devices, deficiencies such as internal wear, defective pistons, and excessive carboning of rings will be indicated by a gradual loss of crankcase vacuum. After an engine overhaul, crankcase vacuum will tend to level off and remain relatively constant for a long period of time at any given condition of load and speed. As wear occurs between ring, piston, and liner, crankcase absolute pressures will slowly increase, i.e., vacuum will decrease. As blow-by increases, the relatively high pressure combustion gasses break down the protective oil film on the cylinder walls, causing metal-to-metal contact. As further wear occurs, additional corrosive gasses blow by, accelerating the wear. With increasing blow-by, the engine sump temperature will begin to rise appreciably, driving off the relatively light lubricating oil and fuel fractions. As the oil becomes hotter, more vapors will form. Eventually, hot combustion gasses entering the crankcase can cause a crankcase explosion.

(1) It is important to consider the effect of atmospheric pressure when using a manometer to measure crankcase vacuum. Many Coast Guard diesels are aspirated directly from the engine room. In using a manometer, crankcase vacuum is measured relative to engine room atmospheric pressure. Engine room atmospheric pressure will vary with the number or pieces of combustion equipment in operation, the rate at which they are operating, the status of inlet and exhaust vents, the position of access closures, and the weather atmospheric pressure and temperature. Therefore, it is important to duplicate the settings for the ventilation system and the position of all hatches and doors leading to the engine room when recording crankcase vacuum.

(2) Crankcase vacuum is an indication of engine condition only if the vacuum system is operating normally. If crankcase vacuum decreases with no change in other indicators, the crankcase scavenging system should be checked for proper operation. Also, scavenging air may be leaking into the crankcase. An increase in crankcase vacuum may be

caused by a clogged intake screen.

(3) Changing the size of the orifice plate on an engine to adjust the crankcase vacuum only treats the symptom of the problem. It does not justify ignoring the possible need for an engine overhaul.

d. Intake Manifold Pressure. On a naturally aspirated engine, the intake manifold pressure, or vacuum, will provide an excellent indication of the condition of intake valves, if appropriate, and the general condition of sealing within the engine cylinder on the intake stroke, assuming correct engine timing.

(1) In an engine that uses a positive displacement blower, the intake manifold pressure will only indicate a general composite of the internal engine sealing, less the exhaust system, and the condition of sealing within the blower.

(2) For an engine that uses a turbocharger driven by exhaust gases, the air pressure in the intake manifold will vary considerably during acceleration and deceleration of the engine. However, when the air box pressure does settle out at a constant speed and load, assuming proper operation of the turbocharger, a drop in air box pressure can be attributed to improper sealing of the intake valves if appropriate, or of the pistons, rings, or cylinders.

(3) It is especially important to duplicate rpm and load setting when taking intake and exhaust manifold pressures. A change in intake manifold pressure, and to a lesser extent exhaust backpressure, may be due to carboning of the turbocharger, if fitted. This change should be investigated before concluding that difficulties exist in the engine's center section.

e. Exhaust Back Pressure. When the exhaust manifold or engine's exhaust system is fouled or when there is leakage of combustion gasses past the exhaust valves, the pressure in the exhaust manifold will begin to rise. For a given condition of speed and load, engine operation with no appreciable rise in exhaust backpressure would indicate that the exhaust valves are functioning properly. Any rise in exhaust manifold backpressure should be investigated for cause. Any increase will reduce engine combustion efficiency. Stack fires may cause distortion of internal tubing in mufflers and restrict exhaust gas flow, causing an increase in exhaust manifold backpressure. Carbon build up in two-stroke cycle exhaust ports will cause a decrease in exhaust backpressure. Carboning of turbochargers may increase exhaust backpressure. No two installations are alike. Some engines have mufflers that create greater backpressure than others. Piping diameter, bends, and other resistance to flow vary with each installation. Each installation must establish its own pattern of operation for this parameter. The important consideration is to observe any trend, such trend indicating potential difficulties. Exhaust manifold backpressures should not exceed the manufacturer's recommended maximum.

f. Lube Oil Consumption. Lubricating oil consumption is a generalized indicator of internal and external engine condition. Consumption must be recorded to correct the oil spectrochemical analysis for dilution. Plotting this data is useful in comparing consumption between engines, as well as estimating future requirements. It should be noted that, in general, the values are initially high, decrease, then remain nearly constant until the engine is approaching its overhaul time. The initial high consumption is due to unseated piston rings. As rings become seated, the consumption will decrease to a normal value and remain nearly constant until the rings or liners begin to wear. Any significant increase in lube oil consumption should be carefully evaluated to determine whether the oil is really being consumed in the engine or is being lost because of leaks external to the engine. Too often an engine is assumed to be at fault when lube oil is really being lost because of leakage.

4. Secondary Indicators. Several other parameters are good general indicators of engine health, but they are not closely enough related to specific areas of engine wear or do not change rapidly enough to warrant plotting. These are considered secondary indicators and their values, where available, should be occasionally compared to previous readings. Secondary indicators include, but are not limited to, the following:

(a) Fuel rack settings or fuel system pressures
(b) Fuel consumption
(c) Load sharing checks & calibrations (225 WLB)
(d) Lube oil pressure
(e) Pressure differential across lube oil strainers and filters
(f) Pressure differential across fuel oil strainers and filters
(g) Jacket water temperatures
(h) Lube oil temperatures
(i) Fuel pump delivery
(j) Appearance of exhaust
(k) Vibration
(l) Jacket water contamination
(m) Fuel pump rack and governor load indicator position in relation to HP or KW
(n) Jacket water consumption.

The operator should be familiar with the above engine observations made while underway. They may indicate deterioration of an engine by a gradual or sudden change in values.

a. Fuel Rack Calibration. Fuel rack calibration is an indication of general fuel system or engine condition. An increased rack setting for a given power output is an indication of fuel pump deterioration or a decrease in engine combustion efficiency. Generally, high rack settings will be supported by other indications.

b. 225 WLB Load Sharing Checks and Calibrations. The 225 WLB cutters have a propulsion plant in which two main diesel engines drive a single propeller shaft through a reduction gear. Each engine is outfitted with a Woodward 721 or 723 Electronic governor. These governors are specifically designed for applications where two prime movers are sharing a single mechanical load. Load sharing is accomplished by equalizing the rack position. The rack position signal is provided by a Heinzmann rack position indicating system. Where the governor actuator, Heinzmann rack position system, or fuel control linkage are out of calibration or adjustment on one or both engines the plant will likely be out of balance, resulting in one engine assuming most of the load. (See MPC Cards for load balancing tests and procedures).

c. Fuel Consumption. Fuel consumption is a measure of general engine condition. An increase in fuel consumption for a given power output indicates a loss in engine efficiency.

d. Lube Oil Pressure. Lube oil pressure at the engine is an indicator of engine-bearing condition, lube oil pump condition, piping conditions, bypass or relief valve conditions, fuel oil dilution, temperature, etc. Lube oil pressure obtained at the upper header of Fairbanks Morse opposed piston engines is particularly useful in monitoring the condition of the internal portion of the lube oil system.

e. Pressure Differential Across Fuel Oil Strainers and Filters. Observe and note fuel oil strainer and filter condition and pressures. Shift duplex strainers no less than once a day. Look for signs of foreign matter. It may be helpful to install a magnet in the strainer. Filter pressure drop should not exceed that recommended by the filter manufacturer.

f. Jacket Water Temperature. Water temperature rise across engine should not exceed 10 or 12 degrees.

g. Lube Oil Temperatures. The lube oil temperature should not exceed the normal operating temperatures because the oxidation rate above these temperatures accelerates rapidly. The oxidation rate doubles with each 18-degree rise in temperature. Oxidation is the chemical process promoting the formation of crankcase sludge, known as "mayonnaise", and other products, such as gum and lacquers, that are detrimental to engine condition.

h. Uniformity of Fuel Pump Delivery to Each Cylinder. Normal fuel pump rack position should be within 1 or 3 mm (graduations) of one another. Any greater spread indicates deficiencies in the pump, the nozzle, or both.

i. Appearance of Exhaust. Exhaust smoke color is usually a good indicator of engine condition and balance. White smoke shortly after getting underway indicates that the engine is not warm enough for the load. Heavy, dense smoke indicates overloading. Dirty, amber smoke indicates problems with the fuel system. Cooling water leaking into the combustion system may produce white smoke. Likewise, lube oil in the combustion spaces may produce blue hazy smoke.

j. Vibration. The engine operator should be familiar with the engine's normal pattern of vibration.

k. Jacket Water Contamination. Observe the color and any motion of the jacket water in the engine surge tank. Check for carbon or corrosion particles, bubbles, or an oil film. Leakage from engine spaces exposed to combustion gasses may result in a pulsing action in the jacket water. (See Paragraph A).

l. Fuel Pump Rack and Governor Load Indicator Position. Generator engines are governed to a specific speed. Therefore, if a cylinder fails to carry its share of the load, the governor will call for more fuel to maintain the engine output. Diesel electric propulsion plants respond similarly.

m. Jacket Water Consumption. Noting the daily required makeup jacket water may provide an early indication of jacket water sealing problems or excessive temperatures.

5. Instrumentation. All engines subject to this program are required to monitor the parameters indicated in Table 233-1. Most engines provide for the installation of the instruments necessary to monitor these parameters. The instructions for their use that are given in the applicable technical publications shall be followed. Necessary modifications to engines not having such provisions are authorized under the MLC's supervision. Most MLC's have designated sensor locations for engines under their cognizance. The following guidance is provided for these modifications:

a. Cylinder compression and firing pressures shall be taken with a good quality pressure indicator on engines originally fitted with test fittings for cylinder pressures. Except on Caterpillar engines, compression readings shall be taken with the engine running and the fuel cut off to the cylinder being tested. On the Caterpillar engines, use the pressure leak-down system described in the manufacturer's manual.

b. Cylinder exhaust temperatures shall be measured only with original type, permanently installed pyrometers. If only a combined exhaust thermocouple is fitted, it shall be used.

c. For crankcase vacuum, locate the sensor access well above the sump lubricating oil level, but in a position where it will not interfere in any way with moving parts of the engine. The access should be perpendicular to the side of the engine block or frame. Installation in an inspection cover is preferable; however, if this cannot be accomplished without elaborate reinforcement, then access should be made elsewhere. The ideal location of the sensor is as remote from the breathing access as possible, preferably at the point of highest static pressure.

d. For intake manifold air pressure, the best sensor location is in the area nearest the point where inlet air is admitted to the manifold or air box. Care must be taken to install the probe perpendicular to the air flow, to eliminate the possibility of introducing air velocity pressure into the reading. For exhaust manifold backpressure, install the sensor as close to the exhaust manifold outlet flange as possible. The sensor should be perpendicular to the path of flow. Care must be taken to ensure that there is no penetration of a water jacket. On some engines, it is possible to substitute a cylinder thermocouple for the combined exhaust thermocouple and insert a pipe tee to read the pressure.

6. Gauges. Because of the wide variation in engine design and normal pressures and vacuums, no specific gauge can be recommended for installation at each location. Unless the engine came originally equipped with a sensor installed, no permanent installation of a sensor will be made. When not in use, sensor connections shall be plugged. Sensors shall be approved for use by the MLC. For the purpose of this program, no mercury manometers shall be used on board boats or cutters.

7. Engine Performance Tests. The Engine Performance Test under DEMPS was intended as a condition based monitoring maintenance program for diesel engines. There is an intrinsic value to running the tests, as it provides a valuable snap shot of the engine condition and can indicate premature failure problems, particularly as the engine hours exceed the half-life of the overhaul cycle.

a. Performance tests, or their PAR equivalent, shall be conducted on each engine when the engine's overhaul break-in period is completed, in order to establish a baseline. A second set of tests will then be completed when the engine reaches 50 percent of its stated overhaul hours. Performance tests will then be completed at intervals of 500 operating hours. Requirements for expanded DEMPs readings performed under the DECM Program are detailed in the class-specific maintenance procedure cards. Those detailed requirements supercede the general requirements provided herein.

b. These are minimum requirements and EOs and EPOs should increase the frequency of performance tests if engine operating condition or previous performance test results are abnormal. It is intended that tests be conducted during the course of normal operations. It is the responsibility of the cutter's Commanding Officer or Officer-in-Charge to ensure that enough time is dedicated to performance of these tests. When conducting performance tests, engines should normally be operated at approximately 80 to 90 percent of the Coast Guard rated load. Regardless of the exact operating condition chosen to conduct the test, it is extremely important that the engines be test run under the same load, speed, and ambient conditions each time a test is conducted. Lube oil and engine jacket water should be within 5 degrees of the normal operating temperatures. RPM and load should be duplicated. Before the test is conducted, the following should be accomplished:

(1) Ensure that all instruments are accurate. Test and calibrate them if any doubt exists about their accuracy and reliability.

(2) Install any required temporary gauges into the system.

(3) Set ventilation and engine room accesses to duplicate standard test conditions.

c. Engine operating trends in crankcase vacuum, inlet air pressure, exhaust pressure, and lube oil consumption shall be plotted on graph paper. Use operating hours as the horizontal scale, even if testing is on a monthly basis. Choose the vertical scale carefully. Minor variations in readings due to normal operating variables should appear small enough to not distort the trend information. It may be advisable to plot a faired line rather than one through every data point. It is the overall trend of the values that indicate wear patterns and project overhaul. Drastic shifts are either incorrect data or machinery malfunctions requiring immediate response. Do not assume that a reading is incorrect unless the reason for the unusual reading can be explained or additional normal readings can be taken. Cylinder compression readings and firing pressures shall be monitored per paragraph C.3.a. Exhaust temperatures shall be monitored per paragraph C.3.b. Chapter 262 of this instruction provides guidance for monitoring lube oil analysis readings.

d. This approach to maintenance is intended to aid the engineer in maintaining diesel engines. It is not intended to be a license to ignore obvious maintenance because it is not specifically identified by the "as indicated" maintenance program.

e. It is intended that overhauls be as infrequent and as manageable as is compatible with a cutter's mission. This approach will succeed in direct proportion to the quality of the maintenance actions taken and the promptness with which they are taken. No formal inspection requirements, overhaul requirement, or diagnostic process yet devised will provide more reliable machinery than will the knowledgeable attention of those persons, of whatever rate or rank, responsible for the machinery in question.

8. <u>On-Line Monitoring Systems</u>. Vessels with engines with approved on-line monitoring systems need not perform DEMP or PAR testing as described in paragraph 12 of this section. Performance testing used in conjunction with on-line engine monitoring systems shall be developed to exploit the features/capabilities of the monitoring system while providing the most telling indication of engine condition possible. Approval for on-line engine monitoring systems shall be provided by ELC-01. Suitable on-line monitoring systems are systems with the capability to:

a. Acquire and log all primary DEMP parameters and selected secondary DEMP parameters including, rack position, fuel consumption, jacket water temperature(s), lube oil temperature(s), lube oil pressure, raw water temperature(s), fuel pump pressure etc.

b. Monitor engine performance by comparing measured relationships between key parameters with engine manufacturer's performance data or baselines established during trials. Typically, key engine parameter's are functions of engine BHP, RPM or both.

9. Allowances for Emerging Technologies. Where the emergence of diesel engine diagnostic technologies provides equipment and or testing methods potentially beneficial to the Coast Guard, requests may be submitted through the cognizant MLC (v) to replace or supplement existing DEMP or PMS procedures with diagnostic procedures associated with the new equipment/methods.

D. PERFORMANCE TESTS OF SHIPBOARD AND SHORE-BASED GASOLINE AND DIESEL BOAT ENGINES. This section gives minimum performance testing schedules for engines in shipboard and shore-based boats not included in Table 233-1, or covered by the boat's maintenance procedure card.

1. Periodic operation of boat engines is necessary to ensure reliability. Manufacturer's instruction books vary widely and frequently omit performance test instructions.

a. Operating a boat engine once a week exercises movable engine parts, relieves valve and injector springs under compression, replenishes the coating of lubricating oil on polished surfaces, flushes out stagnant fuel from fuel lines and injectors, and checks the engine starting system, alternator, etc. If an engine has not been operated for 7 days, start and run for a few minutes without load and bring up to operating temperature.

b. Operating a boat engine under load once a month checks its operating ability; warms up the engine and driven equipment, thereby reducing the effects of moisture; and trains operating personnel. The engine should be run until all operating temperatures have leveled off at normal values. This normally requires 30 minutes, while operating at 50 percent or more of rated full load. If an engine has not been operated under load for 30 days, operate it at 50 percent load until completely warmed.

c. The boat engine should be operated at rated full load and speed for 10 consecutive minutes semi-annually to check the reliability of the engine and the driven equipment. Record all useful readings. Maintain a file at the unit level for comparison with the manufacturer's instructions and previous tests. Inability of an engine to carry full load satisfactorily should be investigated and corrected as soon as practical.

d. The stated frequency of performance tests is a minimum. More frequent tests are encouraged if conditions warrant.

e. The above instructions do not apply to engines in storage.

2. Include the above tests on the appropriate check-off records. Log non-accomplishment of tests and the reasons. Reports of these tests are not required.

E. MARKING BOAT INSTRUMENT PANEL GAUGES.

1. To provide a ready reference for boat operators, boat instrument panel gauges should be marked to show dangerous operating ranges.

2. All units operating inboard powered boats shall be sure that any existing markings on boat instrument panel gauges are as shown in Table 233-3. Remove any incorrect markings and signs and mark operating gauges as follows:

    a. Refer to Table 233-3 to determine the normal temperature and pressure range at normal continuous duty RPM. Mark these ranges in GREEN.

    b. Determine the dangerous operating ranges from the table and mark those on the gauges in RED.

    c. Install a warning sign in a conspicuous location near the instrument panel, showing the maximum continuous duty RPM of the engine.

3. Since gauge glasses are difficult to remove, the ranges can be marked on the surface of the glass by a stripe about 1/8 to 3/16 inches wide, located at the outer edge of the glass. The gauges shall be marked neatly and checked periodically to be sure that markings have not been obliterated or otherwise rendered useless. For engines not listed in the table, consult the appropriate manufacturer's instruction book. Refer questions to the MLC (v).

TABLE 233-3. ENGINE PRESSURE AND TEMPERATURE CHART

Engine Model	Lube Oil Pressure		Fresh Water Temperature	
	Green	Red	Green	Red
GM-71 Series	18-60	0-18	160-195	195 UP
GM-53 Series	10-60	0-10	160-185	185 UP
Cummins V6,VT6,V8,VT8	10-70	0-10	160-18Mercruiser (4,6,8 cyl.)	
15-60	0-15	185 UP		
Caterpillar	15-60	0-15	160-185	185 UP
GM-6V92TI	15-70	0-15	5	85 UP

F. DIESEL ENGINE CRANKWEB DEFLECTION REQUIREMENTS.

1. Frequency.

a. Crankweb deflection readings need only be taken after each major overhaul, unless damage is suspected to the engine or driven equipment, such as generator or reduction gear, as a result of a grounding/collision. Note that additional crank web deflections may be required as part of the DECM Program.

b. Crankweb deflection readings should only be taken with the cutter waterborne. On opposed piston engines, it is not considered necessary or important enough to check the upper crankshaft, since any misalignment of the engine will be distributed throughout the block and will not be measurable in the upper crank. On engines such as the Cummins, on which crankweb deflections cannot easily be taken after the engine is installed, there is no requirement for taking or reporting crankweb deflection readings on installed engines.

c. The test is relatively easy and can be done in a short time. Although not required by some manufacturers, the check remains a good engineering practice for marine diesel engines. Crankshaft deflection readings are to be recorded in the machinery history and reported in the Cutter Engineering Report for engines with crank journals of 4 inches or more.

2. Instructions. Instructions for taking web deflection readings and the meaning of their results can be found in the NSTM, Chapter 233. It is good engineering practice to take deflection readings on all crank throws. Maximum allowable crankweb deflection for Fairbanks Morse (38D8 1/8 and 38TD8 1/8) and General Motors EMD diesel engines is from 0.004 to 0.005 inches on any throw.

CHAPTER 235. ELECTRIC PROPULSION

A. PROPULSION DIELECTRIC ABSORPTION TESTS.

1. The dielectric absorption test (DAT), as described in the Institute of Electrical and Electronic Engineers (IEEE-43; 1974), is a good way to determine the degree of moisture and dirt to which windings have been subjected. This test differs from the normal megger reading in that the test involves applying a fixed voltage for a period of time and observing the insulation resistance or leakage current as a function of time. DAT'S should be performed in accordance with PMS procedures or when low megger readings indicate that further insulation testing is required and before any high-potential testing. Where IEEE-43 and Naval Ships Technical Manual (NSTM), Chapter 300, differ, the NSTM takes precedence. Refer to paragraph C for high potential testing.

2. DAT test equipment should include a motor-driven or electronic magneto/megohmmeter that will deliver constant DC potential. A hand-cranked megohmmeter will not give close enough voltage regulation for the long time tests required to determine dielectric absorption. For safety reasons, the test voltage should not exceed the normal circuit voltage. Test equipment is available both commercially and through the Federal Stock System. It is not intended for DAT test equipment to be required as part of shipboard allowances. MLCs/NESUs having DAT test equipment shall coordinate its use as needed.

B. IN-PLACE CLEANING OF DIRECT CURRENT PROPULSION MOTORS AND GENERATORS.

1. Approved procedures for in-place cleaning of direct current propulsion motors and generators are described in the following publications:

   a. Naval Engineering Technical publication No. 1986, available from the ELC.

   b. Naval Ships Technical Manual (NSTM), Chapter 300,Section 5, entitled "Reconditioning Electrical equipment after Damage by Seawater or Similar Material".

   c. Technical Guide: Practices for Respiratory Protection, COMDTINST M6260.2 (series)."

2. NSTM, Chapter 300, Section 5, provides appropriate information on reconditioning electrical equipment after seawater damage. Contact MLC (v) for specific instructions for each occurrence of seawater damage or flooding of propulsion motors or generators.

3. Technical Guide: Practices for Respiratory Protection, COMDTINST M6260.2 (series), provides the minimum required respiratory and clothing protection for personnel who clean direct current propulsion motors and generators with approved cleaning solvents.

C. HIGH-POTENTIAL TEST.

1. A high-potential test of propulsion machinery and cabling shall not be accomplished without MLC approval.

2. An alternating-current high-potential test shall not be performed on installed propulsion machinery or cabling.

3. Only direct-current, high-potential testing will be approved for machinery in service as a diagnostic test that may be terminated if leakage current indicates impending failure.

CHAPTER 243. PROPULSION SHAFTING

A. **<u>GENERAL</u>.** Each MLC shall develop and promulgate detailed guidance on the inspection and repair of propulsion shafting. Procedures outlined in NSTM 243, MIL-STD-2199 (SH), and MIL-STD-2191 may be used for guidance.

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CHAPTER 244. PROPULSION BEARINGS

A. **BEARING STAVE MATERIAL.** "ROMOR" backed rubber faced and "THORDON" bearing staves are authorized substitutes for naval brass backed and rubber faced or micarta bearing staves. The alternate staves have demonstrated similar or improved service life and reliability; they are interchangeable (in sets) and are available in a variety of dimensions.

B. **BEARING SLEEVES.** 70Cu – 30Ni alloy C96400 ASTM Specification B369-95 or C95500 may be used as a substitute for all bronze and naval brass water lubricated stern tube and strut bearing sleeves. It may not be used as a substitute for monel bearing sleeves without specific approval from ELC (02).

C. **CUTLASS BEARINGS.** For boats, rubber water lubricated bearings having a Fiberglass Reinforced Epoxy (FRE) shell may be used as an alternative to micarta, bronze or naval brass backed water-lubricated bearings. The FRE shells are lighter, less expensive and reduce corrosion problems.

D. **BEARING CLEARANCE CRITERIA.** NSTM Chapter 244, Table 244-4-1, provides bearing clearance criteria.

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CHAPTER 254. CONDENSERS AND HEAT EXCHANGERS

A. **ZINC ANODES IN CONDENSERS AND HEAT EXCHANGERS.** If dissimilar metals connected together are immersed in an electrolyte (a current-carrying liquid such as sea water), a simple galvanic cell is formed. An electric current flows from one metal to the other through the electrolyte. The connection between the two metals completes the circuit. The metal from which the current is flowing (the anode) will tend to suffer accelerated corrosion; the metal to which the current is flowing (the cathode) will tend to be protected from galvanic corrosion. The current's direction depends on the composition of the metals or alloys exposed to the electrolyte and on such factors as the hardness of the metal and the cleanliness of the metal surfaces. Thus, if a single metal is immersed in an electrolyte and one part of the metal is harder or cleaner than another part, current will flow from one part to the other, and galvanic corrosion will take place.

1. Use of Zinc. If clean metallic zinc is properly attached to the condenser or heat exchanger water chests, current will tend to flow from the zinc to adjacent metal surfaces exposed to the sea water since zinc is more active than the materials used in a condenser. This sea water constitutes the electrolyte of the galvanic cell. The zincs are corroded as the current flows from the zinc surface to the sea water and to the other metal surfaces. The current flowing to the metal surfaces of the condenser tubes, tube sheets, and water chests tends to protect these parts from galvanic corrosion. The electrical circuit is completed through the metal parts of the condenser. Since the circuit is completed through the metallic bolts and collar studs that secure the joints, the flow of current is not interrupted by gaskets between the water chests and manhole covers (to which the zinc is generally attached) and those between the tube sheets and the water chests.

2. Types of Zinc. Zinc as specified in MIL-A-18001 is required for use in a sea-water circuit. These zincs possess a property of sloughing off corrosion products, thus maintaining a high current output.

   a. Class 1 zincs contain cast-in cores and are recommended wherever possible. Class 1 zincs are of the following types:

      ZEP - Square or circular slab, with a pipe core.

      ZBP - Bar, with a pipe core.

      ZDM - Segmented disc, with a machine formed interlocking core.

      NOTE: Types ZEP and ZBP are usually secured on a 1/2-inch diameter stud by two jam nuts. Not more than one anode per stud is used. Type ZDM anodes can be screwed together and tightened by hand or simple tools.

   b. Class 2 zincs are plain zincs. A National Fine Thread 12-28 stud secures each anode to the next and to the support plug. Class 2 zincs are of the following types:

      ZPN - Rolled or extruded plate.

ZRN - Solid cylindrical rod.

NOTE: Type ZRN rod, or pencil, zincs are available in iron pipe size (ips) diameters. They are sized so that one end may be threaded with the standard pipe die and inserted into the bore of the support plug that is tapped for the ips thread. To ease mating, zinc oxide paste may be applied to the bottom two or three threads.

B. INSTALLATION AND MAINTENANCE REQUIREMENTS.

1. Only cutters operating exclusively in fresh water where the use of zincs has not been necessary to prevent corrosion of heat exchangers are exempted from the requirements of this section.

2. It is essential that good metallic contact exist between the zinc and the metal of the condenser, so that the electrical circuit will not be interrupted. Zincs shall be installed in accordance with MIL-A-19521. The average life of zincs is 3 months. Maintenance on zincs shall be in accordance with published PMS procedures.

3. Cutters having equipment (machinery) outfitted with zincs shall report the following in the unit Zinc Log (until incorporated in CMplus):

   Machinery and zinc location

   Types and amount of zinc in use

   Zinc size

   Amount remaining at last inspection

   Action taken upon inspection

   Date of this inspection

CHAPTER 262. LUBRICATING OILS

A. **GENERAL.** This chapter establishes a service-wide policy concerning lubricating oil to be used in the various diesel engines in service throughout the Coast Guard. It describes the Navy Oil Analysis Program (NOAP), and provides guidance regarding the use of commercial oil analysis labs for units that wish to use commercial labs in lieu of NOAP labs.

B. **DIESEL ENGINE LUBRICATING OIL POLICY.**

1. Policy. In the past , Coast Guard cutters and boats were authorized to use MIL-L-9000 lubricating oil, Military Symbol 9250, in main propulsion and auxiliary diesel engines and reduction gears. Executive Order 13101 requires the use of recycled (re-refined) oil wherever possible. Cutters with centralized lube oil storage tanks and lube oil purifiers may continue to use Military Symbol 9250. Cutters and boats whose equipment OEM have approved the use of recycle oil will use recycled (re-refined) oil supplied by Defense Supply Center Richmond. Oil ordered from the stock system is delivered together with empty barrels. The empty barrels are used to off load used oil. The re-refiner picks up the barrels. This supplies a stock of oil to be re-refined and relieves the unit's burden of disposing the used oil. The recycled (re-refined) oils are qualified to MIL-L-2104 and API and are available in 15W-40 and 40W viscosity grades. Caterpillar, Cummins and Detroit Diesel have approved the used of recycled (re-refined) oils. Table 262-1 provides a list of engines that use MIL-L-2104 lubricating oils. Units may obtain waivers to use lube oils other than 9250 and MIL-L-2104 for diesel engines. Waiver requests shall be submitted to the ELC (01) via the unit's chain of command and the cognizant MLC (v) Waiver requests shall be accompanied by written testimonial from the engine manufacturer stating that the candidate lube oil is suited for use in the engine(s) in question operating under the intended service and that the use of either MIL-L-9000, type 9250 or MIL-L-2104 is detrimental to the engine.

APPROVED ENGINE OIL EXCEPTIONS TABLE 262-1

Cutter/Boat Type	Main/Gen/Aux Engine	Lubricating Oil
175 WLM	CAT D-3508	MIL-L-2104 SAE40
160 WLIC	CAT D-3304	MIL-L-2104 SAE40
160 WLIC	CAT D-379	MIL-L-2104 SAE15W40*
160 WLIC	GM 4-71	MIL-L-2104 SAE15W40*
160 WLIC	GM 8-53	MIL-L-2104 SAE15W40*
140 FT WTGB	Fairbanks Morse	MIL-L-2104 SAE40
	Detroit 12-71	MIL-L-2104 SAE40**
	CAT D-3306	MIL-L-2104 SAE40
110/123 FT WPB (A&B)	Paxman 16RP200M	MIL-L-2104 SAE40
	CAT D-3304	MIL-L-2104 SAE40

APPROVED ENGINE OIL EXCEPTIONS TABLE 262-1 (CONT.)

Cutter/Boat Type	Main/Gen/Aux Engine	Lubricating Oil
110/123 FT WPB (C)	CAT D-3516	MIL-L-2104 SAE15W40
	CAT D-3304	MIL-L-2104 SAE15W40
100 FT WLI (A&C)	CAT D-353	MIL-L-2104 SAE40
	Detroit 6-71	MIL-L-2104 SAE40
87 FT WPB	MTU 8V396TE94	MIL-L-2104 ***
	MAN D0824LF01	MIL-L-2104 ***
75 FT WLIC (A,B&D)	CAT D-353	MIL-L-2104 SAE40
	Detroit 4-71	MIL-L-2104 SAE40
75 FT WLR (C&E)	CAT D-353	MIL-L-2104 SAE40
	CAT D-3304	MIL-L-2104 SAE40
75 FT WLR (F)	CAT D-3412	MIL-L-2104 SAE40
	CAT D-3304	MIL-L-2104 SAE40
65 FT WLR (A&B)	CAT D-353	MIL-L-2104 SAE40
	CAT D-3304	MIL-L-2104 SAE40
65 FT WLI (A)	Detroit 8-71	MIL-L-2104 SAE40
	Detroit 2-71	MIL-L-2104 SAE40
65 FT WLI (B)	Detroit 8-71	MIL-L-2104 SAE40
	Detroit 3-71	MIL-L-2104 SAE40
65 FT WYTL (A)	CAT D-3412	MIL-L-2104 SAE40
	CAT D-311	MIL-L-2104 SAE40
65 FT WYTL (B,C&D)	CAT D-379	MIL-L-2104 SAE40
	Detroit 2-71	MIL-L-2104 SAE40
55 FT ANB	Detroit 12-71	MIL-L-2104 SAE40
	Cummins 4.2	MIL-L-2104 SAE40
52 FT MLB	Detroit 6-71	MIL-L-2104 SAE40
	Perkins 4.108	MIL-L-2104 SAE40
49 FT BUSL	Detroit 8-71	MIL-L-2104 SAE40
	Perkins 4.236	MIL-L-2104 SAE40
49A BUSL	Cummins 6C & 4B	MIL-L-2104 SAE 15W40
47 FT MLB	Detroit 6-92	MIL-L-2104 SAE40
46 FT BUS	Detroit 6-71	MIL-L-2104 SAE40
45 FT BUS	Detroit 6-71	MIL-L-2104 SAE40
44 FT MLB	Detroit 6-53	MIL-L-2104 SAE40
41 FT UTB	Cummins VT-903	MIL-L-2104 SAE15W40
39 FT ASB	Detroit 6V-53	MIL-L-2104 SAE40**
36 FT LCVP	Detroit 6-71	MIL-L-2104 SAE40**
30 FT SRB	Detroit 6-92	MIL-L-2104 SAE40
25 FT 8 IN MCB	Detroit 3-53	MIL-L-2104 SAE40**
26 FT MSB MK V	Cummins 4BT 3.9	MIL-L-2104 SAE15W40

APPROVED ENGINE OIL EXCEPTIONS TABLE 262-1 (CONT.)

Cutter/Boat Type	Main/Gen/Aux Engine	Lubricating Oil
130 FT BARGE	Cummins 4BT 3.9	MIL-L-2104 SAE15W40
	Cummins 6BT 5.9	MIL-L-2104 SAE15W40
120 FT BARGE	Cummins 6BT 5.9	MIL-L-2104 SAE15W40
	Cummins NTA 855	MIL-L-2104 SAE15W40
100 FT BARGE	Detroit 4-71	MIL-L-2104 SAE15W40
90 FT BARGE	Detroit 4-71	MIL-L-2104 SAE40
84 FT BARGE	Detroit 4-53	MIL-L-2104 SAE40
70 FT BARGE	Detroit 4-53	MIL-L-2104 SAE40
68 FT BARGE	Detroit 3-71	MIL-L-2104 SAE40

* Use MIL-L-2104 SAE 15W-40 with an API rating of CD or CDII or later.

** When cold ambient temperatures result in cranking or starting problems, MIL-L-2104 SAE 30 may be used.

***Use Kendall Super D-3, Mobile DELVAC 1300 or Shell Rotella

NOTE 1: Cutters and boats currently using MIL-L-9000 SAE 40 weight oil in reduction gears and auxiliary equipment are authorized to use MIL-L-2104 SAE 40 weight oil in reduction gears and auxiliary equipment unless specifically prohibited by the equipment manufacturers.

NOTE 2: Cutter and boat PMS documents will be amended to reflect this change.

NOTE 3: Cutters and boats shall expend existing stocks of MIL-L-9000 oil before changing to MIL-L-2104.

NOTE 4: Although MIL-L-2104 and MIL-L-9000 oils are compatible when mixed together, smaller cutters and boats shall drain engine sumps, clean external strainers and change oil filters before adding MIL-L-2104 to an engine. Larger cutters are not required to drain oil sumps and bulk storage tanks before adding MIL-L-2104, however, manufacturers recommend expending existing stocks of MIL-L-9000 oils in bulk storage tanks to the lowest possible levels before adding MIL-L-2104.

NOTE 5: On cutters equipped with lube oil centrifuges, the difference between the specific gravity of MIL-L-2104, MIL-L-9000, and suitable commercial grades (where authorized) may be great enough to require a change in the size of centrifuges discharge rings, ring dams and float assemblies.

NOTE 6: When evaluating waiver requests, the following factors shall be considered:

Compatibility: The candidate commercial lube oil must be compatible with the existing lube oil (whether the existing lube oil is MIL-L-2104 or 9250).

Commonality: A single lube oil should be used for all engines on the vessel. In light of this, the candidate lube oil's capacity to serve as suitable engine oil for all engines on the vessel shall be considered.

Shared lube oil storage tanks and lube oil distribution systems: Where multiple engine types share a common lube oil storage tank or lube oil distribution system, commercial lube oils shall not be considered unless it is suited for all connected engines. Commercial lube oils shall not be considered where engines and reduction gears share a common lube oil storage tank and and/or common lube oil distribution system.

C. LUBRICATING OIL TESTING AND ANALYSIS PROCEDURES.

1. General. This section provides the Coast Guard's policy regarding lube oil sampling and analysis. Although lube oil testing and analysis will never be a substitute for determining engine condition by component inspection, it is a proven system that will:

   Permit maximum useful life of lube oil
   Determine when to change oil
   Detect fuel dilution and water leaks
   Determine harmful changes in viscosity - high and low
   Detect buildup of wear metals
   Reduce costly engine damage

2. Administration. MLCs shall administer the lubricating oil testing program in accordance with the guidelines set forth in this chapter and in section 4 of Naval Ships Technical Manual. Funding for Coast Guard participation in NOAP shall be handled centrally by Commandant (G-SEN).Applicability. All OPFAC cutters 65 feet in length and longer, including those assigned to SARFAC and ANFAC, are required to participate in the Navy Oil Analysis program or an oil analysis program administered by a qualified commercial lab. Qualified labs shall be able to perform the tests and analyses required in paragraphs 7a. 7b. and 7c. of this chapter. Qualified labs shall comply with any one of the following requirements:

   a. The Lab shall have obtained chemical testing accreditation from the American Association of Laboratory Accreditation (AALA) or shall be certified to be in accordance with the practices and procedures specified in ISO Guide 25.

   b. The Lab shall be certified and approved by a major manufacturer of marine equipment for performing oil analysis. Examples of this are labs that are certified in accordance with Caterpillar's Vision of Excellence Program.

   c. The Lab shall be certified and approved by a major manufacturer of lubricants or hydraulic oils for performing oil analysis.

   d. Laboratories not meeting the above requirements may be used if approval to do so is obtained from ELC (01).

3. Equipment Sampled. Periodic oil samples on some equipment is required and shall be taken in accordance with the cutter's PMS manual on the following equipment:

WAGB (HEALY)

Main Diesel Engines
AC Propulsion Motors
Auxiliary Diesel Generator

WAGB (POLAR CLASS)
Main Diesel Engines
Main Gas Turbines
Reduction Gears
Controllable Pitch Propeller Systems
DC Propulsion Motors
Ship Service Diesel Generators
Central Hydraulic System

WAGB (MACKINAW)

Main Diesel Engines
Ship Service Diesel Generators

378 WHEC

Main Diesel Engines
Main Gas Turbines
Reduction Gears
Controllable Pitch Propeller Systems
Ship Service Diesel Generators

295 WIX (USCGC EAGLE)

Main Diesel Engine

283 WMEC

Main Diesel Engines
Ship Service Diesel Generators
Emergency Diesel Generator
Reduction Gears
Controllable Pitch Propeller Systems

270 WMEC

Main Diesel Engines
Ship Service Diesel Generators
Emergency Diesel Generator
Reduction Gears
Controllable Pitch Propeller Systems
Fin Stabilizer Hydraulic Systems

230 WMEC

Main Diesel Engines
Ship Service Generators

<u>225 WLB</u>

Main Diesel Engines
Controllable Pitch Propeller System
Bow Thruster
Stern Thruster
Forward Buoy Deck HPU's
Aft Deck Machinery HPU's
Steering Gear HPU's
Boat Davit Winch HPU's

<u>213 WMEC</u>

Main Diesel Engines
Ship Service Generators
Reduction Gears

<u>210 WMEC</u>

Main Diesel Engines
Reduction Gears
Controllable Pitch Propeller System

<u>180 WLB</u>

Main Diesel Engines
Central Hydraulic System
Bow Thruster

<u>175 WLM</u>

Z-drive Hydraulic Oil
Central Hydraulic System HPU
Boat Davit Winch HPU.

<u>140 WTGB</u>

Main Diesel Engine

<u>WYTL, WLIC, WLI, WLR</u>

Main Diesel Engines

110/123 WPB

Main Diesel Engines
Reduction Gears
Fin Stabilizers (water and particulate content tests only)
Steering Gear (water/particulate content tests only)

87 WPB
Main Diesel Engine
Reduction Gears
Steering Gear

4. Sampling Point. Oil samples shall be drawn from running machinery at normal operating temperatures and only from the designated sampling points.

a. All sampling points shall meet the approval of the cognizant MLC. Engineers are cautioned to ensure that the metals between the machine and sampling installation are compatible; that is, stainless steel plumbing to a gas turbine. In general, sampling valve installation shall be as follows:

(1) Insert a tee pipe fitting in the lube oil line ahead of the oil filter connection. Locate the tee fitting so that it will not be an obstacle for maintenance work or personnel.

(2) If necessary reduce the tee fitting's base leg (branch) to accommodate the sampling valve. This valve shall have a 1/4-inch opening and be able to withstand a pressure of at least 100 psi and a temperature of 275 degrees F. This valve shall be capped and the cap chained to the valve. A double male pipe spacer (nipple) will be required between the valve and the cap.

b. Precautions In Sampling. The overriding emphasis is to avoid contamination of the samples. The following instructions should ensure this:

(1) Store unused kits in clean closed containers, such as the packaging boxes in which received.

(2) Cap off sampling point valve opening to prevent contamination.

(3) When drawing samples, allow adequate oil run out before filling the sample bottle.

(4) Never take a sample immediately after an oil or filter change or the addition of oil to the sump.

(5) After oil and filter change, or the addition of oil, allow a minimum of 25 hours operation before sampling.

(6) Avoid contact of the sample bottle with equipment, rags, hands, etc. A

"sterile" sample is required.

(7) Open the sample bottle only when completely ready to take the sample. Replace bottle cap immediately after taking the sample.

(8) If a sampling tube is used, discard the tube after taking the sample.

(9) Hot samples are the required method because of flushing action, etc. Samples shall be drawn from the machinery while running at normal operating temperature and only from the designated sampling point.

(10) If the time to sample a piece of machinery and the necessity for adding lube oil coincide, take the lube oil sample before adding oil.

(11) Use a clean, lint-free wiping cloth to avoid introducing lint into the system or oil. Sweaty hands will cause an erroneous reading if they come in contact with the bottle or stopper.

(12) Exercise caution to avoid dropping the sample bottle or other material into the system during sampling.

6. Oil Sample Intervals. The oil sampling interval policy provided in this paragraph applies to main diesel engines, ship service diesel engines, reduction gears, thrusters, controllable pitch propeller systems, and hydraulic systems. Sampling intervals shall be as follows:

a. For diesel engines with defined oil change intervals greater than or equal to 750 hours, oil samples shall be taken a minimum of three times between oil changes, at even operating hour intervals. Oil sampling intervals shall not exceed 250 operating hours.

b. All equipment with defined oil change intervals of less than 750 hours shall not be required to undergo routine sampling. Unless specified herein. Where specified the oils samples shall be taken at oil change intervals.

c. Sampling intervals for reduction gears, thrusters, controllable pitch propellers, and hydraulic systems that don't have defined oil change intervals shall be taken quarterly. Samples from reduction gears, thrusters, controllable pitch propellers and hydraulic systems with defined oil change periods shall be taken a minimum of three times between oil changes at even increments of elapsed time. Oil samples shall be taken no less frequently than quarterly.

d. Samples shall be taken before oil is changed. Sampes of new oil being installed shall be taken. In addition, newly overhauled engines shall have oil samples drawn and submitted after 1, 25, 50 hours, and thereafter at the regularly scheduled sampling intervals.

e. If at all possible, an oil sample shall be drawn and submitted after any major engine casualty. The sample will be used to relate the casualty to oil characteristics and develop data that may be useful in predicting similar casualties. A sample from the engine sump will suffice.

7. Oil Analysis Tests and Analysis. The following tests and analysis shall be done regardless of whether NOAP or commercial labs are used:

   a. Spectrometric Analysis for wear metals: Data shall be reported in parts per million (ppm). Results shall be trended. Labs shall use both wear metal levels and wear metal trend levels to make determinations regarding the existence and severity of machinery problems. Labs shall also make diagnostic determinations based on the types of wear metals exhibiting abnormally high wear metal concentrations and trend levels. The following wear metals levels shall be measured and reported:

      (1) Iron
      (2) Silicon
      (3) Lead
      (4) Magnesium
      (5) Copper
      (6) Chromium
      (7) Aluminum
      (8) Molybdenum
      (9) Nickel
      (10) Silver
      (11) Tin
      (12) Zinc

   b. Particle Count Analysis (Applicable to CPP and Hydraulic Systems only): Labs shall perform particle count analysis on all hydraulic oil system samples (including CPP systems). Particle counts shall be determined and reported for each of the following particle size categories:

      (1) Greater than 2 Microns
      (2) Greater than 5 Microns
      (3) Greater than 15 Microns
      (4) Greater than 25 Microns
      (5) Greater than 50 Microns
      (6) Greater than 100 Microns

   In addition to the above particle count determinations, Labs shall provide ISO 4406 3-digit cleanliness codes for hydraulic oil samples.

   c. Physical properties tests. Labs shall test for and report on the following physical properties:

(1) **Diesel Engines**
- (a) Viscosity @ 40 C
- (b) Viscosity @ 100 C
- (c) Viscosity Index
- (d) Fuel dilution
- (e) Glycol Contamination
- (f) Suspended Solids
- (g) Non-suspended solids
- (h) Water
- (i) Total Base Number
- (j) Percent oxidation
- (k) Flash point
- (l) PH

(2) **Reduction Gears, Thruster Lube Oil**
- (a) Viscosity at 40 C
- (b) Viscosity at 100 C
- (c) Viscosity Index
- (d) Water
- (e) Suspended Solids
- (f) Non-suspended Solids
- (g) Percent Oxidation
- (h) Total Base Number
- (i) Flash Point
- (j) PH

(3) **Gas Turbines**
- (a) Viscosity at 40 C
- (b) Viscosity at 100 C
- (c) Viscosity Index
- (d) Water
- (e) Suspended Solids
- (f) Non-suspended Solids
- (g) Percent Oxidation
- (h) Total Acid Number
- (i) Flash Point
- (j) PH

(4) **Hydraulic Systems (Including CPP Systems)**
- (a) Viscosity at 40 C
- (b) Viscosity at 100 C
- (c) Viscosity Index
- (d) Water
- (e) Particle Count

8. Reporting Requirements, Commercial Labs:

   a. Commercial oil analysis reports shall include a complete oil analysis history and applicable recommendations for the sampled equipment. Pursuant to this, the unit providing the sample shall provide labs with the following information for each sample:

      (1) Name/Address of the Cutter or unit providing the sample

      (2) E-mail address of the unit providing the sample

      (3) Addresses of units receiving the oil analysis results. This shall include the ELC (para: C.8.c.)

      (4) E-mail addresses of the units receiving the sample results. This shall include the ELC (para: C.8.c)

      (5) Equipment type, manufacturer and model number

      (6) Equipment Serial Number

      (7) Date the sample was taken

      (8) Operating hours/days since last overhaul

      (9) Operating hours/days since last oil change

      (10) Reason for submitting the oil sample i.e. routine, request by the lab, other

      (11) Quantity of oil added since the last sample was taken

      (12) Actions taken since the last sample was taken, i.e. oil was purified

      (13) Symptoms/problems experienced

      (14) An indication of how the sample was taken, drain, hot sample, sampling tube, or cold sample

   b. Commercial oil analysis shall include:

      (1) A complete oil analysis history for all applicable equipment/systems. The history shall present results listed in tabular format. Each test shall indicate the date the sample was analyzed, the number of operating hours on the equipment sampled, the number of operating hours since last overhaul (if applicable), and the number of operating hours since the last oil change. It shall include an indication of whether or not an oil change was performed after the sample was taken, and the quantity of oil added since the last sample was taken. Sample results shall include spectrometric wear metal levels, particle counts, and oil physical properties IAW paragraphs 7a. 7b. and 7c.

      (2) Recommendations shall be provided based on the sample results.

      (3) The lab shall provide the response time on the lube oil analysis report. The response time is the difference in hours between the time the sample is submitted and the lab response is provided.

c. Lube oil analysis reports shall be provided to the unit/cutter that submitted the sample and to the ELC. Oil analysis reports to the ELC shall be provided in either electronic or hardcopy. An electronic copy is preferred. In order to accommodate the desire of some units to use commercial oil analysis facilities, it is important that copies of oil analysis reports from commercial labs are sent to the ELC. The purpose of this is to allow the ELC to establish and maintain a consolidated database that can be used to track trends in equipment health. Reports shall be forwarded to the ELC at the following address:

Attn: Condition Based Maintenance Group
U.S. Coast Guard Engineering and Logistics Center
Code 026, Propulsion Branch
2401 Hawkins Point Road, Mail Stop 25
Baltimore MD 21226-5000

Electronic copies of oil analysis reports shall be sent to the following E-mail Address: **ELCOAR.elcbalt.uscg.mil**

NOTE: Commercial labs will usually provide oil analysis sampling bottles, labels and shipping bags. These items may or may not be included in the price of the analysis.

d. Questions/Comments regarding this chapter may be submitted by E-Mail to ELCOAR.elcbalt.uscg.mil.

9. This section applies only to submission policies, analysis, procedures and practices associated with NOAP Labs with the exception that wear metal threshold limits listed in table 262-2 apply to the equipment listed. These limits shall be provided to the testing laboratory regardless of whether NOAP or commercial Labs are used.

a. Submission to NOAP Labs: Samples to NOAP Labs shall be mailed first class mail within CONUS and air mailed outside CONUS to the participating laboratory.

(1) Pacific Area cutters and units shall submit samples to:

Commanding Officer, SIMA San Diego (Code 2442A)
Box 368106
3755 Brinser Street
San Diego, CA 92136-5299
SIMA San Diego CA//2400//

(2) All other cutters/units shall submit samples to:

(2) MARCC/JOAP LAB
9349 Fourth Street
Norfok, VA 23511-2116

(3) All samples shall be labeled and be accompanied by the "Oil Analysis Request," DD Form 2026. Instructions for completing the form are listed in Paragraph C.9.b.

(a) Sample Bottles. Oil samples shall be submitted in lube oil analysis bottles. A kit of 72 bottles, labels, shipping bags and forms is available through the Navy supply system.

(b) Delayed Submission. In those instances when a cutter is unable to comply with the testing interval specified in paragraph C.6. because of operational schedules, oil sampling shall continue and samples collected shall be forwarded to the analyzing facility at the first opportunity. The purpose of these delayed submissions is to maintain continuity both in the oil history and in the flow of maintenance information feedback, even though the benefit of rapid response to an oil sample submission is lost.

NOTE: If an oil sample for any unit of equipment is not received by NOAP within a 240 day period, NOAP will delete all historical data on that piece of equipment from its database.

(c) Acting on Laboratory Recommendations. The lube oil analysis program is a maintenance tool to be used in conjunction with other indicators. Ultimate maintenance responsibility remains with the unit. Recommendations made are based on the preprogrammed criteria in the automated laboratory system and final evaluation of abnormal results by a trained laboratory evaluator. Advice may range from "normal" to "sample in a specified number of hours" or even to "reinspect." The laboratory advice codes are listed for information.

b. How to fill out "Oil Analysis Request," DD Form 2026. Care must be exercised when filling out the "Oil Analysis Request." Without a correctly and completely filled out form, a correct evaluation of the oil sample may be impossible. Figure 262-1 shows an example of a correctly filled out form.

(1) TO OIL ANALYSIS LAB - Enter the address of the laboratory.

(2) FROM MAJOR COMMAND - Enter the district or Area for the unit submitting the sample. Example: CGD ONE.

(3) FROM OPERATING ACTIVITY - Enter the complete mailing address of the unit submitting the sample. Example: Commanding Officer, USCGC SPENCER (WMEC 905), Boston, MA 02109.

(4) EQUIPMENT MODEL/APL - Enter the complete APL of the equipment from CALMS from which the oil sample was taken if available.

(5) EQUIPMENT SERIAL NO. - Enter the complete serial number of the equipment from which the sample was taken. For SIMA Norfolk use the unique ESN (Hull #, Unit # and Type Equipment Code (TEC)).

(6) END ITEM MODEL/HULL NO. - Enter the cutter class and number for the unit submitting the sample. Example: WMEC 905.

(7) END ITEM SERIAL NO./EIC - Enter the EIC of the equipment from which the sample was taken. Example: B101/Main Propulsion Engine, Diesel, Mechanical.

(8) DATE SAMPLE TAKEN (day-month-year) - Self-explanatory.

(9) LOCAL TIME SAMPLE TAKEN - Self-explanatory.

(10) HOURS/MILES SINCE OVERHAUL - Enter the number of operating hours or miles since overhaul, or since new if never overhauled.

(11) HOURS/MILES SINCE OIL CHANGE - Self-explanatory.

(12) REASON FOR SAMPLE - Check appropriate block. Be sure to explain if "other" block is checked.

(13) OIL ADDED SINCE LAST SAMPLE (pints, quarts, and gallons) - Enter the amount of oil added since the last sample was taken.

NOTE: Accurate reporting for oil added will allow correction of the apparent spectromatic reading for this factor.

(14) ACTION TAKEN - Enter any maintenance action taken since the last sample.

(15) DISCREPANT ITEM - Enter the nomenclature of the discrepant item found as a result of the previous sample.

(16) HOW MALFUNCTIONED - Enter a description of how the equipment malfunctioned prior to finding the discrepant item.

(17) HOW FOUND - Check the appropriate block.

(18) HOW TAKEN - Check the appropriate block.

(19) REMARKS - Enter appropriate remarks or leave blank as applicable.

(20) FOR LAB USE ONLY - Complete the sample number block only.

(21) KEYPUNCH CODE - Disregard these blocks.

OIL ANALYSIS REQUEST	KEY PUNCH CODE
TO: OIL ANALYSIS LAB CHARLESTON NAVAL SHIPYARD NOAP LAB (CODE 134), CHARLESTON, SC 29408	
FROM: MAJOR COMMAND CGD ONE	
FROM: OPERATING ACTIVITY *(Include ZIP Code/APO)* USCGC SPENCER, WMEC 905, BOSTON, MA 02109	
EQUIPMENT MODEL/APL 665360253	
EQUIPMENT SER. NO. 970-873	
END ITEM MODEL/HULL NO. WMEC-905	
END ITEM SER. NO./EIC B101/MAIN PROPULSION ENGINE, DIESEL, MECHANICAL	
DATE SAMPLE TAKEN *(DAY, MO., YR.)* 22-12-82 — LOCAL TIME SAMPLE TAKEN 1345	
HOURS/MILES SINCE OVERHAUL 1200 HOURS	
HOURS/MILES SINCE OIL CHANGE 1200 HOURS	
REASON FOR SAMPLE ☒ ROUTINE ☐ LAB REQUEST ☐ TEST CELL ☐ OTHER *(Specify)*	
OIL ADDED SINCE LAST SAMPLE *(Pt., Qts., Gals)* 50 GALLONS	
ACTION TAKEN PURIFIED OIL	
DISCREPANT ITEM	
HOW MALFUNCTIONED	
HOW FOUND ☒ LAB REQUEST ☐ CREW	
HOW TAKEN ☐ DRAIN ☐ TUBE ☒ HOT SAMPLE ☐ COLD SAMPLE	
REMARKS NO.1 MAIN DIESEL ENGINE	

FOR LAB USE ONLY

SAMPLE RESPONSE TIME						
FE	AG	AL	CR	CU	MG	NI
PU	SI	SN	YI	MO .	.	
LAB RECOMMENDATION						
SAMPLE NO.			COMPONENT CONTROL NO. *(CCN)*			

DD FORM 2026 1 AUG 76 REPLACES AFTO FORM 110, APR 78, DA FORM 3282, NOV 72, AND NAVMAT FORM 4731/1, FUL 72 WHICH ARE OBSOLETE

Figure 262-1. "Oil Analysis Request Form" DD Form 2026

c. Providing Feedback Information. Feedback reports are required to answer laboratory advice on maintenance action, to describe significant maintenance actions taken in accordance with laboratory advice, and to describe maintenance actions such as inspections or overhauls. Feedback information must be included with each oil sample submitted, regardless of how insignificant the maintenance may seem. The conditions found on inspection or replacement of components may be reported on DD Form 2026. An attached typewritten summary may also be used. This information will ensure that decision-making criteria are updated. Reports shall list significant actions that could affect laboratory results. All cases of material failure shall be reported. Feedback information shall be reported on the following occasions:

(1) When the laboratory warns of critical impending failure.

(2) When special samples are requested.

(3) Malfunctions (actual or incipient) that should have been detected by oil analysis.

(4) When the equipment is removed from service or stricken from inventory.

(5) When the equipment is transferred to another operating activity, maintenance activity or storage.

(6) When specific maintenance feedback information is requested.

(7) When samples of unused lube oil are required to compare with the lube oil in the system.

(8) After oil filter changes and centrifuging of oil. Certain cutters may realize a dilution factor from common suction and discharge piping with other machines in the purifier system. The testing facility must also be notified if your unit has this type of system.

(9) Upon striking aboard new oil. Submit a new oil sample from the storage tank to the testing facility as soon as possible.

d. Laboratory Services. The Navy oil analysis program laboratories provide the following services:

(1) Spectrometric measurements of wear metals, particle count, and physical properties testing and analysis as described in para 7 a., 7.b. and 7.c.

(2) Analyze samples within 24 hours after receipt. If the item is indicated to be abnormal, the unit will be advised by fastest possible means.

(3) Laboratory recommendations, which will consider results of both spectrometric and physical tests.

(4) Continual analysis of data to upgrade threshold criteria, determine differences between equipment models and make and correlate feedback data with laboratory criteria.

e. Lube Oil Analysis: Theory, Reports, and Threshold Values. Lube oil analysis is the process by which oil samples, drawn from machinery at periodic intervals such as every 500 hours or quarterly, are tested by spectrometric analysis and physical properties tests for abnormal conditions. Both tests help evaluate the internal condition of an enclosed mechanical system. Spectrometric analysis is the method by which wear metals in the fluid are measured by an emission spectrometer in parts per million. Physical tests are a series of tests for the physical condition of the oil.

(1) Spectrometric analysis is based on the fact that moving contact between metallic components wears away fine metal particles that are carried in suspension. After a break-in period, the wear metal is produced at about the same rate until near the overhaul period when wear metal production increases sharply. The laboratory technique is accurate, but interpretation depends on many variables, beginning with the sampling process. Data interpretation requires knowledge of normal and abnormal quantities, threshold limits, trend tables, decision guides, metallurgy, data trend, and accurate data from the cutter concerning the sample. Contrary to some belief, no single level of wear metal concentration can be used as a go/no go indicator.

(2) Figure 262-2 shows the hypothetical effect of constant oil replenishment on wear metal concentration, from the NOAP laboratory manual. Figure 262-3 shows the actual results of oil added, also from the lab manual. Note that there is a drop after each oil addition and a drop to near zero after an oil change. Oil samples shall not be taken after an oil change or within 25 hours after oil has been added. A correction for oil added will be included in the automated system.

(3) Threshold value is the amount of trace metal concentration expressed in parts per million at which level evaluation for abnormality starts; that is concentrations below threshold values are normal. As the database increases these threshold values will be automatically adjusted up or down to reflect more accurately normal and abnormal conditions.

f. Reports. The automated laboratory system generates the following messages and reports:

(1) Message - When any sample tests abnormal in either trace metal monitoring (spectrometric) or oil condition (physical tests), the unit is informed by

message of the abnormality and quantitative value of the parameter or parameters responsible. Laboratory advice (resample, inspect) is also given with probable source of the problem indicated.

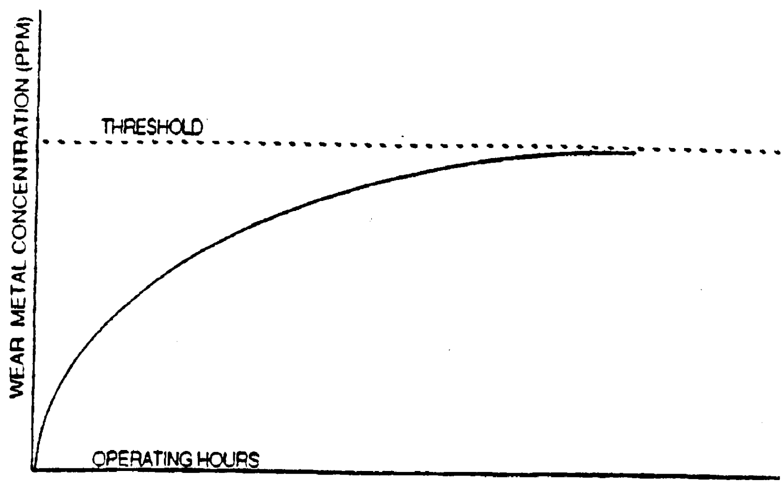

Figure 262-2. Wear Metal Concentration Vs Constant Oil Replenishment

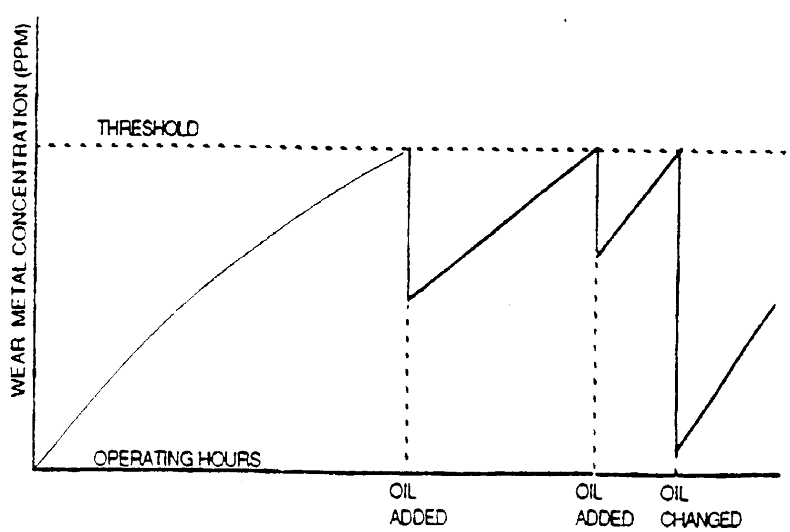

Figure 262-3. Wear Metal Concentration Vs Periodic Oil Addition and Oil Change

(2) Equipment History - After each sample is analyzed, an equipment history will be printed, giving all data on the sample and the five previous samples in the automated laboratory data system. A copy will be forwarded to the unit. Interpretation of the data requires knowledge of trend analysis and criteria. Figure 262-4 shows an example of an "Equipment History." In the event that a unit receives abnormal readings or feedback from the oil analysis lab, that unit shall notify its respective MLC.

g. Decision-Making Procedure. The evaluation of spectrometric data is automatically performed by the automated laboratory system and reviewed by a trained evaluator. A simplified version of the steps involved using the ALCO V16-251B engine as an example follows:

(1) EQUIPMENT/EQUIPMENT IDENTIFICATION CODE AND MANUFACTURER - Select equipment/equipment identification code/manufacturer -- B101 - Main Propulsion Engine - ALCO V16-251B.

(2) WEAR METAL THRESHOLD LIMITS - Find the appropriate threshold limits for the trace metals from Table 262-2.

NOTE: Using the above example, the wear metal threshold limits are:

Fe	Ag	Al	Cr	Cu	Mg	Ti	Pb	Sn	Ni	Mo	Si
52	0	13	23	33	100	0	10	0	4	4	50

(3) TREND ANALYSIS LEVELS - The threshold limits are used to find the trend analysis levels for decision-making. For each trace metal, using the threshold values, find the ppm level for the threshold in "Trend Analysis Levels." Next find the level (1, 2, 3, or 4) in which the present sample results fall.

(a) EXAMPLE - for the B101 ALCO propulsion diesel, assume the spectrometric readings for the sample were:

Fe	Ag	Al	Cr	Cu	Mg	Ti	Pb	Sn	Ni	Mo	Si
35	0	13	41	13	35	0	8	0	0	0	7

COAST GUARD WEAR METAL THRESHOLD LIMITS (PPM)

	Fe	Ag	Al	Cr	Cu	Mg	Ti	Pb	Sn	Ni	Mo	Si
EQUPMENT/EIC												
MPE/B101											2	11
ALCO V16-2519	52	0	13	23	33	45	0	10	0	2	4	54
ALCO 18-251-8	51	0	13	23	33	100	0	10	0	4	4	54
CATERPILLAR D-353	57	0	17	7	15	41	0	21	0	2	2	11
CATERPILLAR D-375	57	0	17	7	15	41	0	21	0	2	2	11
CATERPILLAR D-379	57	0	17	7	15	41	0	21	0	2	2	11
CATERPILLAR D-398	57	0	17	7	15	41	0	21	0	2	2	11
CUMMINGS V12-525	75	0	15	13	20	40	0	30	15	0	0	12
CUMMINGS V12-600	75	0	15	13	20	40	0	30	15	0	0	12
FAIRBANKS-MORSE 38TD 8-1/8	39	2	6	53	35	100	0	15	2	2	2	11
GM 6-71	88	0	27	30	27	100	0	19	5	2	2	17
GM 6-110	140	0	0	30	125	100	0	30	45	0	0	50
GM 16V 149	140	0	0	30	125	100	0	30	45	0	0	50
PAXMAN 16RP200M	85	0	10	50	15	0	0	20	17	0	0	25
MTU 8V#(^												
CATERPILLAR 3516												
CATERPILLAR 3412	65	-	15	6	25	-	-	40	-	-	-	23
CATERPILLAR 3406	65	-	15	6	45	-	-	23	-	-	-	23
CATERPILLAR 3508	90	-	17	6	75	-	-	33	-	-	-	28
CATERPILLAR 3608	25	-	6	3	12	-	-	8	-	-	-	12
MPE/C101												
ALCO V16-251-F	52	0	13	23	33	45	0	10	0	2	2	11
ENTERPRISE DSR 46	43	0	9	25	19	34	0	10	0	1	1	6
FAIRBANKS-MORSE 38D 8-1/8	65	0	3	12	100	100	0	21	13	2	4	7
CATERPILLAR D-698	57	0	17	7	15	41	0	21	0	2	1	11
COOPER-BESSEMER GN-8, GND-8, GSB-8	43	0	8	6	14	24	0	10	0	2	2	21
GM 12-567	84	0	26	27	26	100	0	17	3	2	2	15
GM 8 & 12 278A	99	5	4	15	105	100	0	90	0	0	0	17
INGERSOLL RANDS	68	4	32	20	60	100	0	35	0	0	0	17
MPE/D101												
PRATT-WHITNEY FT4A-2	39	3	0	4	3	21	4	40	17	3	3	9
PRATT-WHITNEY FT4A-6	39	0	0	4	1	0	0	40	10	2	0	9
PRATT-WHITNEY FT4A-12	39	0	0	4	3	21	4	40	17	3	3	9
RGM/B301												
FARRELL-BIRMINGHAM	50	0	5	2	30	40	0	40	0	2	2	10
LUFKIN HSQ 1616	28	0	6	2	33	41	0	43	0	2	2	14
LUFKIN MSQ 2724	34	0	6	2	33	45	0	39	0	2	2	14
PHIL-GEAR DHMGS	56	0	5	2	15	28	0	10	0	2	2	17
PHIL-GEAR 75VMGS	56	0	5	2	15	28	0	10	0	2	2	17
PHIL-GEAR 120 DHMGS	56	0	5	2	19	100	9	10	4	3	3	13
PHIL-GEAR 96DHCMG-CP	56	0	5	2	19	100	9	10	0	3	3	21
WESTERN 46123R	22	2	5	2	19	100	9	10	4	3	3	13
PC/8408												
ESCHER-WYSS 400G	87	3	4	5	23	100	0	12	0	2	3	10
KAMEWA 66/4	23	0	5	2	76	100	1	23	5	2	1	11
PROP SYS PSI 50/3	18	1	2	1	24	1	2	6	7	1	3	10
PROP SYS PSI 63/4	18	1	2	1	24	1	3	6	7	1	3	10
PROP SYS PSI 125/4	18	1	2	1	24	4	3	6	7	1	3	10
PC/C408												
ESCHER-WYSS N	87	3	4	5	23	100	0	12	0	2	3	10
MM/M101												
WESTINGHOUSE S082P046-SSG/3101	20	0	0	4	20	100	0	10	5	2	3	10
ALCO V8-2518	52	0	13	23	33	45	0	10	0	2	2	11
CATERPILLAR D-343	57	0	17	7	15	41	0	21	0	2	2	11
CATERPILLAR D-318	57	0	17	7	15	41	0	21	0	2	2	11
CATERPILLAR D-348	57	0	17	7	15	100	0	10	0	4	4	50
CATERPILLAR D-398	57	0	17	7	15	41	0	21	0	2	1	11
CATERPILLAR 3304	86	0	18	9	26	0	0	51	0	0	0	24
FAIRBANKS-MORSE 38E5-1/4	69	0	8	4	20	100	1	13	6	1	3	9
FAIRBANKS-MORSE 38F5-1/4	69	0	3	3	11	100	1	13	6	1	3	6
GM LL-8-567CR	24	2	5	12	23	100	7	9	0	2	2	12
GM8	110	0	25	20	25	100	0	30	5	2	2	15
GM6061	88	0	27	30	27	100	0	20	5	2	2	15
GM 4 & 6071	88	0	27	30	27	100	0	19	5	2	2	17
GM 3, 6, 8, - 268A	99	5	4	15	105	100	0	90	0	0	0	17

Table 262-2. Wear Metal Threshold Limits

EQUIPMENT HISTORY

LAB : NAVSHIPYD CHARLESTON SC

EIC : B101 EQUIP: MPEDM

HULL NUMBER : WMEC 630

UNIT NUMBER : 1

APL NUMBER : 664010026

EXAMPLE ONLY

CUST SERVICE : COAST GUARD

TYCOM UIC/CGD : 00003

SPECTROMETRIC HISTORY

SMPL NUM	DATE ANAL ADVICE	RESP TIME	HOURS SINCE OVHL	HOURS SINCE OIL CH	REASON FOR SAMPLE	FE	AG	AL	CR	CU	MG	TI	PB	SN	NI	MO	SI	COMPUTER ADVICE	LAB
						PPM READINGS													
3318	6244	05	04657	0306	ROUTINE	112	000	027	976	035	049	000	059	000	001	000	021	INSP/25	S1
1461	6258	03	04017	0033	ROUTINE	042	000	011	394	016	036	000	019	000	000	001	009	50/25	B1
516	6280	99			ROUTINE	043	000	009	087	017	036	000	010	000	000	000	011	50/25	B1
1819	6289	22	04861	0023	ROUTINE	025	000	009	094	015	033	000	013	000	001	000	004	50	B1
0281	6307	10	05077	0238	ROUTINE	035	000	013	041	013	035	000	008	000	000	000	007	NRML/50	B1
					THRESHOLDS	052	000	013	023	033	100	000	010	000	004	004	050		

PHYSICAL TEST HISTORY

SMPL NUM	DATE ANAL	RESP TIME	HOURS SINCE OVHL	HOURS SINCE OIL CH	OIL ADDED	ACID NUM	% WATER	FLASH PT	FUEL DILUT	VISC	% SOLIDS	LAB ADVICE
3318	6244	05	04657	0306	XXX	A	00.0	325	XXX	159	XXX	A2
1461	6250	03	04017	0033	XXX	A	00.0	325	XXX	131	XXX	A2
516	6280	99			XXX	A	00.0	325	XXX	124	XXX	A2
1619	6209	22	04061	0023	XXX	A	00.0	325	XXX	XXX	XXX	A2
0281	6307	10	05077	0238	053	A	00.0	325	XXX	114	XXX	A2

Figure 262-4 Example of Equipment History

(b) Using the threshold limits from the example under Step 2, the present trend analysis levels for each trace metal are:

Fe	Ag	Al	Cr	Cu	Mg	Ti	Pb	Sn	Ni	Mo	Si
2	1	2	4	1	1	1	2	1	1	1	1

(c) These trend levels are used in the decision-making process to recommend maintenance actions.

(4) TREND ANALYSIS AND DECISION-MAKING - Trend analysis is the method by which data from prior samples are averaged and used with laboratory results from the current oil sample to find out if there are increasing levels of trace metals pointing to abnormal internal wear. <u>It is important to understand that both the previous trend levels and the present trend levels determine the recommendation for action, not the present sample results alone</u>. Trend analysis levels are expressed as whole numbers (1, 2, 3, or 4).

(a) Levels 3 and 4 are the more serious. Level 1 is normal and 2 may require resampling in either 25 or 50 hours.

(b) To average the trend analysis level for each wear metal, add the trend numbers for at least the previous three samples, and then divide by the number of samples. If there are fewer than three samples, the previous trend level is left to the evaluator's judgement. This average is the previous trend analysis level to be used in "Decision-Making Guide." A worksheet example of previous trend level computation is provided on the next page:

(c) Note that a present trend level of 4 results in an inspection or resamples laboratory recommendation, depending on the evaluator's judgment. A present trend analysis level of 3 preceded by a trend level of 4 requires inspection. The automated laboratory system automatically averages the trend levels for each trace metal, applies the present trend analysis level, and selects those warranting inspection or resampling and the resample period. In determining the advice code, physical test criteria are used by the ADP system in addition to spectrometric data. The computer selects the most critical advice. The laboratory evaluator reviews the automated system recommendation and concurs, or substitutes another recommendation. The above example would result in a recommendation to resample in 25 hours.

	Fe	Ag	Al	Cr	Cu	Mg	Ti	Pb	Sn	Ni	Mo	Si
Threshold	52	0	13	23	33	100	0	10	0	4	4	50
Previous SampleTrend Levels	2	1	2	4	1	1	1	2	1	1	1	1
	1	1	2	4	1	1	1	2	1	1	1	1
	1	1	2	3	1	1	1	2	1	1	1	1
	1	1	2	4	1	1	1	2	1	1	1	1
Average	1.3	1	2	4	1	1	1	2	1	1	1	1
Present Trend Level	2	1	2	4	1	1	1	2	1	1	1	1

* = Use 1 if no previous data exists.

TABLE 262-3 - DECISION MAKING GUIDE

Present Trend Analysis Level	Previous Trend Analysis Level	Lab Recommendation
1	1	Normal
	2	Normal Resample in 50 hrs*
	3	Resample in 50 hours
	4	Resample in 25 hours
2	1	Resample in 25 hours
	2	Normal Resample in 50 hrs*
	3	Resample in 25 hours* Resample in 50 hours
	4	Resample in 25 hours*
3	1	Resample in 25 hours*
	2	Inspect Resample in 25 hrs
	3	Resample in 25 hours
	4	Inspect
4	1	Resample in 25 hours*
	2	Inspect Resample in 25 hrs*
	3	Inspect Resample in 25 hrs*
	4	Inspect

* = The preferred code is left to the evaluator's judgment based on the circumstances.

NOTE: For initial sample on equipment, use Level 1 for previous Trend Analysis Level.

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(5) OIL ANALYSIS LABORATORY ADVICE CODES - Laboratory Advice Codes are developed for wear metal monitoring (spectrometric) and oil condition. For each sample, two laboratory recommendations are recorded and will appear on the equipment history. Advice Code depends on several factors, including trace metal concentration, trend levels, the trace elements, equipment metallurgy, time after overhaul (break-in wear), type of oil, oil added, oil condition, viscosity and rate of change in viscosity, water, and fuel dilution.

(6) INTERPRETATION - The above process decides whether the results are normal or abnormal. If abnormal, the trend levels determine whether to inspect, resample, or both, and the resample interval (25 to 50 hours). Resampling confirms that the sample was a valid indication of lube oil condition.

(7) LABORATORY RECOMMENDATION (ADVICE CODE) - The selection of advice code depends on the wear metals with abnormally high readings. Metallurgy of engine parts and prior failures indicate the probable cause, such as cylinder liner, rings, pistons, camshafts, lube oil pumps, salt water leaks, etc. Often the cause could be two or more items. Data feedback is essential to confirm diagnosis and aid future analysis.

The summaries are listed for information only:

. Physical Test Criteria
. Significance of Wear Metals and Source
. Trend Analysis Levels

TABLE 262-4 – PHYSICAL TEST CRITERIA

PHYSICAL	TESTS WARNINGS
Viscosity	- 130 CS (fuel dilution warning) - 190 CS 10% decrease in viscosity 40% increase in viscosity - 25 CS warning for main propulsion gas turbine engines only
Fuel Dilution	- 5.0%
Water	- 0.2% Salt Water - 0.5% Fresh Water
Neutrality	- 0.5 - 1.0 warning for main propulsion gas turbine engine only

TABLE 262-5 – WEAR METALS AND SOURCE

ELEMENT	SYMBOL	INDICATOR/SOURCE
Iron	Fe	Antifriction bearings, gears, cams, shafts, oil pumps, valves, cylinder liners, and piston rings
Silver	Ag	Wrist pin bearings (in some engines)
Aluminum	Al	Bearings, pistons, pumps, blowers, cylinder heads
Chromium	Cr	Chromium-plated cylinder liners, rings, bearings.
Copper	Cu	Bushing wear (Camshaft, rocker arm, or fuel pump.). Piston thrust washers
Lead	Pb	Bearing overlay material, main and connecting rod bearing shells
Magnesium	Mg	Salt water or contaminated fuel
Titanium	Ti	Bearings, supports, sleeves
Tin	Sn	Bearings, bushings, pistons.
Nickel	Ni	Valves, crankshaft
Molybdenum	Mo	Piston rings

ELEMENT	SYMBOL	CONTAMINANT ELEMENTS
Silicon	Si	Airborne sand/air filters
Boron	B	Commonly found as additives in coolant, presence in engine oil might indicate an internal water leak.
Sodium	Na	Commonly found as additives in coolant, presence in engine oil might indicate an internal water leak.
Potassium	K	Commonly found as additives in coolant, presence in engine oil might indicate an internal water leak.
Sodium	Na	This element is associated with sea water contamination.
Magnesium	Mg	This element is associated with sea water contamination.

ELEMENT	SYMBOL	ADDITIVE ELEMENTS
Magnesium	Mg	Dispersent/detergent to clean and neutralize acids.
Calcium	Ca	Dispersent/detergent to clean and neutralize acids.
Barium	Ba	Dispersent/detergent to clean and neutralize acids.
Zinc	Zn	Anti-Wear additive to reduce friction.
Sodium	Na	Anti-Wear additive to reduce friction.

TABLE 262-6
STANDARD LAB RECOMMENDATION CODES FOR SPECTROMETRIC ANALYSIS

CODE	GENERAL LAB RECOMMENDATIONS
A	Sample results normal, continue routine sampling
Z	Previous recommendation still applies

CODE	INSPECTION RECOMMENDATIONS (Requires Feedback)
H**	Inspect unit and advise lab of finding. Abnormal wear indicated by (ppm) (element). Resample after (maintenance/*** hours/etc.)
K**	Impending failure, critical wear indicated by (element). Inspect unit and advise lab of findings. Resample after (maintenance/*** hours/etc).
L**	Inspect brake and clutch plate adjustments, change oil service filters, resample after *** hours of operation.
M**	Perform engine coast-down check. If engine fails test, examine for discrepancy and advise lab of results; otherwise, resample after *** hours of operation.
U**	Cooling system leak indicated by (Mg/CR/Na/B). Inspect unit and advise lab of findings. Resample after (maintenance/*** hour/etc).

CODE	OIL CHANGE RECOMMENDATIONS
D	Change oil and service filters. Resample after *** hours of operation.

CODE	LAB REQUESTED SAMPLES
B*	Resample as soon as possible; do not change oil.
C	Resample after *** hours.
F*	Do not change oil. Submit special sample after test run. Do not operate until after receipt of lab results or advice.
G*	Contamination suspected; resample in accordance with break-in schedule or after *** hours.
N*	Unit 'wear-in' indicated; resample in accordance with break-in schedule or after *** hours.
P*	Do not operate; do not change oil; submit resample as soon as possible.

NOTE:
*** Resample (red cap) required.**
**** Maintenance feed back required; advise lab of findings**
***** Laboratory will specify time limit**

TABLE 262-6 (CONT'D)
STANDARD LAB RECOMMENDATION CODES FOR SPECTROMETRIC ANALYSIS

CODES	PHYSICAL TEST
AA	Oil condition normal continues routine sampling.
DN	Do not operate.
ER	Evaluate and repair component.
TS	Check oil type and source.
ZZ	Previous recommendation still applies.

CODE	OIL CONDITION STATEMENTS
FD	Fuel dilution.
NN	Neutralization or acid number.
PC	Particle count excessive.
SA	Solid or abrasive material.
VS	Viscosity (high/low/change).
WA	Water.

CODE	OIL CHANGE RECOMMENDATIONS
CS	Change oil and service filter.
CP	Purify, renovate or change oil and service filters.

CODE	LAB REQUESTED SAMPLES
RB*	Resample as soon as possible.
RC*	Resample after *** hours.
RH*	Submit hot sample.
RI*	Resample, insufficient amount of sample received.
RS*	Submit sample of new oil servicing this unit.

CODE	INSPECTION RECOMMENDATIONS (Requires Feedback)
IA**	Inspect and repair air induction system.
IC**	Inspect and repair fuel system; change/service filter and oil.
IW**	Inspect for source of water.

NOTE: * Resample (red cap) required.
** Maintenance feed back required; advise lab of findings
*** Laboratory will specify time limit

10. Records. Each unit participating in this program shall maintain a file containing the complete lubricating oil history, including the report of the result of spectrochemical and physical properties tests, accompanying analyses, and the resultant maintenance recommendations for each unit of machinery entered in the test program. This record shall be called the " Oil History Log".

11. Field Evaluation. The information received from the analyzing facility must be evaluated in light of all other known factors in order that sound engineering decisions may be made concerning the need for preventive maintenance on any piece of equipment. The key to the success of this program is "evaluation". The responsibility for evaluation rests with the submitting unit.

12. Cutter and Boat Lubricating Oil Testing Procedures. All cutters and boats are required to carry equipment to test and compare the viscosity of lubricating oil of diesel engines. Either the lube oil testing kit outlined in NSTM Chapter 233 (Falling Ball) or the Visgage are acceptable for testing 9000 and 2104 series oil.

    a. Viscosity. Viscosity is a measure of the internal friction of the oil. Lubricating oil used in internal combustion engines is subject to a change in viscosity due to fuel dilution, water contamination, and the by-products of combustion etc. Some of the major causes of viscosity changes are provided below.

        (1) Fuel Dilution. This type of contamination cannot be removed by filtration or centrifuging. Testing oil with a viscosity comparator or tester and comparing it with the viscosity of the oil when new may detect lubricating oil dilution.

        (2) Water Contamination. The presence of appreciable amounts of water in lubricating oil can usually be detected by the cloudy or milky appearance of the oil and an increase in viscosity. Where contamination with water exists and cannot be removed by centrifuging, the lubricating oil should be discarded and replaced with fresh oil, after the source of the contamination has been located and repaired.

    b. Testing Procedures.

        (1) The following applies to all cutters and boats (weather/operations permitting). All engines shall have a viscosity test made every day the engine is operated. The operating personnel shall make this check and the results shall be recorded in the machinery or boat log as applicable. Viscosity limits are 40 percent increase and 5 percent fuel dilution from new oil; engine manufacturer limits shall apply if more stringent. Oil samples are taken in accordance with paragraph B.5.b.

        (2) Cutters with oil-filled propeller shaft stern tubes or controllable pitch propeller systems shall visually test this oil every week for water.

NOTE: For Detroit Diesel Allison Series 53, 71, and 149 engines, the manufacturer's recommended maximum viscosity increase is 40 percent. The manufacturer's recommended maximum fuel oil dilution is 1.0 percent fuel dilution for series 149 engines, and 2.5 percent fuel dilution for series 53, 71, and 92 engines. If fuel dilution reaches these limits, the oil shall be changed out and any fuel oil leaks shall be fixed. Engines with fuel systems designed in such a way that failures to oil seals will result in fuel contamination of the lube oil system shall have an oil viscosity check every four engine operating hours.

c. Oil Filter Change Periods. Oil filters and centrifuges are installed to remove water and other contaminants that the engine adds to the oil and that raise the precipitation number. Liberal use of installed centrifuges will ensure that the oil is kept free of foreign matter. A point will be reached, however, when further centrifuging will prove to be of little value. Further, those cutters without centrifuges must rely solely on filters to remove these contaminants. When these installed filters have removed all they can hold, they must be changed. Oil filters shall be changed in accordance with manufacturer recommendations or as required by the respective PMS manuals.

d. Lubricating Oil Change Periods. For internal combustion engines under normal conditions, no difficulty should be experienced in maintaining satisfactory viscosity of the oil with periodic centrifuging or by filter changes. If, however, such action does not reduce or halt the rise of the viscosity, it is to be expected that the mechanical condition of the engine is less than satisfactory. When operational commitments require continued use of the engine or where routine oil testing is not possible, the oil will eventually reach a viscosity limit beyond which further use of oil is ill advised. In addition, neither centrifuging nor filtration will affect acidity or fuel dilution. Therefore, lubricating oil shall be changed in accordance with manufacturer recommendations, as required by the respective PMS manuals, or whenever the condemning limits as stated above, are reached.

D. TWO-STROKE CYCLE GASOLINE ENGINE LUBRICATING OIL. All Coast Guard two-stroke cycle gasoline engines, including those powering outboard motorboats and P-250 MOD 1 fire pumps, shall use oil having the BIA-TC-W or later designation (Boating Industry of America, two-cycle, water or air cooled). BIA-TC-W oilshall be used with a fuel-to-oil ratio of 50 to 1 (one pint of oil per 6 gallons of fuel). This is the ratio recommended by most manufacturers of modern two-stroke cycle engines. There are several fuel-oil ratios now recommended for various older applications, and it is recommended that the subject oil be used at the fuel-to-oil ratio specified by the applicable equipment technical manual. The importance of thorough mixing of the oil and fuel at the specified ratio cannot be over emphasized. Improper mixing can greatly affect engine operation and maintenance. See chapter 555 for additional requirements regarding the P-250 MOD 1.

CHAPTER 300. ELECTRIC PLANT (GENERAL)

A. **SHORE ELECTRIC POWER FACILITIES.** Commercial electric power services are installed and available at most Coast Guard mooring facilities to provide shore-to-ship electric power. Use of commercial electric power is encouraged to reduce operating costs, reduce engine-operating hours, and ease the demand for watch standers.

1. Connection Requirements.

   a. Dockside electric shore tie connections are normally sized for the cutter or boat home-ported there. Both homeport and visiting cutters and boats shall ensure that the dockside connection has the proper voltage, current rating, configuration, and phase rotation each and every time they hook up.

   b. The long time delay setting of each dockside circuit breaker shall be no greater than the smaller of:

      (1) The total ampacity of the shore-to-ship cable(s) connected to it.

      (2) The ampacity of the feeder between the associated shore power receptacle(s) and the in hull circuit breaker, including the rating of any step down transformer.

   c. Cable ampacities shall normally be calculated at 40 DegC (104 DegF) ambient air temperature. A 50 DegC (112 DegF) ambient air temperature should be substituted in exceptionally hot climates or when a cable passes through an operating engine room or boiler space. For cutters with LSTHOF-400 shore-to-ship cables and [LS] TSGU or [LS] TSGA-400 feeders, the limiting ampacity is normally 400 amperes per cable; however, LSTHOF-400 ampacity derates to 365 amperes per cable at 50 DegF

   d. When necessary, approved adapters may be used for connection to dockside receptacles, provided their rating is equal to or greater than the dockside protective devices. IEEE-45 clause 10.11.1 prohibits splicing of cable for repeated flexing service (e.g. shore power cables).

   e. Cutters with three-phase systems shall verify phase rotation compatibility of shore power to ship's power before transfer to shore power.

   f. When the shore tie is not in use, all circuit breakers shall be secured, shore side and shipside, and the cable(s) shall be disconnected at both ends. The receptacle and plug ends shall be covered to prevent moisture or foreign material from entering the plug or receptacle. The shore tie cable shall be properly stowed to prevent accidental damage.

   g. During dockside electric plant testing evolutions, the cable(s) need not be disconnected when shore power will be restored at the conclusion of testing.

2. Operating Precautions. The following procedures are recommended for cutters and boats when using shore electric power.

a. In general, Ship Service Generators shall not be operated in parallel with shore power, however, those cutters with the built in capability may do so momentarily for the sole purpose of shifting power supply from ship to shore or vice versa.

b. Shore power cable connections shall not be made or broken before dockside and vessel shore power circuit breakers have been opened.

c. Heavy equipment, whose operation would result in excessive load on the shore tie connection, shall be operated with the ship service generator(s) supplying the shipboard power system.

d. Shore power plugs and receptacles shall be kept clean and dry, and receptacles shall be tightly covered when not in use.

e. Contacts should be examined frequently for signs of arcing or loose connections.

f. Frequent inspections shall be made to ensure that no undue heating of plugs, receptacles, or cables exists.

g. Whenever the electrical load nears the maximum value of the shore tie's capacity, steps should be taken to either reduce the shipboard load or have a ship service generator placed in operation.

h. Cutters shall include, in their In port Fire Bill, procedures to be followed when the cutter is receiving electric power from ashore.

CHAPTER 475. DEGAUSSING

A. DEGAUSSING INSTALLATIONS.

1. References. NSTM Chapter 475 and NAVSHIPS 250-66034, Degaussing Manual, provide guidance on the operation, maintenance, inspection, testing and repair of degaussing installations and compass compensating equipment. NAVSEA 8950/1, Degaussing Folder, provides guidance on record keeping, and reporting procedures.

2. Applicability. The instructions in this chapter apply only to the cutters indicated in Table 475-1. Maintenance on all other cutters may be discontinued, and system deactivation is authorized.

3. Degaussing Ranging. Each cutter outfitted with degaussing coils shall be ranged at least once a year. In addition, 378-foot WHEC and 270-foot WMEC Class Cutters shall adhere to the provisions of Magnetic Silencing, COMDTINST 8950.3 (series). During wartime, 378' WHECs and 270' WMECs shall be ranged at least every 6 months. The Area Commander in special circumstances may approve deviation from this requirement. Deviation examples include when impending expenditures for maintenance appear to be unjustified or when the area of the cutter's operation is not within a reasonable distance of a degaussing facility. "Reasonable distance" is considered to be approximately 24 hours steaming each way. When a cutter is required to operate where the use of degaussing is necessary, arrangements shall be made to have the cutter ranged, if ranging has not been accomplished within the past 12-month period. This relaxation of ranging requirements is not to be construed as an overall relaxation of other degaussing maintenance requirements. The latest edition of "Degaussing Facilities" shall be maintained in the Degaussing Folder and kept current with changes issued by the Hydrographic Center of the Defense Mapping Agency as "Notice to Mariners." The current "Degaussing Facilities" is distributed to all cutters having degaussing installations.

4. Watch List. For magnetic and degaussing equipment, recommendations on conditions requiring attention that are made known to NAVSEASYSCOM as a result of ranging or inspection are published in the "Degaussing Watch List" issued by the Naval Ordnance Laboratory. The code letter inserted after the cutter name indicates the action to be taken by the cutter.

5. Reports. Report the date of the last ranging and last degaussing inspection on Line 17 of the Cutter Engineering Report, Form CG-4874.

6. Coast Guard-Navy Responsibility. Magnetic Silencing, OPNAVINST C8950.2 (series) describes the basic policy of the Navy regarding degaussing protection for ships of the United States. For Coast Guard cutters, the delegation of responsibilities is as follows:

   a. Installation and conversion is the Coast Guard's responsibility.

   b. Maintenance and repair is the Coast Guard's responsibility.

c. The Navy supplies special materials through appropriate stocking and control activities, on an exchange-of-funds basis.
d. Appropriate Navy activities will provide industrial degaussing inspections and compass compensation assistance upon request, on an exchange-of-funds basis.
e. Naval degaussing facilities will perform non-industrial degaussing effectiveness tests and deperming on a non-reimbursable basis.

7. Coast Guard Degaussing Installations. Table 475-1 shows the Degaussing Coils applicable to Coast Guard Cutters.

TABLE 475-1. DEGAUSSING COILS

Cutter Class	Beam (FT)	Degaussing Coils								
		M	F	Q	FI	QI	FP	QP	L	A
WHEC 378			X			X		X		
WMEC 270		X			X		X			

CHAPTER 505. FLEXIBLE HOSE AND EXPANSION JOINT PROGRAMS

A. **GENERAL**. This chapter will provide guidance for the classification, inspection, maintenance and replacement schedule for all flexible hoses and expansion joints used on Coast Guard cutters and boats. The Hose Log database includes hoses as well as expansion joints.

B. **HOSE CLASSIFICATION.** All flexible hoses shall be classified according to the type of hose and the system in which it is operating. Hoses will be grouped in one of three groups.

Standard
Non-Standard
Condition Based Maintenance (CBM)

1. Standard Hoses. Hoses in the following systems shall be considered standard duty and shall have a normal replacement cycle of 8 years.

   Fuel oil
   Hydraulic oil
   Lube oil
   Engine jacket water and fresh water cooling
   Compressed air and compressed gas
   Refrigerant and Oxygen
   Chilled water
   Seawater
   Boiler feed water, steam and condensate
   Distillate and brine
   Potable water
   Hoses in the weather provided they have appropriate protective coverings
   Bilge and oily water

2. Non-Standard Hoses. The following hose applications shall be considered as non-standard and shall have special replacement schedules established because of known hose degradation or operating limits.

   a. Hoses installed in the weather that are exposed to extreme sun, heat, cold, ice or snow, AND do not have an outer covering specifically designed for such abuse. Hose replacement cycle shall not exceed 5 years.

   b. Special hoses as identified by the hose manufacturer, equipment manufacturer, or by MLC that must be replaced on a more frequent basis.

   c. Engine exhaust system hoses shall be replaced as recommended by the hose manufacturer or equipment manufacturer, on a schedule not to exceed 5 years.

3. Condition Based Maintenance (CBM). The following hose applications shall be considered as CBM unless otherwise directed and replacement will be on condition not service life.
   a. Test, instrumentation and specialized maintenance hoses.

   b. Metal, PTFE (Teflon) and thermoplastic hoses in high pressure systems which are frequently pressurized, (such as operating hydraulic systems), shall be removed from service for thorough internal and external examination on a schedule not to exceed 8 years. These hoses may be reinstalled if found to be fit for service.

   c. Metal, PTFE (Teflon) and Thermoplastic hoses in low pressure or infrequently pressurized systems. Pneumatic hoses with quick-disconnect couplings for connecting portable tools to ship service air systems.

   d. Auxiliary drain systems, plumbing/gravity drain systems, or other drainage systems open to atmosphere.

   e. Vacuum flush waste systems.

   f. Halon and CO2 fixed extinguishing system hoses.

4. USN Hose Criticality Method. NAVSEA Technical Directive S6430-AE-TED-010/Volume 1 is not approved for use on Coast Guard vessels.

C. HOSE LOG.

1. Database Implementation. Hose Log software has been certified by TISCOM and the electronic database Hose Log will be distributed by the ELC. Until Hose Log program software is distributed, units shall use their existing Hose Logs. Units with the approved Hose Log database shall upload/download data to the Coast Guard hose log internet site every three months or when hoses are replaced or when PMS is completed.

2. Inclusion. Hose Logs shall include all standard and non-standard hoses and the following because of high costs, or high cost of potential failures:

   a. Metal, PTFE (Teflon) and thermoplastic hoses.

   b. Test, instrumentation and specialized maintenance hoses that can be pressurized.

   c. Halon and CO2 fixed extinguishing system hoses.

   d. Expansion Joints will be included in the electronic database Hose Logs as an expansion assembly.

3. Exclusions. The following hoses are exceptions and are not required to be listed in Hose Logs.

a. Outboard Engine Fuel Hoses. Outboard engine fuel hoses and fuel hoses internal to small engines (packaged) on boats. These hoses shall be inspected and maintained in accordance with the boat's PMS manual.

b. Fire Hoses. Fire hoses, firefighting foam (AFFF) hoses, water main jumper hoses, and other detachable water hoses covered under other programs. These hoses shall NOT be included in the Hose Log and shall NOT be tagged as a flexible hose. These hoses shall be inspected and maintained IAW the DC PMS manual.

c. General usage CBM hoses. These hoses are routinely inspected during use or during system inspections or their failure is of low impact.

(1) Pneumatic hoses with quick-disconnect couplings that connect portable tools to ship service air systems.

(2) Hoses internal to vacuum flush systems.

(3) Auxiliary drain systems, plumbing/gravity drain systems or other drainage systems open to atmosphere.

D. HOSE REPLACEMENT SCHEDULES. Hose replacement schedules shall reflect the service life and shall note the hose classification. The schedules may be modified by the ELC or cognizant MLC to reflect service life conditions.

1. Standard Hoses. Standard hoses shall be identified as "Standard" in Hose Logs and shall normally be scheduled for replacement at intervals not to exceed 8 years.

2. Non-Standard Hoses. These hoses shall be identified as "Non-Standard" in Hose Logs and replacement cycles shall be as noted in paragraph B.2 above.

3. Condition Based Maintenance (CBM) hoses. Replace all CBM hoses when the hose shows signs of extreme wear or damage or when they fail hydrostatic test.

E. HOSE SHELF LIFE. The shelf life for hoses and prefabricated hose assemblies shall not exceed 10 years. Note that hoses manufactured to SAE J518 and similar industry standards are designed to have a shelf life of not less than 10 years under ideal storage conditions. Shelf life is difficult to qualify as many factors affect the hose or hose assembly. The storage environment can vary the shelf life. Hoses and hose assemblies that have been on the shelf for more than 6 years shall not be automatically rejected for age alone. Hoses and hose assemblies shall be inspected to evaluate their acceptability for use. If there is any question concerning adequacy of a hose assembly, a hydrostatic test may be warranted. Questions concerning hose shelf life should be referred to the cognizant MLC or to the ELC. Storage of hoses and hose assemblies should be in a cool dry area not exceeding 100^{o} F. Periodic inspection of spare hoses with close visual inspection prior to hose assembly fabrication or installation is recommended. Storage of hoses and hose assemblies should not stack hoses too high as the weight can crush hoses on the bottom. Direct sunlight, rain, high temperatures, or being near heaters or electrical equipment can reduce hose life. SAE J1273, Recommended Practices for Hydraulic Hose Assemblies, provides additional guidance.

F. **HOSE SERVICE LIFE**. Hoses shall be renewed at the end of their service life. The start of service life marks the end of the shelf life. Questions concerning hose service life should be referred to the cognizant MLC or the ELC.

1. Hose manufacture dates, and the resultant shelf life and service life dates are typically marked in quarter calendar year increments. Most hose manufacturers stamp the manufactured date onto the hose or a hose tag attached to the hose.

2. The service life of a hose assembly shall begin when the assembly is installed in the system. The service life of hoses are specified in paragraph B above.

3. Stowage of a minimal quantity of bulk hose and a minimum number of mating reusable or field attachable fittings for emergency use is acceptable. Bulk hose stored on a cutter shall not be routinely fabricated into hose assemblies.

4. A used hose or hose assembly, regardless of its service life, shall not be reused if one or both of its fittings are removed. The hose shall be discarded and any reusable fitting removed for reuse if possible.

5. To distribute the cost of renewing all hoses, units are encouraged to implement a phased replacement philosophy. For high pressure hydraulic systems, all hoses in a system or major subsystem should be scheduled to be replaced at the same time to minimize contamination to the system.

G. **HOSE PMS AND INSPECTIONS.**

1. Preventive Maintenance Schedules (PMS). Schedules should reflect the criticality of the equipment or system, the recommended maintenance procedures of the equipment manufacturer, any regulatory requirements, Coast Guard guidance, appropriate commercial or Navy guidance, and Coast Guard experiences (MLC/NESU/UNIT) with the equipment or system. Except for Fleet-wide equipment, PMS schedules may be determined independently for each class of cutter. In general, PMS shall include periodic visual inspection of hoses, and a second level, more detailed periodic visual inspection where necessary. PMS for hoses that are subject to weather or other adverse conditions should be inspected on a more frequent basis. A direct correlation between Navy guidance and Coast Guard applications can not be assumed due to compartment classification differences and the use of MILSPEC hoses versus commercial grade hoses.

2. Hose Inspection. Preventive maintenance inspections shall follow the guidance provided in applicable PMS manuals. Second level hose inspections should include very through examination of the hose for presence of soft spots, bulges or accelerated deterioration. Long hoses should be inspected with the hoses pressurized and under operating conditions. The intent is to check for alignment, hose movement and

chaffing which occurs under pressure and which may not be obvious when the system is not under pressure. Poor hose installation practices that could lead to hose failure or reduced service life should be identified as part of any inspection. Replacement hoses should not be installed in the same manner. SAE Standard J1273, Recommended Practices for Hydraulic Hose Assemblies, and hose manufacturer's literature may be used for guidance. Installation of anti-chaffing covers, stand-offs, clamps or other devices to reduce wear or failure is encouraged. All hoses, including PTFE, nylon, CPE, silicone and rubber, will normally "take a set"; that is, after a period of use in a particular configuration the hose has permanently assumed a fixed shape. Drastically changing this shape in removal, inspection or to access another part may cause damage, thus shortening or ending the service life of the hose.

H. <u>HYDROSTATIC TESTING</u>.

1. Standard and Non-Standard hose assemblies which are assembled by Coast Guard personnel, hose vendor or contractor as a contractual hose purchase requirement, shall be hydrostatically tested prior to the assembly being installed. This test is of the complete hose assembly, including attached fittings. Pressure tests conducted on the hose alone (at the factory) are not applicable for this test.

2. Testing procedures shall comply with 46 CFR Subpart 56.97-5 requirements, which require a test pressure of twice the rated working pressure of the hose. The test pressure shall be held for approximately 5 minutes. Where a high pressure hose is intentionally used in an extreme low pressure application (e.g. a 4000 psi rated hose in a 100 psi drainage system), the hose assembly may be tested to at least twice the design pressure of the system, provided that such test pressure is clearly noted in the hose log. The system design pressure must be verifiable from the system diagram.

3. After hydrostatic testing, the hose shall be flushed and capped to minimize contamination. For hydraulic system hoses, the flushing procedure shall be to the established contamination level for the intended system.

4. CBM Hoses operating in low pressure (less than 150 psi) do not have to be hydrostatically tested.

5. Instrumentation hoses that are factory assembled and subject to factory quality assurance testing do not have to be hydrostatically tested.

I. <u>HOSE SELECTION</u>.

1. Hoses and hose assemblies used in hydraulic, fuel oil, lube oil, salt water and high pressure air systems shall meet the requirements of SAE J 1942, Hose and Hose Assemblies for Marine Applications. SAE J1942-1, Qualified Hoses for Marine Applications, may be used for guidance. SAE J1942-1 tables indicate whether a fire sleeve assembly is required to meet SAE J1942 fire resistance requirements.

    a. Where hoses meeting this requirement can not be used or are inappropriate, hose selection shall be justified and documented in an appendix to the hose log.

Justification must be acceptable to cognizant MLC and the ELC.

b. ISO Standard 15540, Ships and Marine Technology, Fire Resistance of Hose Assemblies, is emerging as an alternative to the 2-1/2 minute fire test currently required by SAE J1942 and 46 CFR. Compliance with ISO 15540 test requirements is not required at this time, but it may be used as an indication of acceptability for use with hydrocarbon fluids.

2. Gasoline or diesel oil hoses aboard small boats shall meet the requirements of SAE J1527 Marine Fuel Hose.

3. For metal, PTFE and thermoplastic hose applications, NAVSEA Technical Directive S6430-AE-TED-010/Volume 1 and other USN references may be used as guidance.

4. Hoses used in other Condition Based Maintenance applications shall be manufacturer's standard commercial grade product.

5. The service pressure rating of hose assemblies shall not be less than the design pressure of the system.

J. EXPANSION JOINTS (FLEX JOINTS).

1. General. This section addresses expansion joints in fluid systems. It does not address expansion joints in diesel or gas turbine intake and exhaust systems or HVAC duct systems.

   a. Improper Use. Expansion joints shall not be used to correct for improper piping workmanship or misalignment. Joint movements must not exceed the limits set by the joint manufacturer.

   b. Standard Applications. For resistance to oils, the outside cover of expansion joints shall be neoprene. For lube oil service, the inner sleeve of expansion joints shall be nitrile-butadiene (BUNA-N). For jacket water and seawater systems, the inner sleeve of expansion joints shall be chlorobutyl or neoprene.

   c. Alternate materials. Based on critical factors, such as service fluid, fluid treatments, design pressure and maximum operating temperature, expansion joint manufacturers may suggest alternate inner sleeve materials. Requests for approval of alternate materials should be forwarded via the cognizant MLC to ELC-025.

   d. Problem materials. Chlorobutyl, butyl, styrene-butadiene (BUNA-S) and ethylene-propylene-diene-terpolymer (EPDM) elastomer materials are not compatible with oil-based fluids. Neoprene linings are typically compatible with normal water treatment levels, but are not compatible with high concentrations of treatment chemicals.

e. Compatibility. Exposed metallic components of expansion joints shall be compatible with the fluid.

f. Special Application. Expansion joints for special applications should have their design and material requirements documented in the cutter equipment publications and/or piping drawings.

2. Arch Type Synthetic Rubber Expansion Joints. Arch Type Synthetic rubber flanged expansion joints shall comply with ASTM F1123, Standard Specification for Nonmetallic Expansion Joints. These joints were previously specified by MIL-E-15330. This type of expansion joint may have one or more arches.

3. Other Expansion Joints. Other types of expansion joints exist on cutters to address special applications. To the maximum extent practicable these expansion joints shall comply with the following:

   a. Synthetic rubber, non-flanged, corrugated flexible joints shall comply with Commercial Item Description (CID) A-A-50604, Expansion Joint, Sleeved, (Non-Flanged), Fire-Retardant, with Retaining Clips. These joints were previously specified by MIL-E-15330. This type of expansion joint may typically have application in a low pressure or vacuum services.

   b. TFE fluorocarbon resin, corrugated joints shall comply with Commercial Item Description A-A-50605, Expansion Joint, TFE Fluorocarbon Resin, Corrugated with Ductile Iron Flanges. These joints were previously specified by MIL-E-15330. This is a molded TFE expansion joint that is not typically used in Coast Guard applications.

   c. Flexible Rubber Pipe Connectors, which are reinforced straight rubber pipes designed to absorb noise and vibration in a piping system, should meet the original MIL-E-15330 requirements under which they were designed.

4. Ordering Data. Measurements are unique to each individual expansion joint and need to be identified and measured separately. The following information shall be provided to the joint manufacturer for each joint:

   a The style of expansion joint and nominal pipe size.

   b The system fluid, including all treatments. For jacket water systems, the system treatment and typical PH shall be identified.

   c The face-to-face distance between flanges measured to the nearest 1/8-inch or better.

   d The maximum operating temperature, which shall be at least the high temperature alarm set point.

e The maximum design pressure, which shall be at least the set pressure of the system relief valve.

f Notations of lateral (horizontal offset), angular and rotational (flange rotation) misalignments.

g If control rods are required to limit movement.

h Special notation of flanges and flange drilling pattern (e.g. ANSI or Navy style), and rotational misalignment (if any).

i Backing ring requirements.

j. Cover and Liner material requirements or restrictions.

k. Number of humps or corrugations.

5. General Installation. Expansion joints shall be installed in such a manner that they can expand and retract as designed. Expansion joints should not be stretched or compressed to fit a specific installation, as this can eliminate the required flexibility. Expansion joints should be manufactured based on the measured dimensions and parameters specific to the individual application. Expansion joints should not be routinely installed to compensate for bad piping installation practices. However joints can be specially ordered to compensate for specific misalignment. For additional guidance, see technical information and installation instructions provided by the expansion joint manufacturer, and Technical Handbook for Non-Metallic Expansion Joints and Flexible Pipe Connectors, published by the Fluid Sealing Association. www.fluidsealing.com.

6. Flexible Joint Log. A Flexible Joint Log shall be maintained for each cutter and boat, where applicable. This log may be incorporated into the unit's electronic Hose Log; see Section C of this Chapter. It is intended that the Flexible Joint Log be a consolidated reference to document joint requirements, identify all joints installed, and provide procurement data for replacement joints. To that end, the Flexible Joint Log shall include at least the following information for each flexible joint:

   a. Flexible Joint Log Item Number (Serial Number). This is a unique sequential flexible joint identification number.

   b. The specific service, including system name, the specific location of the joint, and the system fluid.

   c. The data and technical requirements for ordering replacement joints; see Ordering Data above.

   d. A list of applicable references, drawings, technical publications, specifications, vendors information, source of supply, part number, and National Stock Number (if applicable).

e. Date of installation for each joint [MO/YR], and projected service life (replacement) date [QTR/YR].

7. General Maintenance Policy. Flexible joints shall be inspected on a semiannual basis and maintained in accordance with cutter specific PMS and manufacturer technical publications.

8. Replacement Policy. Flexible joints shall be replaced in accordance with manufacturer technical publications. Existing policy within the Hose Log Program, which includes the Flexible Joint Log, has established a flexible joint replacement interval at a nominal 8 years, except the replacement interval is 1) five years for lube oil and jacket water applications; 2) 12 years for raw water applications; and 3) joints installed in the weather have a five-year replacement interval. MLCs may shorten joint replacement intervals for those cutters that require more frequent change-outs. Abbreviated replacement intervals should be captured within specific Cutter Class Maintenance Plans and in the unit's electronic Flexible Joint Log database (as applicable).

9. Spares. Because each expansion joint is uniquely sized for its particular application, the storage of generic replacement joints as spares is not appropriate, unless the generic length actually fits the installation. Onboard spare flexible joints shall be marked or tagged with the serial number, see paragraph 6.a above, to ensure the correct installation location and reference within the Flexible Joint Log. In addition, a separate tag shall be attached to spare joints, clearly marked with the words JACKET WATER ONLY, LUBE OIL ONLY OR SEAWATER ONLY to identify the correct service fluid.

K. HOSE AND FLEXIBLE JOINT TAGS. Each installed hose and expansion joint shall be tagged. This tag provides the serial number of the item for cross reference in the Hose Log or Flexible Joint Log, respectively. To the maximum extent practicable, tags shall be attached to stay bolts on the coupling, to a tab locally manufactured of shim material and captured under a flange bolt head, or to an equivalent fixed point of the hose or joint. Tags shall be attached using materials that will not damage hose or flexible joint in any way; i.e., metal strapping, self cinching nylon straps, or equivalent means. Tag installation shall be done in a manner that will not cause damage to the hose or joint and shall not interfere with the normal flexing motion. Where necessary, hose tags may be attached to bands around the working section of the hose or joint but care shall be taken to avoid interference with flexibility.

1. Form. Hose tags may be in one of several formats. Tags shall be stamped metal, engraved metal, or units may (optionally) use a scannable bar code identifier. The use of Navy Standard Hose Tags, as described in MIL-P-15024/15 and other USN hose documentation, is acceptable but not required. The data requirements for the USN tag exceed the data requirements herein.

2. Tag Information. The following information shall be placed on the hose tag.

   a. Tags associated with a paper based Hose Log or Flexible Joint Log shall include the following information, and shall be reference keyed to the applicable Log.

      (1) Item (hose or flexible joint) serial number.

      (2) Hydrostatic Test Pressure and Test Date [DD/MM/YY]. This may be provided by the assembly manufacturer on an separate tag. Where a hydrostatic test is not required, insert the annotation "NA".

      (3) Service Life Date (Replacement Date) [QTR "Q"/YY]. References to calendar year quarter should include the letter "Q" after the quarter number to avoid confusion with months. The 4th quarter of 1999 would be represented by "4Q99".

   b. Tags associated with the approved electronic database shall include a serial number that is reference keyed to the Hose Log. The electronic database Hose Log includes both hoses and flexible joints and therefore the tag fitted to the item only requires the serial number. Service life date and hydrostatic test pressures will be tracked and recorded in the hose log, and are not needed on the hose tag.

CHAPTER 517. AUXILIARY BOILERS AND FORCED CIRCULATION STEAM GENERATORS

A. <u>FEEDWATER TREATMENT</u>. Boiler feedwater on board Coast Guard cutters with auxiliary boilers or forced circulation steam generators shall be treated in accordance with the respective cutter class PMS Manual, using either of the following techniques.

1. <u>Magnetic Water Treatment</u>.

   a. The current alternative to the chemical treatment method is Magnetic Water Treatment (MWT) with devices meeting or exceeding the following salient characteristics:

      (1) Mount external to the feedwater piping.

      (2) Require no outside source of electrical power.

      (3) Capable of generating a magnetic field of at least 20,000 Gauss (+/-5%) perpendicular to the feedwater flow which will penetrate the pipe walls producing a measurable magnetic field in the water stream.

      (4) Flux leakage during shipping and after installation must not exceed .00525 Gauss at 15 feet.

      A known source of MWT devices with these characteristics is International Water Management Inc. of Seal Beach, CA. They are registered under the trade name "MagneGen".

   b. With MWT, the need to purchase, store, and add boiler treatment chemicals is eliminated, and daily boiler water treatment and testing PMS is reduced. MWT eliminates the need for active scale removal (acid flushing), and protects boiler waterside components from corrosion. Existing scale will be removed and watersides will remain scale free, resulting in improved heat transfer efficiency and service life.

   c. The exclusive use of distilled water is not required with MWT. The water chemistry monitoring and blowdown procedures in B.1.b allow for make-up sources to include the potable water shore-tie.

   d. Water softeners shall not be used.

   e. The treatment requirements of NSTM, Chapter 220, and Vol. 2 for Auxiliary Boilers do not apply to boilers using MWT.

2. Coordinated Phosphate Chemical Treatment. Cutters without an Engineering Change directing MWT shall use chemical treatment. Cutters using chemical treatment should make every effort to use distilled water, obtained from a properly functioning evaporator, as make-up. Some cutters may have no alternative but to use dock water as make-up. Where such a condition exists, particularly in areas with hard water, units shall use a water softener. The MLCs shall review and approve new chemical treatment products prior to implementation on a cutter or boat. Chemical treatment for Auxiliary Boilers shall be as prescribed in NSTM, Chapter 220, Volume 2.

B. FEEDWATER TESTING.

1. Boilers and Steam Generators Using Magnetic Treatment. Systems using this type of treatment remain subject to continued careful monitoring of water chemistry and waterside inspections per cutter class PMS. MWT is simply an alternative to the chemicals traditionally used for scale prevention and corrosion control.

   a. With MWT, the daily feedwater testing program shall include pH and Total Dissolved Solids (TDS) of boiler, hotwell, and make-up water. Boiler water chloride testing is required only on cutters with raw water heat exchangers in the condensate return system and without feedwater salinity detection systems. Cutters with such systems shall maintain the ability to test for chloride levels in the event of a salinity sensor failure.

   b. Recommended ranges for boiler water parameters using MWT is:

      (1) pH. 8-11.5

      (2) TDS. 1000 parts per million (ppm) or 2X make-up TDS, whichever is GREATEST. Identifying maximum boiler TDS as a function of make-up TDS is commonly referred to as "cycles of concentration". As long as the make-up has a TDS reading of 500 ppm or less, the upper limit for boiler blow down is a TDS level of 1000 ppm. In some areas, notably the southwest, dock water may have TDS levels in excess of 1000 ppm. In those situations, the upper limit for boiler TDS may be extended to 2X that of the make-up (i.e. 2 cycles of concentration).

      (3) Chloride. Less than 10 ppm for all cutters (except less than 50-60 ppm on WAGB 400). If chloride levels exhibit a distinctive upward trend, there is likely salt water incursion taking place somewhere in the system.

      (4) Feedwater Temperature. Feedwater temperature shall be kept at approximately 200 degrees F to assist in the removal of dissolved oxygen.

c. These limits should be maintained by adjusting the frequency and duration of surface and bottom blowdown. If the parameters exceed their upper limits surface blowdown will, in general, return them to within acceptable limits, as well as remove any oils that may enter the feedwater system. Bottom blowdown will remove accumulated sludge; however, for a bottom blowdown to be effective the boiler should be taken off line for approximately 30 minutes before blowing it down to give the sludge time to settle. When it becomes necessary to blowdown due to water chemistry exceeding recommended ranges, wait at least 12 hours before testing again to allow fresh make-up to enter the system and dilute the feedwater. Once a boiler is stabilized with MWT, water chemistry will likely remain within the recommended ranges for several days or more. Regardless, blowdowns should be done on a periodic basis per cutter class PMS.

d. Advances in sensing technology provide an opportunity to shift from traditional chemical titration type water testing procedures to relatively inexpensive and faster electronic means in most cases. With MWT there is no need to test for Phosphates since that measurement's purpose is to assist in determining the amount and type of treatment chemical to add. The Alkalinity test is replaced by a direct measurement of pH, and TDS level is used to determine when the blowdown threshold is reached. Tests are performed using hand held electronic pH and TDS testers that provide direct and instantaneous digital readout, in conjunction with a chloride test kit. Both the electronic testers and the chloride test kit, which uses Silver Nitrate as the titrant, are available from The Hach Company. The catalog numbers are as follows: pH tester 44350-00, TDS tester 44400-00, and chloride test kit #144001, MODEL 8-P. Hach also has available a Mercuric Nitrate based chloride titration test kit; however, it is being phased out due to the difficulty in disposing of the test by-product which contains mercury. Cutters using the Mercuric Nitrate-based test kit should allow their stock of this titrant to deplete and replenish with the Silver Nitrate version. In addition to being easier to dispose of the titration by-product, it costs less than the Mercuric Nitrate version.

e. The testing requirements of NSTM, Chapter 220, Vol. 2 for Auxiliary Boilers, including use of Navy Standard log sheets, do not apply to boilers using magnetic treatment.

2. Boilers and Steam Generators using Chemical Treatment.

a. Boilers. Chemical testing shall be as prescribed in NSTM, Chapter 220, and Vol. 2 for Auxiliary Boilers.

b. Forced Circulation Steam Generators.

(1) The chemical used in the treatment of feedwater for forced circulation steam generators shall contain each of the following chemicals, in approximately the proportions given:

Compound	Parts by Volume
Sodium Sulfite	4.17
Trisodium Phosphate	1.0
Sodium Hydroxide	1.59
Cobalt Sulfate	0.02

A known product used in chemical feedwater treatment is Clayton compound 1A.

(2) The purpose of each of the compounds is as follows:

Compound	Purpose
Sodium Sulfite	Oxygen scavenging
Trisodium Phosphate	Scale reduction and pH control
Sodium Hydroxide	pH control
Cobalt Sulfate	Increased rate of oxygen scavenging

(3) All cutters equipped with forced circulation steam generators are required to have a test kit. The Clayton Model UH-2442D Kit (Clayton Mfg. Co.) is a known product that can be used in conjunction with the chloride test kit described in B.1.d.

C. SUPPLEMENTAL REQUIREMENTS FOR ALL BOILERS AND STEAM GENERATORS.

1. When placing boilers in an extended lay-up, the primary consideration is prevention of oxygen corrosion on waterside surfaces. No matter which water treatment is used, the treatment loses its effect when the boiler is secured for long periods. Each MLC shall ensure an adequate wet or dry lay-up process is carried out prior to placing a boiler out of commission for an extended period. The lay-up procedures listed in NSTM Chapter 220 Volume 2, are acceptable, however the quantities of chemicals cited are for large propulsion boilers. When carrying out this process consult the boiler manufacturer.

2. Waterside corrosion will be reduced by MWT; however, for maximum protection, feedwater temperature shall be kept at approximately 200 degrees F to assist in the removal of dissolved oxygen.

3. In general the loss of feedwater should be limited to reduce introduction of impurities. Once a week, cutters equipped with a condensate tank and hotwell shall drain approximately 10% of the water from the bottom of the tank to prevent sludge accumulation.

4. Due to its carcinogenic properties, the chemical hydrazine, in any combination or in any circumstance, shall not be used.

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CHAPTER 530. POTABLE WATER SYSTEMS

A. **POTABLE WATER SYSTEMS.** Water Supply and Waste Water Disposal Manual, COMDTINST M6240.5 (series), and NSTM Chapter 533 provide detailed guidance on the arrangement, operation, maintenance, and treatment of shipboard potable water systems.

B. **TREATMENT OF EVAPORATOR FEEDWATER.** The build-up of scale in evaporators has plagued operating personnel since the evaporator was first developed. Various methods have been used to reduce or eliminate scale. The chemical treatment of feedwater has proven to be a most effective method in combating and preventing scale build-up in Coast Guard evaporators.

1. Applicability. Coast Guard cutters equipped with evaporator feedwater treatment equipment shall use this equipment to the fullest extent. Major cutter classes have been equipped with feedwater treatment equipment, as authorized by Engineering Changes. Requests for issuance of Engineering Changes for classes of cutters not so equipped, but that need such equipment, will receive favorable consideration.
2. Selection of Treatment Chemical. Presently, there are two authorized feedwater treatment chemicals, HAGEVAP PD-8 and AMEROYAL. While the Coast Guard cannot test every new commercial product introduced, there are instances where a controlled program of evaluation may be beneficial. MLCs may request such a program under the Testing of Commercial Products Section in Chapter 041 of this manual.

C. **CHEMICAL CLEANING OF EVAPORATORS.**

1. General. Manufacturer technical instructions and cutter specific PMS provides guidance on the chemical and mechanical cleaning of evaporators. NSTM Chapter 531, Volumes 1, 2, and 3 provide additional information. In the event that chemical cleaning is unsatisfactory, mechanical methods may be used.
2. Policy. Sulfamic acid shall be used as the chemical cleaning agent for Coast Guard evaporators. Requests and recommendations for exemption to this policy shall be forwarded to the appropriate MLC for review.

NOTE: Chill shocking is not an authorized method for descaling evaporators.

D. **JOINT SEALING COMPOUNDS.**

1. General. The use of a sealant or paste on piping and pressure vessel joints is standard practice. White lead is a common choice for this purpose. However, lead is toxic, and contamination of potable water supplies is possible.
2. Prohibited Sealing Material. The use of white lead is prohibited on flanged or threaded connections on evaporators, all elements of the evaporator salt water feed system, and all elements of the potable water system. The removal of white lead from applicable systems shall be accomplished the first time the connections are opened for inspection, maintenance, or other similar purpose.

3. Proper Sealing Compounds. Only sealing compounds that conform to Type I of MIL-A-46146 shall be used. These compounds are noncorrosive, silicon, room temperature vulcanizing, adhesive-sealants. Type I is a soft, spreadable thixotropic paste.

CHAPTER 540. GASOLINE, HANDLING AND STOWAGE

A. **GASOLINE, GASOLINE EQUIPMENT, AND STOWAGE.** This chapter provides guidance on authorized quantities, stowage, and handling of gasoline on board Coast Guard cutters and boats.

1. Classification of Material. Gasoline is classified as a Category I FLAMMABLE (extremely flammable, highly volatile) Material. NSTM Chapter 670 provides guidance on the stowage, handling, and disposal of gasoline and other hazardous general use consumables.

2. Gasoline Stowage. Gasoline containers shall be stowed on the weather deck (aft, if possible) and located so that they can be readily jettisoned overboard. Interior stowage of gasoline is prohibited on board Coast Guard cutters and boats. Stowage locations shall not be in the vicinity of hatches, doors, galleys, ready service magazines, heat producing spaces, ventilation intakes and exhausts, or helicopter launching and recovery areas.

   a. 55-gallon drums may only be stowed on cutters that have installed (by ShipAlt or original outfit) quick-release, remote activated jettison racks as detailed on NAVSHIPS dwg 801-4444641.

   b. Portable containers shall be secured within P-250 foundation housings or designated storage locations (easily detachable for hand-jettisoning).

   c. The Dewatering Pump Kit, with gasoline, shall be stowed in accordance with the Coast Guard Rescue and Survival System Manual, COMDTINST M10470.10 (series).

   NOTE: Gasoline stowage areas shall be designated as GASOLINE HAZARD AREAS. Gasoline containers shall be labeled as FLAMMABLE.

3. Authorized Gasoline Containers. The following containers are authorized for shipboard use:

   a. Stowage Containers.

      (1) 5-gallon metal cans meeting MIL C 1283F, *20 Liter Military Fuel can Commercial Item Description (CID) A-A-59592*

      (2) 6-gallon or smaller *metal* safety cans meeting FED Spec RR S 30F Underwriter Laboratory approval standard *UL 30*

      (3) 6-gallon or smaller molded plastic containers *nonmetallic safety cans* meeting Underwriter Laboratory (UL) and Factory Mutual (FM) approval standards for safety containers *approval standard UL 1313*

      (4) 55-gallon drums meeting FED Spec PPP-D-729E, Type I, Class A

b. Portable Fuel Systems for Outboard Motors and the P-250. 6-gallon portable fuel tanks certified for marine use and meeting American Boat and Yacht Council (ABYC) standard requirements for portable fuel systems.

WARNING: Gasoline shall be handled with extreme caution. Partially filled and empty gasoline containers contain an explosive mixture of gasoline vapors and air. Empty or partially filled containers shall be drained completely or refilled as soon as practicable.

4. Quantities to Be Carried.

a. Cutters and boats should carry enough gasoline to operate portable equipment for at least 4 hours at its maximum gasoline usage rate. The following reflects the approximate quantities of gasoline used by portable equipment in a 4 hour period:

P-250 Mod 1 fire pump - 21 gallons
Dewatering Pump Kit - 2 gallons

b. Sufficient quantities of gasoline shall be carried to meet the operational requirements of gasoline powered boats and equipment.

5. Deterioration of Gasoline. To reduce the risk of using deteriorated gasoline, storage containers shall be renewed with fresh gasoline every 3 months.

6. Disposal of Gasoline. Disposal of gasoline must be controlled and shall comply with local, state, and federal environmental regulations. The Hazardous Waste Management Manual, COMDTINST M16478.1 (series), provides guidance on the disposal of hazardous waste materials.

CHAPTER 541. FUEL SYSTEM, CUTTERS AND BOATS

A. **FUELING EVOLUTIONS.** Prior to taking on or transferring fuel, cutters and boats shall be electrically grounded. Only those fuels outlined in paragraph B.1 are authorized for Coast Guard use. Clear and bright tests shall be conducted before accepting fuel.

B. **AUTHORIZED FUELS FOR CUTTERS AND BOATS**. This policy reflects the increasing concern with minimizing fuel costs.

1. Cutters/boats shall select the least expensive of (NATO) F-76, (NATO) F-44 (JP-5), or an approved product obtained through a Defense Energy Support Center (DESC) bunker fuel contractor. Approved DESC bunker fuels include: Navy Purchase Description Marine Gas Oil (NPD MGO) Domestic NSN 9140-01-313-7776 and Overseas NSN 9140-01-417-6843; Fuel Naval Distillate (B76) Domestic NSN 9140-01-447-1031; and Diesel Fuel #2 (DF2) Domestic NSN 9140-01-456-9443. The fuel selected must meet the technical specification requirements of paragraph B.4 below. Sources of DESC bunker fuels are listed on DESC's web page at "http://www.desc.dla.mil/DCM/DCMPage.asp?LinkID=DESCPHBBunkers".

2. Cutters participating in the Coast Guard's In-Line Fuel Quality Sampling Program are exempt from the 6 month use limit on approved DESC bunker fuels. The sampling program is discussed in further detail below (C.2.b). Non-participating cutters shall consider the time that the fuel will be held onboard before it is fully burned. If the fuel can not be burned within 6 months, only F-76 or F-44 (JP-5) should be taken onboard.

3. Participation in the Fuel In-Line Sampling Program is required for FT4 gas turbine powered cutters. Should there be a fuel quality concern, problem specific advice will be forwarded to minimize any risk to the FT4 gas turbines.

   NOTE: The following manufacturer's recommend the following precautions when using F-44 (JP-5):

   a. In Caterpillar engines, JP-5 should not be allowed to exceed 100ºF (38ºC) in temperature. This ensures that adequate viscosity is retained.

   b. Volvo Penta diesel engines used in diesel RIBs, some TANBs and other small boats require five (5) percent clean lube oil to be mixed with JP-5 prior to use.

4. Mixing Fuels. F-76, F-44 (JP-5), and approved DESC bunker fuel products may all be mixed without adverse effects. However, some fuel oil purifiers will require a different gravity disk to remain effective when used with JP-5. Units with centrifugal purifiers should review technical manuals, and contact the respective manufacturer and MLC for guidance.

5. Minimum Acceptable Requirements. The following are the minimum acceptable requirements for F-76, F-44 and approved DESC bunker fuel products:

a. F-76 must meet MIL-PRF-16884K.

b. F-44 (JP-5) must meet MIL-DTL-5624T.

c. NPD MGO can be procured under National Stock Number 9140-01-313-7776 (domestic) and 9140-01-417-6843 (overseas). NPD MGO is supplied under DESC bunker fuel contracts.

d. B-76 can be procured in selected domestic locations under National Stock Number 9140-01-447-1031. B-76 is supplied under DESC bunker fuel contracts.

e. DF2 can be procured in selected domestic locations under National Stock Number 9140-01-456-9443. DF2 fuel is authorized for use only if purchased under a DESC bunker fuel contract. Open market "Grade Number 2 Diesel" (No. 2-D) fuel shall be treated as an emergency substitute fuel.

f. Special cetane requirements for Paxman powered cutters. The combustion quality requirements for F-76, NPD MGO, and B-76 allow a minimum cetane number of 42 and a minimum cetane index of 43. This is adequate for all Coast Guard diesel engines except for Paxmans. DF2 has a minimum cetane number/cetane index of only 40. Paxman powered cutters require a minimum cetane index of 45 and should therefore specifically include a request for fuel with a minimum cetane index of 45 in their LOGREQs. Note; the JP-5 contract requirement for cetane index is “report only”. Paxman powered cutters may burn JP-5 without cetane restrictions.

6. General Fuel Characteristics.

a. F-76. F-76 is a MIL-SPEC distillate fuel suitable for use in shipboard diesels, gas turbines, or boilers. F-76 has very tight specification and storage/handling quality control requirements. It is the fuel normally obtained directly from naval facilities and oilers. It has a minimum flash point of 60°C (140°F). Older naval engineering terminology referred to F-76 as Diesel Fuel Marine (DFM). Current practice no longer uses "DFM" as a descriptive name for F-76. To avoid confusion, F-76 fuel should only be referred to as "F-76". F-76 is never dyed.

b. F-44 (JP-5). F-44 (JP-5) is a MIL-SPEC kerosene type jet fuel with a minimum flash point of 60°C (140°F). It also has very strict specification and storage/handling quality control requirements. JP-5 is ideally suited to FT-4 gas turbine engines. JP-5 can have a lower energy content than diesel fuels such as F-76 and NPD MGO (a nominal 5% difference). Its consumption rate may therefore be slightly higher. Burning JP-5 may also make achieving full power shaft rpm more difficult. JP-5 also contains a fuel system icing inhibitor (FSII) which is required for aviation use. This additive tends to migrate readily into any free water and has some anti-microbial properties. This means rigorous stripping procedures are critical if the anti-microbial activity of the icing inhibitor is to be realized. JP-5 is never dyed.

c. Navy Purchase Description Marine Gas Oil (NPD MGO). NPD MGO is a type of marine gas oil (100% distillate with no residual fuel contamination) that can be purchased from commercial sources under contract with DESC. Marine gas oil is a very broad classification of fuels, pertaining to their distillation temperature, general properties, and minimum flash point of 60°C (140°F). F-76, at one end of the quality spectrum, could be considered a marine gas oil, but so could fuels containing significant percentages of residual fuel (such as commercial Marine Diesel Fuel). The Navy Purchase Description has fewer and less strenuous requirements than the F-76 specification, but it does invoke additional requirements over what could otherwise be acceptable under a purely commercial specification (such as ASTM D-975 Grade No. 2-D). Storage and handling quality control is consistent with standard commercial practices. It is possible that fuel can meet the NPD MGO specification requirements, but be marketed under several different names, including "MDF" and/or "Commercial No. 2". As long as the fuel is obtained through a DESC contract, and ordered under National Stock Number 9140-01-313-7776 (domestic purchase) or 9140-01-417-6843 (overseas), cutters/boats will be assured of receiving fuel that meets the NPD MGO requirements. As discussed below, there is a 6 month time limit placed on the use of NPD MGO, starting when the fuel is taken onboard, due to concerns with storage stability. Cutters/boats that are participating in the Coast Guard In-line Fuel Quality Sampling Program are exempt from this restriction. NPD MGO can be, but not necessarily will be dyed. In domestic ports, only red dye can be used. In overseas ports, other colored dye may also be used.

d. B-76. B-76 is a special commercial product available under DESC bunker contracts in only a few domestic locations. This fuel product has identical properties to MIL-SPEC F-76 with the exception that the fuel can be dyed red and F-76 storage stability requirements have been waived. This means the storage stability characteristics of B-76 are similar to that of NPD MGO. B-76 also has a 6 month use limit.

e. DF2. DF2 is a special commercial product available under DESC bunker contracts in some domestic locations. This fuel product is based on a purely commercial fuel specification (ASTM D 975 Grade No. 2-D) and is the least preferred of the approved DESC bunker fuel products. DF2 has fewer and less stringent requirements than either NPD MGO or B-76. It also has a minimum flash point of only 52°C (125°F). Special precautions are therefore required when burning this fuel (see paragraph B.8 below). The minimum cetane number/index is only 40 and may not meet the combustion quality requirements of all Coast Guard diesel engines. DF2 has no storage stability requirements; this means the storage stability characteristics of DF2 are identical to that of NPD MGO and B-76. DF2, therefore, also has a 6 month use limit. DF2 can be dyed red. An open market “number 2 diesel” fuel shall be treated as an emergency substitute fuel (see below).

7. Emergency Substitute Fuels. If none of the above fuels are available, and bunker fuel must be purchased on the open market, cutters should contact their MLC (vr) or ELC

026 for guidance prior to purchasing and taking on fuel. NSTM Chapter 541, Section 10, identifies a number of emergency substitute fuels. Emergency substitute fuels may be used in an emergency, in place of fuels discussed above, after determining that the product is acceptable. These fuels, in order of preference, are ASTM D-975 Grade No. 2-D (if not obtained from a DESC bunkers contractor) or ASTM D-396 No. 2; ASTM D-2880 No 2-GT; and Commercial MGO (100% distillate), from a commercial supplier not under a DESC contract. These fuels may not be suitable for long term use in marine gas turbines and/or some diesel engines. They may contain additives which could degrade coalescer/separator performance. Because they were not originally intended for marine use, their specifications may allow flash points lower than 60°C (140°F). The mixing of emergency substitute fuels with F-76, F-44 (JP-5), or NPD MGO is not recommended. Consolidate storage tanks before taking on emergency substitute fuels. Any emergency fuel taken onboard must be used as soon as possible. Storage stability will be a concern for all emergency substitute fuels.

Note: A fuel that has the terminology Automotive Gas Oil (AGO) is sometimes requested as an emergency fuel. Like MGO, AGO is a very broad generic term and can describe a very wide range of fuel properties. It is likely to have a flash point less than 60°C (140°F). When offered AGO, determine what specific specification the fuel complies with and then apply the above criteria to determine suitability.

(8) Fuel Flash Point. Flash point is a measure of a fuel's flammability. The flash point affects a fuel's ease of ignition, flame spread rate once ignited, and extinguishing difficulty. As ambient temperature in a space approaches a fuel's flash point, the presence of flammable vapors increases dramatically. Marine fuel, by definition (and by international law), must have a minimum flash point of 60°C (140°F).

a. Low Flash Point Fuel. Prudent shipboard safety practice is to take on fuels with a minimum flash point of 60°C (140°F). However, due to market conditions in some parts of the world, only non-marine diesel fuel may be available. For example, DESC bunker fuel product DF2 has a minimum flash point value of 52°C (125°F). This product is currently available in only a few domestic locations. Emergency substitute fuels may also have flash points less than 60°C (140°F). In addition, flash points may routinely be as low as 52°C (125°F) in Mexican ports (year round). Risk is obviously highest for cutters that must routinely load low flash point fuel, but even a single low flash point fueling warrants special precautions. This is especially true in warm/hot operating environments.

Note: Only under an extreme operational emergency, and with the concurrence of MLCLANT/PAC (vr)shall a fuel be loaded onboard if its flash point is below 52°C (125°F).

b. Cold Weather Blending. Additionally, in the winter months it is common commercial practice in some areas of the country to cut or blend No. 2-type diesel fuels with kerosene or No. 1-type diesel fuels to improve cold weather handling properties. However, this can lower the fuel's minimum flash point below 60°C (140°F). This practice is authorized by DESC bunkers contracts only in Alaska and only from 15 October to 15 April (the winter blend minimum flash point is 52°C (125°F)). However, the practice is becoming more common in many northern states and Canadian provinces. Low flash point winter blends may therefore be a concern in any open market purchase in cold climates. Note that the practice is prohibited on MIL-SPEC F-76 and JP-5 products. Risk is minimal for cutters that burn the low flash point "winter blend" fuel solely in cold climates. This is due to generally colder ambient air and water conditions. SOLAS guidance states that storage and engineering space temperatures should be kept at least 10°C cooler than the flash point of the fuel. This translates to a maximum safe engineering space air temperature of 42°C (108°F). However, cutters that are deployed to a cold climates, take on low flash point winter blend fuel, and then transit to warm or tropical waters with that low flash point fuel, are at increased fire risk.

c. Precautionary Measures. Prevention of fuel leaks and proper insulating/shielding of fittings/hot surfaces remains the best defense against the hazards of using fuels in general. When forced to load low flash point fuel (less than 60°C (140°F)), the following precautions shall be taken:

d. Applicable to all onloaded low flash point fuels:

(1) Cutters should be aware of the flash point of all fuels onloaded. Cutter LOGREQs should require flash point information be provided as part of LOGREQ reply.

(2) Take on only the minimum amount of low flash point fuel required for mission and ship stability reasons.

(3) Advise engineering watchstanders of the reduced flash point fuel and the required precautions.

(4) Maintain vigilance to locate and correct any/all fuel leaks and fuel spray, especially around operating machinery.

(5) Increase efforts to keep bilges dry and free from fuel leaks.

(6) Do not perform full power trials.

(7) Review ECCM and main space fire doctrine (or Fire Bill) procedures with all engineering and bridge watchstanders.

(8) Ensure "smoking lamp" is out throughout the ship (underway or in port) when transferring or unloading the lower flash point fuel.

If there is a designated "Smoking Lounge," ensure it is well clear (10 ft radius) of any fuel tank vent(s).

e. <u>For cutters operating in cold climates during winter months</u>:

(1) Keep low flash point fuel segregated and minimize mixing with fuel from tanks with high flash point fuel. Keep track of which tanks contain low flash point fuel and use low flash point fuel first to minimize the overall extended risk to the cutter.

Note: the Flooding Casualty Control Software (FCCS) has been modified to provide a "Comment" column (on the "Liquid Load Spreadsheet" screen) as a job aid for keeping track of fuel characteristics in each storage tank.

(2) Adjust engine room ventilation and/or propulsion plant configuration to maintain compartment air temperatures below 42°C (108°F).

(3) When departing cold operating climates, burn as much of the low flash point fuel as soon as possible. As engineering space air temperatures approach the maximum safe operating value of 42ºC (108ºF), discontinue burning low flash point fuel. Upon next bunkering, or using onboard non-low flash point fuel, blend remaining low flash point fuel with high flash point fuel. The resulting flash point can be estimated as follows:

FC = (FA*GA + FB*GB)/(GA + GB)

Where:
FC = Estimated flash point of commingled fuel (°F).
FA = Flash point of fuel A (°F).
GA = Quantity of fuel A (gallons).
FB = Flash point of fuel B (°F).
GB = Quantity of fuel B (gallons).

If the measured value of a high flash point marine fuel is not known, assume it is 140°F (60ºC) for the purposes of the calculation.

f. <u>For general guidance outside of cold operating climates</u>:

(1) If possible, adjust engine room ventilation and/or propulsion plant configuration to maintain compartment air temperatures below 42°C (108°F).

(2) If engine room air temperature can be maintained below 42°C (108°F), keep low flash point fuel segregated and minimize mixing with fuel from tanks with high flash point fuel. Keep track of which tanks contain low flash point fuel and use low flash point fuel first to minimize the overall extended risk to the cutter.

(3) If engine room air temperature can not be maintained below 42°C (108°F), blend low flash point fuel with high flash point fuel. Burn blended fuel as soon as possible to minimize the overall risk to the cutter. See guidance above (B.8,e.(3)) for estimating blend's flash point.

g. Cutters participating in the In-Line Sampling Program will be provided with the fuel's measured flash point for each fuel load. In many cases, the actual flash point will be higher than the minimum allowed by the purchase requirements. Note that the minimum flash points on MIL-SPEC products F-76 and JP-5 will never be below 60°C (140°F).

NOTE: Above precautions do not take precedence over paragraph B.7 requirements regarding emergency substitute fuels.

C. ONBOARD FUEL MANAGEMENT. Effective onboard fuel management is critical in maintaining adequate fuel quality. The primary concerns are particulates, water, and microbiological contamination. With any fuels other than F-76 and F-44 (JP-5), storage stability is also a potential concern. NSTM Chapter 541, Section 10, gives excellent fuel testing and maintenance procedures and guidance. While compliance with these guidelines is strongly encouraged, only partial compliance will be possible for most cutters/boats. Much of the test equipment discussed in NSTM (such as centrifuges for conducting "bottoms water and sediment" testing) is currently not provided to Coast Guard vessels. These policies are currently undergoing review.

1. General Characteristics.

a. Particulate Contamination. Particulate contamination can be caused by dirt, rust flakes, catalyst fines, or other foreign matter introduced into the fuel. It can be introduced from a fuel source, or from the ship's own storage tanks and piping. Particulates generally settle out of solution and accumulate at the bottom of storage tanks. However, biological contamination and storage stability problems also generate particulates that can stay in suspension. Particulate contamination will clog fuel filters, and can potentially damage fuel injection equipment. Timely and periodic tank stripping is the best means to keep particulate contamination manageable.

b. Water Contamination. Water can be introduced by condensation, through onloaded fuel, via wet fueling lines, and by ballasting fuel storage tanks. Free water is water that can be removed from the fuel by mechanical means, for example by a centrifugal purifier. Free water, if allowed to remain still for a relatively short time, will settle to the bottom of the tank (or container) as a distinct layer or as droplets. Periodic tank stripping will therefore remove free water. Entrained water is defined as free water droplets that are suspended in the fuel. Entrained water typically appears as a haze. Dissolved water is water that can not be removed from the fuel by mechanical means and is not visible to the naked eye as haze. The concentration of dissolved water varies with fuel temperature, the relative humidity of the air contacting the fuel, and the chemical composition of the fuel. Water is necessary for microbial growth. Water can also cause damage to fuel injection equipment. Gas turbines are particularly sensitive to water contamination. Only water separators (coalescers) can remove entrained water from fuel. Timely and periodic tank stripping will help prevent the occurrence of problems associated with water.

c. Microbiological Contamination. Microbial contamination consists of organic debris created by fungi (including yeasts), bacteria, and protozoa. Microbes gain entrance to fuel tanks from contaminated fuel supply sources, from airborne particulates through tank vents, and from seawater if tanks are ballasted. After entrance into a tank, microbes settle on tank surfaces and especially at the fuel/water bottoms interface. Proliferation of those microbes adapted to this environment can occur if free water is present. Growth will be favored by warm environments. Sludges or interfacial mats can form – having a slimy or stringy consistency and appearing as a black, brown or dark olive color. Enmeshed non-biological particulate matter as well as fungal and bacterial cells may also be included. This kind of contamination can quickly clog fuel filters. If free water could be eliminated from the fuel, microbiological contamination would no longer be a major concern. Once again, timely and periodic tank stripping will minimize concerns with microbiological contamination. The addition of biocides is another means of preventing microbiological contamination. However, any fuel additive (including biocides) increases the chance of fuel compatibility problems when fuels are commingled (adding a new fuel load to a partially filled tank). The effectiveness of biocides can also be problematic. The use of biocides is discussed further below (C.2.d).

d. Storage Stability. F-76 and F-44 (JP-5) are the only marine fuels that have “built in” protection against problems associated with long term storage. NPD MGO, and other commercial fuels, are not delivered with a storage stability "guarantee" and therefore should be consumed as soon as possible - but not to exceed six months. Cutters participating in the In-Line Fuel Quality Sampling Program are exempt from this guidance because the analysis will characterize the storage stability of the fuel. Operational indications of unstable fuel are very similar to that of microbial contamination. It will most likely be manifested by frequently and quickly clogged fuel filter elements. Filter elements clogged by unstable fuel products may appear to be coated with a black gummy substance or a gel.

NOTE: The most recent information provided by Navy fuel experts is that there is no direct link between fuel haze and a fuel's storage stability characteristics.

e. Fuel Incompatibility. Incompatibility problems between distillate fuels are rare, but it can happen. Incompatibility will cause rapid formation of particulate matter similar to what can be observed with storage instability. The factors that influence incompatibility are not well understood. Chances for a compatibility problem are highest for cutters that fuel from multiple and remote locations, and from fuel sources that likely originated from different crude oils. Cutters and boats that generally refuel from the same supplier are at minimal risk.

2. Recommended Fuel Management Practices.

a. Clear and Bright Testing. Clear and bright visual testing upon receipt of fuel is important. NSTM, Chapter 541, Section 10 provides specific directions for performing this test. Clear and bright testing can identify water and particulate contamination, and to a limited degree, microbiological contamination problems. This test is particularly important when receiving an approved DESC bunker fuel product, or emergency substitute fuel. A microbial contamination problem can show up as fine particulates which may or may not settle out to the bottom of the sample bottle. If fuel passes clear and bright criteria, and onboard fuel stocks are routinely rotated, chances are slight that a fuel quality problem will occur before the fuel has been burned. When required by operational emergencies to accept fuel that will not pass clear and bright visual inspection criteria, minimize the amount of fuel taken onboard and burn it as soon as possible. However, the most likely cause of cloudiness, or haze, is entrained water. DESC contract requirements for NPD MGO requires that if a sample fails clear and bright visual testing, it must then be subjected to a water & sediment centrifugal test (max allowable water and sediment content is 0.05% vol). If the fuel passes this more rigorous test, it is acceptable for use. Unfortunately, Coast Guard vessels are not currently supplied with the equipment required to conduct this test onboard. Alternative arrangements may therefore become necessary to conduct the water and sediment test if the supplier insists on the next stage of testing.

NOTE: Marine fuel may have a colored dye mixed into the fuel. Only red dye is used domestically, but blue/green dye may be found in some foreign ports. In the Mediterranean, even black dye may be found. The dye can complicate performance of a clear and bright test. The resulting fuel/dye blend can have a colored tint (red/pink, etc.), but it must not be visually brown or darker in appearance.

b. Inline Fuel Quality Sampling Program. All WHEC, WMEC, and WAGB cutters should be participating in a joint Coast Guard/Navy/DESC In-line Fuel Quality Sampling Program. Fuel samples shall be obtained by ships force whenever non-MIL-SPEC fuel is delivered. This includes all diesel fuel purchased from DESC bunker contractors (either domestic or overseas) and open market purchases. F-76 obtained directly from U.S. Government/Navy bulk sources should not be sampled unless a quality problem is suspected. JP-5, even if delivered by a commercial transport company, should **not** be sampled. The samples are then shipped to an analysis laboratory for a rigorous set of tests. The samples are subjected to both the NPD MGO contract requirement tests and (for informational purposes) the more numerous and strenuous F-76 standards, including storage stability, particulate, carbon residue, and trace metal content. The participating cutters will get fuel quality testing far beyond what could ever be accomplished onboard ship and recommendations for corrective actions (should a problem be identified). Knowing the fuel properties allows appropriate actions to be taken to minimize or prevent a shipboard problem. It is important the samples be shipped to the analysis laboratory as soon as possible, preferably directly from the bunkering port. This is the only way to ensure that results are available before the fuel is burned and to minimize risk to equipment and personnel. In addition, ELC will initiate a customer complaint for any approved DESC bunker product that does not meet the NPD MGO contract requirements. Fuel quality has improved at a number of ports through this process. Contact ELC 026 for additional information.

c. Tank Stripping. Timely and periodic tank stripping of bottoms water and particulate contaminates is the single most effective procedure for maintaining fuel quality. Storage and service tanks are to be tested for free water content using bottom soundings and water indicating paste. Testing for free water shall be performed:

(1) Prior to receiving fuel (if the receiving tank had been ballasted),

(2) 24 hours after receiving fuel,

(3) And on a monthly basis.

To the best of your cutter's ability, strip the tank if free water is detected. It is recognized that many cutters do not have effective stripping systems.

d. Use of Biocides. This section states the requirements for biocide treatment of all diesel fuel oil and JP-5 fuel carried for shipboard use. The 400-foot WAGB, 378-foot WHEC, 210-foot WMEC classes, and CGC HEALY shall comply with the following fuel treatment provisions. All other cutters that regularly ballast their fuel oil storage tanks (manually or automatically), shall also comply. MLC's may, at their discretion, require participation of other cutters in the program.

Note: The provisions of this section DO NOT apply to fuels carried on board cutters for use in aircraft.

(1) Biocides. Biocides are commercially available products which are toxic to microorganisms. The most useful biocides for treating fuels are soluble in the fuel but have sufficient water solubility that they can partition into any present free water. Biocides prevent growth and proliferation of microorganisms but will **not** reduce the amount of microbial particulates taken in from a fuel supply source, or which may have developed in a tank before biocide treatment. To be effective for shipboard use, biocides must not alter the

characteristics of the fuel. Biocides must also be compatible with fuel storage, handling, transfer, and delivery systems for equipment that uses fuel. Multiple biocide products were approved for Coast Guard use in the past. However, due to recent changes in the MIL-S-53021A and its associated qualified products list (QPL-53021-9), and concerns with toxicity, compatibility, and other technical issues, only Biobor JF or Nalfleet 9-303 are currently approved for use. Cutters that are currently using another biocide product may use up existing stock. In addition, due to compatibility concerns, cutters shall run two complete tank fillings without any biocide product before transitioning to either Biobor JF or Nalfleet 9-303. Note: earlier information that stated compatibility problems existed between Biobor and Nalfleet were investigated by the Naval Research Laboratory and found to be in error. If a cutter should decide to switch from Biobor to Nalfleet (or vice versa) the new biocide may be directly added to a partially filled tank that had been previously been treated with the original biocide without compatibility concerns. There remains a general compatibility concern with fuel that has been treated with different additive products. For that reason, no additives (other than Biobor JF or Nalfleet 9-303) shall be used onboard Coast Guard vessels.

(2) Restrictions on Offloading Additized Fuel. Recent Naval Operational Logistics Support Center (NOLSC) (formally the Naval Petroleum Office) policies prevent offloading of additized fuel (fuel with biocides added) at Navy bulk storage facilities except under very special conditions. These policies can be obtained from www.navpetoff.navy.mil, under technical advisories. Unless other arrangements are made, additized fuel offloaded at Navy bulk storage facilities will be treated as waste oil and a disposal fee imposed. The only exception to this policy is for FISC, Seattle. Coast Guard additized fuel, provided it was treated only with Biobor JF and/or Nalfleet 9-303, may be offloaded without penalty or restriction.

(3) Storage and Handling of Fuel Treatments. Containers of fuel treatment chemicals must be kept closed to the atmosphere and possible water contamination. These fuel treatment chemicals are toxic. Follow Material Safety Data Sheets guidance on first aid, handling, stowage, and disposal.

(4) Use of Fuel Treatments. Use in accordance with manufacturer’s instructions.

(5) Magnetic Fuel Treatments. Magnetic fuel treatments are **not** authorized for use in place of biocides.

e. Stock Rotation. In order to counter the concerns with storage stability and microbial contamination, it is critical to keep track of the fuel product in each onboard storage tank, and when it was received. Approved DESC bunker fuel products and emergency substitute fuels should be burned as quickly as possible after being taken onboard. In general, onboard fuel stocks should be rotated so that older fuels are used first. Continually drawing fuel in the same tank order, and not transferring fuel from tanks at the bottom of the normal tank rotation, is inviting disaster. FCCS can be used to help keep track of the type of fuel that has been loaded, and when, in each tank.

f. Corrective Action. Once severely contaminated or unstable fuel has been detected, stop burning it as soon as possible, isolate that storage tank, and contact your group engineer or type desk for assistance with tank cleaning. Operationally, unstable fuel is defined as requiring frequent and repeated fuel filter changeouts. Do not attempt to cut or blend unstable fuel with good fuel - this will most likely only add to the problem and will certainly add to the expense of disposal. If you have a fuel storage stability concern, MLCLANT/MLCPAC or ELC 026 can assist you in getting your fuel tested.

D. FUEL REQUEST/LOGREQS. When requesting fuel in LOGREQS or when arranging fuel deliveries, cutters should not use the term "DFM" (which is non-specific), but should utilize the standard naming phrases listed above in paragraph B.4 to ensure the fuel requested is the fuel received. Cutters should also contact their husbanding agent or ship chandler to obtain the latest fuel info for planned foreign port BSF(s). To help cutters meet the fuel selection policy and ensure the fuel received meets the listed technical requirements, recommend the following in all LOGREQS:

FOXTROT: RQST XXX GALS FUEL, SEE PARA ZULU (1) FOR SPECIFICS.
ZULU: (1) FUEL PREFERENCE AND REQUIREMENTS AS FOLLOWS: IF AVAILABLE, SUPPLIER PREFERENCE FOR FUEL IS DOD FACILITY (FIRST), DESC CONTRACTED SUPPLIER (SECOND) AND COMMERCIAL SUPPLIER (LAST). FROM THE SUPPLIER WITH THE HIGHEST PRIORITY ONLY, REQUEST THE LEAST EXPENSIVE FUEL AVAILABLE OF NATO F-76, NATO F-44, NPD MGO, OR B-76.
CUTTERS EQUIPPED WITH PAXMAN ENGINES REQUIRE MINIMUM CETANE NUMBER OF 45, REGARDLESS OF WHETHER F-76, NPD MGO, DF2, OR B-76 IS SUPPLIED.

E. REPORTING FUEL PROBLEMS.

1. DESC Contractor Supplied Fuel. If you encounter problems with the fuel you have received and the source is a DESC contractor, all problems and information should be directed back to DESC FORT BELVOIR VA//DESC-BQ//. COMCOGARD MLC LANT NORFOLK VA//VR/F//, COMCOGARD MLC PAC ALAMEDA CA//V/VR/F//, COGARD ENGLOGCEN BALTIMORE MD//026//, AND COGARD COMDT WASH DC//G-SEN// should be listed on the info line of these messages. DESC needs the following information to assist with the investigation and determination of appropriate corrective action: Unit POC and the preferred method(s) of contact (phone, e-mail, message, other); the type and quantity (gallons) of fuel received; current disposition of the fuel (how much has been used, problems encountered, if product is commingled with other fuels onboard); if there are retained samples of the problem fuel; the name of the DESC contractor and the contract number.

2. Navy Supplied Fuel. If you encounter problems with fuel received from a Navy facility, all problems and information should be directed back to NOLSC DC FORT BELVOIR VA. COMCOGARD MLC LANT NORFOLK VA//VR/F//, COMCOGARD MLC PAC ALAMEDA CA//V/VR/F//, COGARD ENGLOGCEN BALTIMORE MD//026//, AND COGARD COMDT WASH DC//G-SEN// should be listed on the info line of these messages. NOLSC needs the following information to assist with acting on your problems: Unit POC and the method(s) of contact (phone, e-mail, message, other); the type and quantity (gallons) of fuel received; current disposition of the fuel (how much has been used, problems encountered and has it been mixed with other fuels); the name of the facility that the fuel was received from.

F. **GENERAL QUESTIONS**. If you have any questions regarding the DESC contract or fuel locations and prices, contact MLCLANT (f) or MLCPAC (v). If you have any technical questions on fuel types, please contact your unit type desk manager or ELC-026.

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CHAPTER 542. FUEL SYSTEM, SHIPBOARD AVIATION

A. **SHIPBOARD JP-5 AVIATION FUEL HANDLING.** Shipboard Helicopter Operational Procedures Manual, COMDTINST M3710.2 (series) provides detailed guidance on minimum quality and surveillance standards, testing requirements, safety precautions, and handling procedures concerning the acceptance, storage, and dispensing of aviation fuel**.**

NOTE: Biocides are not authorized for use in aviation fuels.

B. **MAINTENANCE OF EQUIPMENT.** JP-5 fuel transfer, service, and storage equipment shall be maintained in accordance with cutter specific PMS and MLC Standard Specifications.

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CHAPTER 550. COMPRESSED GAS CYLINDERS

A. **GENERAL.** Fixed and portable compressed gas cylinders carried on board Coast Guard cutters shall comply with Department of Transportation (DOT) Code of Federal Regulations (CFR), Title 49, Part 173, Defense Logistic Agency (DLA) requirements, and the U. S. Navy's mandatory 12-year test limit. TP 2006 (series), Damage Control Preventive Maintenance Manual, provides guidance for inspecting, testing, and maintaining portable and compressed gas cylinders. NSTM Chapter 550 provides additional guidance.

B. **HYDROSTATIC TESTING INTERVALS.**

1. Fixed Cylinders. The compressed gas cylinders listed below shall be tested as follows:

Air	Hydrogen
Argon	Helium
Carbon Dioxide	Nitrogen
Refrigerant	Oxygen

a. 12 Years. An installed or stowed compressed gas cylinder that has not been disturbed or discharged may remain installed or stowed up to 12 years from its previous date of hydrostatic testing. When 12 years have elapsed, the cylinder shall be removed from service, discharged, and hydrostatically tested before being returned to service.

b. 5 Years. If a cylinder is discharged and 5 years have elapsed since the cylinder was last tested, that cylinder shall be hydrostatically tested prior to recharge.

NOTE: Cylinders marked ICC8, DOT 8, ICC8AL, or DOT8AL are authorized for acetylene only. NSTM Chapter 074 and 550 provide guidance for transport, handling, and stowage of acetylene and gas welding and cutting equipment.

2. Halon 1301 Fixed Cylinders. Since Halon (Fluorinated Hydrocarbons) is free of corroding components, CFR Title 49, Part 173.34, permits complete external visual inspections in lieu of hydrostatic retests. If this inspection is used in lieu of hydrostatic retesting, subsequent inspections are required 5 years after the first such inspection and periodically at 5-year intervals thereafter. A competent person shall only make inspections and the results shall be recorded on a suitable data sheet CFR Title, Part 173.34 provides guidance for conducting complete external visual inspections and maintaining inspection records. The external visual inspections outlined in the Compressed Gas Association (CGA) Pamphlet 6 meet the CFR requirements for visual inspection.

NOTE: If a Halon cylinder is discharged and 5 years have elapsed since the cylinder was last tested, that cylinder shall be hydrostatically tested prior to recharge.

3. Portable Cylinders.

a. Portable CO2 cylinders shall be tested every 5 years.

b. Portable Halon 1211 cylinders shall be tested every 5 years.

c. Portable oxygen cylinders (i.e. of the exothermic cutting unit) shall be tested every 5 years.

d. Portable PKP cylinders shall be tested every 12 years.

C. **<u>IDENTIFICATION MARKS</u>.** Compressed cylinders shall be marked with the following information. Marks include the manufacturer's symbol, the Navy serial MFG 4500 NONSHAT number if one was assigned, and the NONSHAT number when the cylinder was tested in accordance with Navy Specifications for nonshatterable cylinders.

EXAMPLE:

Navy symbol, if manufactured under a Navy contract	USN
Inspector's mark	XY
Other side	
Navy specification number and date of manufacture (month and year)	51631 3/63
Original test date	7/63
Subsequent test dates	9/69/ 6/75

D. **<u>TEST FACILITIES</u>.** Hydrostatic testing shall be performed as prescribed in CFR, Title 49, Sections 178.36, 178.37, or 178.38, as appropriate.

E. **<u>USE OF NONSHATTERABLE CYLINDERS</u>.** Nonshatterable-type cylinders for high-pressure gases are standard for shipboard use. Shatterable-type cylinders may be used only in the event of an emergency. If used, shatterable-type cylinders shall be replaced by nonshatterable as soon as possible. Nonshatterable cylinders, when used, shall be manufactured to appropriate DOT (ICC) specifications.

CHAPTER 551. COMPRESSED AIR SYSTEMS

A. **COMPRESSED AIR PLANTS AND SYSTEMS.** NSTM Chapter 551 provides guidance on the safe operation and inspection of compressed air plant components, equipment, and systems.

B. **MOISTURE SEPARATORS AND AIR OILERS.** Commands shall ensure that moisture separators or air oilers of installed compressed air systems are equipped as follows:

1. For service below 125 psig, either plastic or metal bowls may be used. Plastic bowls shall have threaded inserts and metal guards.
2. For service above 125 psig, metal bowls are required.

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CHAPTER 555. FIREFIGHTING

A. **<u>FIREFIGHTING EQUIPMENT AND PROCEDURES</u>.** The following provide guidance on firefighting equipment and procedures: Machinery Space Firefighting Doctrine for Class Bravo Fires, COMDTINST M9555.1 (series), Shipboard- Helicopter Operational Procedures Manual, COMDTINST M3710.2 (series), Surface Ship Survivability, NWP 3-20.31, NSTM Chapter 555 Firefighting-Ship, NSTM Chapter 074 Volume 3 Gas Free Engineering, NSTM Chapter 077 Personnel Protection Equipment, NSTM Chapter 079 Volume 2 Damage Control-Practical Damage Control, Damage Control-PMS Manual, TECHPUB 2006 (series).

B. **<u>FIREFIGHTING ORGANIZATION</u>.** Surface Ship Survivability, NWP 3-20.31, NSTM Chapter 555 and NSTM Chapter 079 Volume 2 shall be used for guidance in the development and training of repair locker personnel.

C. **<u>MAINTENANCE</u>.** Guidance for maintaining, operating, and inspecting firefighting equipment is provided in Damage Control-PMS Manual, TP-2006 (series), manufacturers' technical publications, NSTM Chapter 555, NSTM Chapter 077, NSTM Chapter 079 Volume 2 and NSTM Chapter 550 (Halon Cylinders).

D. **<u>AUTHORIZED EQUIPMENT</u>.** Cutter Standard Repair Locker Inventory, COMDTINST M9664.1 (series) provides guidance for procurement of authorized Damage Control equipment.

E. **<u>FIREFIGHTING AGENTS</u>.** Surface Ship Survivability, NWP 3-20.31, NSTM Chapter 555 and NSTM Chapter 079 Volume 2 provide information on fire chemistry, physics and firefighting agents.

1. <u>Water</u>. To maintain optimum firefighting capabilities, firemain pressure shall be maintained at the cutter's designed pressure. Firemain systems (pumps and piping) shall be maintained, regulated and operated in accordance with manufacturer's technical publications and TP 2006 (series).

2. <u>Dry Chemical</u>. Potassium bicarbonate (Purple Potassium Powder-PKP), meeting Federal Specification 0-D-1407, is the only dry chemical authorized for use in "portable fire extinguishers" on Coast Guard cutters and boats.

3. <u>Carbon Dioxide Gas (CO2)</u>. Due to its noncorrosive and nonconductive properties, CO2 shall be used as the primary extinguishing agent for Class C, helicopter gas turbine and cutter gas turbine fires.

4. <u>Foam</u>. AFFF concentrate, meeting MIL-F-24385, is the only firefighting foam concentrate authorized for use on Coast Guard cutters and boats. This specification is for both the six percent and three percent AFFF concentrates in each gallon of mixed AFFF solution. Three percent AFFF is only authorized for use on the 225 FT WLB, 175’ WLM, 140 FT WTGB, 87 FT WPB and small boats equipped with the CG-P5 or CG-P6 pump. AFFF is available in 5-gallon plastic containers and 55-gallon steel drums. Storage of the 5-gallon containers shall be in compliance with Fleet drawing

FL-3000-13 (for stacking containers more than two-high). AFFF shall be maintained in accordance with its respective Material Safety Data Sheet (MSDS).

<u>NOTE</u>: 6% and 3% foam concentrate requires different proportioners. Adjustable and dial-in proportioners are available through the Federal stock system.
<u>NOTE</u>: The 270' WMEC's ship-alts are pending to convert the 6% AFFF systems to a 3% AFFF systems.
<u>NOTE</u>: Three percent AFFF is being proposed for new classes of cutters such as the 240' WLBB and the NSC.

5. <u>Halon Agents</u>. Halon agents were selected for specific cutters and boats as a result of smaller space requirements and lower system weight and toxicity levels during application.

F. <u>FIREFIGHTING EQUIPMENT AND INSTALLATION</u>.

1. <u>Fireplugs and Firehoses</u>.

   a. At minimum, two 1-1/2 inch, 50-FT lengths of hose shall be located at each firestation on the main weather deck, lower decks, and superstructures, with one 50-FT length connected to each fireplug. Flight Deck Firestations shall be outfitted with enough hose to extend past the aft edge of the flight deck. Main Space Re-entry Stations shall be outfitted with enough hose to enable fire teams to safely combat Main Space Fires. Firehoses used on Coast Guard cutters and boats shall meet Federal Specification ZZ-H-451, Class A, Type I or II, or MIL-H-24606.

   b. Each fireplug shall be fitted with two spanner wrenches.

   c. Fabric covers are not authorized and shall not cover fireplugs.

   d. 1-1/2 inch hoses not used explicitly for training, firefighting and damage control (i.e. Potable Water Hoses and Water Washdown Hoses) shall be stored in a designated area and stenciled to reflect their intended use and "NOT FOR FIREFIGHTING USE".

   e. When a new hose is placed in service, it shall be installed first at fireplugs below the weather decks and in repair lockers. The displaced hoses, if serviceable, shall be relocated topside and on the weather decks. Some cutters and boats may be outfitted with hose configurations different than those indicated above. Replacement hoses shall comply with original outfit requirements.

2. <u>Nozzles and Applicators</u>. The following nozzles and applicators are authorized for use on Coast Guard cutters and boats:

   a. <u>Vari-Nozzle</u>. Vari-Nozzles meeting MIL-N-24408 are authorized for use on Coast Guard cutters and boats. The 1-1/2 inch (95 gpm or 125 gpm) Vari-

Nozzle shall be used on Coast Guard cutters and boats. Flight deck fire stations shall be fitted with a 1-1/2 inch, 125 gpm Vari-Nozzle, and all remaining stations shall be fitted with the 1-1/2 inch, 95 gpm nozzles.

b. All-Purpose Nozzle.

(1) Coast Guard All-Purpose Nozzles (CGAP)/Navy All-Purpose Nozzles and applicators are authorized on cutters for special firefighting requirements. Cutters fitted with the MK 75 gun mount shall retain a CGAP nozzle and a low velocity fog applicator to combat hot gun conditions. Applicators shall be modified in accordance with Safety Manual For Clearing Of Live Ammunition From Guns, NAVSEA SW300-BC-SAF-010.

(2) The 1-1/2 inch CGAP nozzle, meeting MIL-N-24408, and the 1-1/2 inch (4 FT and 10 FT) Coast Guard applicator are available through the National Stock System. The CGAP nozzle and applicator are equipped with non-clogging fog tips that will pass a 3/8 inch diameter ball. Akron Brass style 2033 (1-1/2 inch Nozzle Fog Head) and Akron Brass style 1034 (1-1/2 inch Applicator Fog Head) replacements tips are available through the Federal Stock System.

3. Foam Equipment.

a. Portable Foam Equipment. NSTM Chapter 555 provides operating instructions for the inline foam proportioner.

b. Installed Foam Equipment. Description and operation of installed foam equipment is contained in NSTM Chapter 555.

4. Halon 1301 Total Flooding System.

a. Halon 1301 on Boats. Only the following classes of standard boats are authorized to have permanently installed Halon 1301 total flooding systems:

30 FT Surf Rescue Boat
38 FT Deployable Pursuit Boat
41 FT Utility Boat
44 FT Motor Lifeboat
47 FT Motor Lifeboat
55 FT Aids-to-Navigation Boat.

Halon 1301 is stored in a steel cylinder, which is super pressurized with dry nitrogen to 600 psi. Halon cylinders shall be installed outside the engine room as a result of high temperatures which may cause the bottle to "cook off". Manufacturers' technical publications shall be used for specific guidance. System components, operating procedures and safety precautions are contained in NSTM Chapter 555.

b. Halon 1301 on Cutters. Halon 1301 Total Flooding Systems, meeting MIL-E-24572, are authorized only on the 400 FT WAGB, 378 FT WHEC, 290 FT WAGB, 110 FT WPB, 82 FT WPB, 65 FT WYTL classes and the following 140 FT WTGB's, Hulls 101-105. KATMAI BAY, BRISTOL BAY, MOBILE BAY, BISCAYNE BAY, NEAH BAY.

5. Portable Fire Extinguishers.

a. Portable PKP Fire Extinguishers. The following portable PKP extinguishers (CO_2 pressurized cartridge type), meeting MIL-E-24091, are authorized for use on Coast Guard cutters and boats.
NOTE: One 27 pound PKP extinguisher shall be provided at each AFFF hose reel or Self Contained AFFF station in propulsion and auxiliary machinery spaces.

10-pound (2 3/4 ounce cartridge)
8-pound (5 1/4 ounce cartridge)
27-pound (8 1/4 ounce cartridge)

b. Portable Carbon Dioxide (CO_2) Fire Extinguishers. 15 pound CO_2 extinguishers meeting MIL-E-24269 are authorized for use on board Coast Guard cutters and boats.

c. Portable AFFF Fire Extinguisher. 2-1/2 gallon stainless steel AFFF fire extinguishers meeting MIL-E-24652 are authorized for use on Coast Guard cutters and boats. Extinguishers are designed to vapor secure a small fuel spill to prevent a fire, to extinguish a small class "B" fire (including a deep fat fryer fire), to extinguish a small class "A" fire and for use in standing fire watch during hot work operations.

d. Portable Halon 1211 Fire Extinguishers. Commandant (G-SEN) authorization is required for the use of Halon 1211 fire extinguishers on board Coast Guard cutters and boats. Extinguishers shall be USCG approved and shall not exceed 9 lb agent capacity. In addition, extinguishers shall be equipped with a USCG approved bulkhead rack, metal control valves, and flexible discharge hoses.

6. Galley Fire Protection Equipment. Fixed shipboard galley deep fat fryers and their exhaust systems shall be protected by Aqueous Potassium Carbonate (APC) fire extinguishing systems that meet MIL-E-24416 specifications. NSTM Chapter 555 provides detailed guidance on how to combat deep fat fryer fires.

7. Fixed Carbon Dioxide Systems. Fixed flooding carbon dioxide system for manned compartments (located below the damage control deck and having vertical exit) shall be fitted with a discharge time delay. Installed time delay systems shall be in accordance with Coast Guard Fleet Drawing FL-9300-31.

8. Portable Firefighting Pumps. The P-250 MOD 1, P-100, CG-P5 and CG-P6 pumps provide a dual function. They can be used either for firefighting or for dewatering. As a result, these pumps shall be maintained at the highest level of readiness.

   a. P-100 Pump. The P-100 Champion Fire Pump is the fleet replacement for the P250 Mod 1 Pump. NSTM 555 and TP S6226-NM-MMC-010/15852 provide operating and maintenance instructions.

   b. P-250 MOD 1 Pump. The P-250 MOD 1 is the only P-250 pump authorized in the Coast Guard. NSTM 555 and TP S6225-BW-MM0-010 provide operating and maintenance instructions. Additional precautions for the P-250 MOD 1 pump are:

      (1) Two-cycle oil with the BIA-TC-W**3** designation (available through OMC, P/N 509903) shall be used with the P-250 MOD 1. This pump does not use oil premixed with gasoline, it has a separate oil injection system. Attempts to run the pump with oil in the gasoline and/or no oil in the injection system will result in a severely damaged pump.

      (2) Failure to thoroughly read and understand the technical manual prior to starting may cause failure and/or destruction of the pump.

9. Portable Exothermic Cutting Unit (PECU). Only the Exothermic torch will be supported by MICA. The Exothermic torch is a direct replacement (one for one) for the Oxyacetylene Torch Cutting Outfit. NSTM Chapter 079 Volume 2 and the manufacturer's operating and maintenance manual provide further information.

   a. Emission Control (EMCON) Considerations. DC WIFCOM radios emit radio frequency (RF) signals which can be detected. Therefore, use of DC WIFCOM must be considered in the ship's EMCON plans.

   b. Hazardous Electromagnetic Radiation To Ordnance (HERO). In general, WIFCOM shall not be used in a weapons handling incident/accident. Specifically, portable radios shall not be closer than 10 FT to HERO susceptible or unsafe ordnance (defined in NAVSEA OP 3565, Electromagnetic Radiation Hazards), especially in the presence of any damaged, broken, or otherwise exposed explosive ordnance.

10. International Shore Connection (Ship).

   a. The Navy and Coast Guard use two types of threads in the firemain system: National Standard Hose (NH) Threads, for 2 1/2 inch and larger connections, and National Pipe Straight Hose (NPSH) Threads, for 1 1/2 inch connections. These threads may not be compatible with municipal fire departments or commercial ships.

   b. On cutters that do not have 2-1/2 inch topside hose connections, it is necessary to install a 2-1/2 inch male by 1-1/2 inch female adapter to the International Shore

Connection (Ship). All cutters shall ensure that local fire departments and other key facilities have the companion flange to the International Shore Connection (Ship). The connection shall be bronze or brass, suitable for 150 psi service. This connection can be purchased through most firefighting equipment dealers and from the supply system.

G. PROTECTIVE EQUIPMENT.

1. Breathing Apparatus. The only breathing apparatus authorized for any firefighting related evolution on board cutters and boats is the Navy Type A-4 OBA. Self Contained Breathing Apparatus (SCBAs) are not authorized unless a unit is taking part in an ELC approved SCBA installation. The green, single candle, self-starting type canister is the only canister authorized to be used with the Type A-4 OBA.

   NOTE: Red training canisters are available for training purposes only and shall not be stored in repair lockers. Type A-4 OBA's shall be stored in an approved locker in accordance with NSTM Chapter 077. However, canisters may be stored either horizontally, with the concave side down, or vertically, copper seal up. NOTE: At a minimum, there shall be 12 canisters per allotted OBA. NAVSEA SS600-AA-MMA-010, NSTM Chapter 077 and NSTM Chapter 079 Volume 2 provide operating instructions for the Type A-4 OBA.

2. Emergency Escape Breathing Device (EEBD). Engineering Changes are being developed which will identify allowance requirements and locations for EEBD's on board cutters. Requests to change the allowance requirements or locations shall be submitted as an Allowance Change Request, per Property Management Manual, COMDTINST M4500.5 (series). EEBD's shall be installed using the installation guidelines contained in TP 2771. Each crew member shall be familiar with the operation and use of the EEBD. NSTM Chapter 077 and NSTM Chapter 079 Volume 2 provide operation and maintenance instructions. General Guidelines for EEBD Allowance Determinations are listed below and are summarized in figure 555-1:

   a. All Manned Machinery Spaces during Condition IV (normal steaming) shall have one EEBD per watchstander for maximum manning during any evolution. These containers shall be installed not more than 5 feet and not less than 1 foot above the deck and equally allocated along the normal and auxiliary egress routes, adjacent to watch stations, or at the base of egress ladders.

   b. All Berthing Spaces shall have one EEBD per rack if the primary (shortest) or secondary (second shortest) egress route is through a main or auxiliary machinery space. These containers shall be installed in the vicinity of the berth where it is readily accessible.

   c. All Other Spaces shall have an EEBD(s) if the requirements of 3.a and 3.b are met.

d. The calculated egress distance between the most remote point of any space to a weather deck (fresh, open air) exit door along the primary or secondary egress route is 200 feet or greater. To calculate the distance use the following list:

(1) Horizontal passageways, 1 ft = 1ft
(2) Vertical Passageways (Ladders), 1 ft = 1 ft
(3) Hatch/Scuttle/Door (NTD, WTD, QAWTD, including the final door), 1 fitting = 50ft.

AND

e. The space meets the requirements of one of the following criteria:

(1) Evolutions – one per watchstander for any manned space for maximum manning during any evolution, except those assigned to Repair Lockers or Engineering Assist Teams. These containers shall be installed adjacent to watch stations.

OR

(2) Remote Spaces – spaces that may have personnel in them during a Condition IV (normal steaming) workday.

(3) Passageways - one EEBD shall be installed in all passageways below the main deck. These containers shall be installed not more than 5 feet and not less than 1 foot above the deck, and along the normal and auxiliary egress routes or at the base of egress ladders.

(4) Machinery Spaces – one EEBD shall be installed in all main and auxiliary machinery spaces. (i.e. CHT pump rooms, Fuel pump rooms, shaft alleys) For Machinery Spaces, the EEBDs shall be installed not more than 5 feet and not less than 1 foot above the deck and equally allocated along the normal and auxiliary egress routes, adjacent to watch stations, or at the base of egress ladders.

In all fuel, CHT, and sewage pumps rooms the EEBDs shall be installed not more than 5 feet and not less than 1 foot above the deck and; at the base of vertical ladders for spaces with vertical primary egress routes and immediately outside the space adjacent to the primary egress exit door for spaces with horizontal egress routes.

(5) Workspace and Lounge Areas – One EEBD shall be installed in the common passageway immediately adjacent to each workspace or lounge. These containers shall be installed not more than 5 feet and not less than 1 foot above the deck, and along the normal and auxiliary egress routes or at the base of egress ladders.

OR

Berthing - one per rack in all berthing areas. These containers shall be installed in the vicinity of the berth where it is readily accessible

3. Clothing / Battle Dress

a. General Emergency or General Quarters. When General Emergency or General Quarters is sounded, all hands must don proper battle dress, which includes but not limited to fire fighting helmet, flash gear heads and hand, long sleeve shirt. All loose clothing / straps will be secured as close to the body as possible. Additional personnel clothing and equipment may be required, depending on the scenario and GE / GQ station assignments. (e.g. Flak Jackets, Life Jackets). The overall decision to require protective equipment and clothing to be worn rests with the Commanding Officer. When in the opinion of the CO the threat is not imminent, battle dress may be relaxed, considering the trade-off of personnel protection versus the adverse effects on personnel efficiency resulting from heat stress or prolonged discomfort.

b. Proximity Suit. The aluminized firefighting suits are used aboard flight deck equipped cutters. Description and maintenance instructions are contained in NSTM 077 and Shipboard-Helicopter Operational Procedures Manual, COMDTINST M3710.2 (series).

(1) Ensemble Components. NSTM Chapter 077 provides detailed descriptions of the FPG components.

(2) Allowance. FPG allowances are contained in Cutter Standard Repair Locker Inventory, COMDTINST 9664.1 (series).

(3) Storage and Donning. Storage and donning procedures are provided in NSTM Chapter 077 and 079 Volume 2.

(4) Repair. NSTM Chapter 077 and Damage Control-PMS Manual, TP-2006 (series) contain information for maintenance and repair of the FPG.

(5) Reduction of Heat Stress for Firefighter Ensemble. NSTM Chapter 077, NSTM Chapter 079 Volume 2, NSTM Chapter 555 and Cutter Heat Stress Program, COMDTINST 6260.17 (series), provide guidance for heat stress with the FPG.

(6) Helmet. Alteration to the Firefighting helmet in any way is not authorized. During General Quarters and General Emergency all personnel will be required to wear the firefighter's helmet in lieu of the hard shell battle helmet.

c. Repair Party Firefighting Ensemble (FFE). When no longer serviceable IAW DC PMS TP 2006 series will be systematically replaced by Fire Protective Gear (FPG).

H. FLEXIBLE HOSES IN FIREFIGHTING SERVICE.

1. Scope: It is Naval Engineering policy that firefighting systems and equipment on Coast Guard vessels generally meet USN requirements, to the extent practical. As a secondary requirement, it is a Naval Engineering policy that firefighting systems shall meet the intent of CFR requirements wherever possible and appropriate, particularly where safety is involved.

2. General Maintenance Policy. Firefighting system equipment shall be inspected and maintained in accordance with cutter specific PMS, and manufacturer technical publications.

    a. Portable Extinguisher Hoses.

        (1) Portable extinguisher hoses which do not have a control valve at the working end of the hose are not required to be hydrostatic tested.

        (2) Portable extinguisher hoses which are equipped with a control valve at the working end of the hose shall be hydrostatically tested when the attached cylinder is tested.

    b. AFFF Rubber Hoses and Related System Hoses.

        (1) Nitrogen hoses and AFFF rubber discharge hoses of AFFF self-contained units (which utilize nitrogen as a propellant) shall be hydrostatically tested to 400 psi at 5 year intervals.

        (2) AFFF Hose Reel System (ex Twin-Agent unit hoses subject to firemain system design pressure) shall be hydrostatically tested to 400 psi at 5 year intervals.

    c. Carbon Dioxide (Nonmetallic) Hoses (Installed Hose Reel Systems).

        (1) Nonmetallic hoses are equipped with a metallic braid cover for electrical conductivity. Electrical conductivity shall be verified at least once annually.

        (2) Carbon dioxide hoses which are equipped with a discharge control valve at the working end of the hose shall be hydrostatically tested at 5 year intervals. The test pressure shall be not less than 1250 psi, in accordance with National Fire Protection Association Standard 10- Standard for Portable Fire Extinguishers. **NOTE: This industrial standard test is higher than NAVSEA or 46 CFR guidance.**

    d. HALON Fixed Flooding Systems and Carbon Dioxide Fixed Flooding Systems shall be maintained in accordance with NEM Chapters 505 and 550.

3. Shelf & Service Life. See hose or equipment manufacturer recommendation for service life requirements and specifications.

4. Hose Replacement Schedule.

   a. Portable Extinguisher Hoses: Rubber discharge hoses shall be replaced at 5 year intervals.

   b. AFFF Rubber Hoses and Related System Hoses

   c. Carbon Dioxide (Nonmetallic) Hoses (Installed Hose Reel Systems)

      (1) Nonmetallic hoses shall be replaced at 7 year intervals.

      (2) Carbon dioxide hoses shall be replaced at 7 year intervals.

5. Hose Tags. Hose tags are not required for flexible hoses used on Coast Guard fire fighting equipment.

CHAPTER 556. HYDRAULIC EQUIPMENT

A. **GENERAL.** This section provides guidance for the inspection and maintenance of hydraulic equipment, the cleaning and flushing of hydraulic piping, and the replacement of hydraulic hoses (flexible rubber, synthetic or composite, hoses carrying petroleum or ester based hydraulic fluid).

B. **INSPECTION AND MAINTENANCE.** Hydraulic equipment, piping, and hose assemblies shall be inspected and maintained in accordance with cutter specific PMS, manufacturer technical publications, and MLC Standard Specifications.

C. **HYDRAULIC HOSE RENEWAL.** See chapter 505 of this Manual for specific hose guidance.

D. **GENERAL REQUIREMENTS FOR CLEANING AND FLUSHING HYDRAULIC SYSTEMS.** Each MLC shall develop and promulgate guidance for cleaning and flushing hydraulic systems. American Society for Testing and Materials (ASTM) D4174, Standard Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems and ISO 4406 Hydraulic Reporting Standard shall be used for guidance.

1. NAS 1638 contains outdated information and shall not be used as cleanliness standard for hydraulic flushing.
2. ISO 4406 is the internationally recognized standard for cleanliness reporting.

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CHAPTER 570. GENERAL DUTY AND REPLENISHMENT WEIGHT HANDLING SYSTEMS

A. **GENERAL.** This chapter describes the requirements for general duty and replenishment weight handling systems. The purpose of this policy is to ensure that the weight handling components and systems aboard cutters and boats are adequately designed and maintained in good working order for safe use. This chapter specifically applies to loose cargo gear, portable davits, portable chain hoists, lifting padeyes, accommodation ladder rigging, general rigging equipment, replenishment systems and other miscellaneous weight handling systems and components. Additional requirements peculiar to replenishment-at-sea, stores handling, cargo handling, buoy handling, boat handling, cranes and elevators, and oceanographic research equipment are contained in their respective chapters within this manual. General and design requirements have been included to support routine field procurement and installation of additional or replacement equipment. Authorization for the installation of new equipment or configuration alterations of existing systems shall be processed through Engineering Change requests; see Chapter 041.

1. References. Several other chapters within this manual provide maintenance, repair, inspection, and testing requirements relative to specific weight handling systems and equipment. Naval Ships Technical Manuals (NSTMs) are a good source of information and guidance for these systems as well as the American Bureau of Shipping (ABS) Requirements for Certification of Construction and Survey of Cargo Gear on Merchant Vessels (1975).

2. Definitions.

   a. Equipment / Systems Integrated Logistics Support Plan (EILSP). EILSP and Equipment Support Sheet (ESS) Development and Maintenance Responsibilities, COMDTINST 4105.7 (series).

   b. Maintenance Procedure Card (MPC). MPC's Provides specific maintenance procedures for the particular equipment or system and the periodicity.

   c. Non-Destructive Examination. These methods include the use of magnetic particle, ultrasonic, dye penetrant, eddy current or other methods deemed suitable by the cognizant MLC.

   d. Loose Cargo Gear. All loose chain, slings, rings, hooks, links, shackles, swivels and similar components not part of an installed system.

   e. "Frequently Used Padeyes." For purposes of this document, shall mean padeyes and tie-downs that are used at least once annually and thus must be maintained.

f. "In-Frequently Used Padeyes." For purposes of this document, shall mean padeyes and tie-downs that are used less than once annually and thus must be tested prior to each use.

g. Working Load Limit (WLL). The maximum weight that can be routinely handled by the equipment.

h. Design Load. The maximum force or load that can be applied, including forces produced by ships motions acting on the loads. Operational Design Loads, during which the cutter and equipment must continue to operate, and Survival Design Loads, which the cutter and equipment must survive, may be established based on design parameters specific for a specific cutter.

i. No-Load Test. An operational test conducted prior to other tests to determine if the system is capable of safely operating through each specified functional mode. The system shall be operated through full operating ranges in all directions. During the test, operation of the travel limit switches, over travel limit switches, emergency stop and emergency run switches (as applicable) shall be checked. Anti-two-block, up-stop, down-stop and rotation stop switches shall be checked.

j. Dynamic Load Test. A load test conducted to validate routine rigging, hydraulic system integrity and equipment braking actions. A test weight, typically equivalent to 125% of the WLL, is lifted by the weight handling system, held, and moved throughout the range of motion of the equipment at no specified speed.

k. Full Load Test. A load test conducted to demonstrate all movements, responses, speeds, interlocks and controls. This test is conducted at 100% WLL. Testing shall be continued until all portions of the system have been brought to steady state operating conditions and steady state operating temperatures. The test demonstrates that the system is capable of continuous operation without overheating.

l. Proof Load Test. A test conducted on portable or loose cargo gear in which the component is externally pulled to simulate 200% of WLL to demonstrate structural integrity.

m. Static Load Test. A load test conducted on newly installed, structurally repaired (e.g. by welding) or structurally overhauled (e.g. replacement of major structural sections) systems where a test weight equivalent to 200% of WLL is applied as a force by external means and held for not less than 10 minutes, to demonstrate structural adequacy of the equipment and foundation. No part of the equipment, fittings, and structure shall take a permanent set, nor shall degradation of any operating or control function occur as a result of the test.

n. Modified Static Test. A load test conducted on existing equipment where the equipment has been removed for non-structural repairs and is being reinstalled (e.g. w/ bolts), or where the installation is being revalidated. A test weight, typically equivalent to 150% of the WLL, is applied by external means and held for not less than 10 minutes, to demonstrate that the equipment has been correctly installed.

B. GENERAL DESIGN REQUIREMENTS.

1. Environmental Considerations. Systems and associated equipment shall be designed for satisfactory operation, for the appropriate duty cycles, under the range of weather and temperature conditions to which the equipment is exposed. Equipment and fittings shall be suitable for use in marine shipboard at-sea environments on exposed weather locations.

2. Mass. Components of the systems, especially portable equipment, shall be designed for the minimum mass consistent with the service required.

3. Strength. Equipment, kingposts, structure, attachment points and fittings of systems shall be designed to withstand the following loads and forces:

   a. The combination of loads and angles within the operating range which produce the maximum load in each component and in each individual part.

   b. Loads imposed by static, dynamic, speed and endurance tests.

   c. Forces induced by mass of components and gear, impact loading, sheave friction, and stress in wire rope due to bending over sheaves.

   d. Wind loading, snow and ice loading, wave slap, and effects of roll and pitch.

   e. Working forces and loads.

4. Factors of Safety.

   a. Installed Rigging. Unless otherwise specified, running rigging shall be designed to a minimum factor of safety of 5 based on the nominal breaking strength of the wire rope. In calculating factors of safety, the total stress acting on the rigging shall include forces produced by ships motion acting on the supported load, in addition to other stresses.

   b. Loose Cargo Gear. Loose cargo gear shall meet the ABS recommendations for cargo gear; see ABS Cargo Gear Certification. Loose cargo gear shall be factory pull tested to 200% of its WLL and be provided with test certification. Components for loose cargo gear shall meet the following:

      1) Metal structural parts (except booms, masts, pins and connections) shall have a factor of safety on the Minimum Ultimate Strength of not less than 5 if rated for 5 tons or less, and 4 if rated for more than 5 tons.

2) Pins and connections shall have a factor of safety on the Minimum Yield Point of not less than 3.00 if rated for 10 tons or less, prorated between 3.00 and 2.50 if rated between 10 and 13 tons, and 2.50 if rated for more than 13 tons.

3) Chains shall have a factor of safety of not less than 4.50 based on the Minimum Ultimate Strength.

c. Designed and Assembled Systems. Unless certified to ABS requirements, systems shall be designed per the following guidance:

1) Unless otherwise specified, the combined stresses in kingposts, structure, attachment points, and fittings shall not exceed 70 percent of the yield strength of the material used when subjected to the static test load.

2) When operating with rated load and subjected to the maximum ship motions resulting from Sea State 3, or the designated working sea state of the cutter or boat, the combined stress in any part of the equipment, machinery, and foundations shall not exceed 35 percent of the yield strength of the materials used. During maximum braking and overload conditions, the combined stress in any part of the equipment, machinery and foundations shall not exceed 70 percent of the yield strength of the materials used.

3) Installed weight handling equipment shall be capable of maintaining its static position while carrying its rated load when subjected to maximum ship motions during Sea State 8, or the designated heavy weather sea state of the cutter or boat. Under these conditions, structural and mechanical components of the equipment shall be designed so the maximum combined stresses in any part shall not exceed 70 percent of the yield strength of the material used.

4) In stress calculations, the following strength relationship shall be assumed to exist:

	Design Strength	Percent of Tensile Yield Strength
(i)	Direct shear	60
(ii)	Torsional Shear	65
(iii)	Compressive (bearing)	160

5. Wire Rope Systems. Sheaves shall be arranged to minimize reverse bends and other conditions in the system that will cause undue wear or a decrease in the wire rope service life. Sheaves shall be provided with anti-friction bearings with seals and pressure lubricated grease fittings, and a fully machined grease distribution groove. Shrouds shall be provided to prevent wire rope from becoming wedged between the sheave and its support structure. Single and multi-purchase blocks for wire rope shall be designed in accordance with American Bureau of Shipping (ABS) requirements for cargo gear. Unless otherwise specified, sheaves and drums shall be designed with

a minimum tread diameter of not less than 18 times the diameter of the wire rope used. Swivel fittings shall be equipped with a grease lubrication fitting. Except for bearing surfaces, metal surfaces of blocks shall be hot dip galvanized or inorganic zinc coated prior to the assembly of parts. Wire rope systems shall also meet the requirements of Chapter 613.

6. Interlocks and controls. Interlocks and controls essential for proper and safe operation of the equipment and the load shall be provided. Indicator lights shall be provided, where required, to indicate proper functioning of the equipment and to provide essential operating information to the operator. Controls shall provide means for smooth acceleration and deceleration of the load and handling system between travel limits. Limit switches and safety stops shall be installed at extreme positions of travel.

7. Control Stations. Control stations shall be located to permit operators to have clear visibility of the working area and to see as much of the handling operation and equipment as possible. Control stations shall be arranged to keep operator fatigue to a minimum. Controls that are sequentially related, which control a particular function, or which are operated together shall be grouped together with their associated displays. The arrangement of functionally similar or identical controls shall be consistent from control station to control station throughout the handling systems. Controls shall be designed and located to prevent accidental actuation.

8. Maintenance considerations. Systems shall be designed and arranged to facilitate all maintenance required. Ladders, rungs, walkways, service platforms, and safety rails with removable chains shall be provided where necessary to to permit safe and efficient servicing and rigging. Padeyes, lifting eyes, eyebolts, sheaves, blocks and other fittings required for maintenance and overhaul of system components shall be provided. Means shall be provided for lubrication of bearings and other working parts of equipment. Except for the need to remove a housing or similar cover for access, lubrication fittings shall be readily accessible,. A separate grease fitting shall be provided for each bearing and where necessary fittings shall be extended with tubing for accessibility.

9. Protective devices. Systems and equipment shall be designed to prevent personnel injury and damage to loads, equipment and the cutter under all operating conditions. Obstacles shall not project into the handling path. Guardrails shall be installed to preclude damage to installed equipment in operating areas for mobile handling equipment. Where guardrails do not provide adequate protection, protective guards shall be provided around deck and bulkhead mounted equipment in maneuvering areas of weight handling equipment.

10. Portable gear. Portable gear shall be constructed to facilitate installation and removal. Portable gear shall be clearly marked with permanently installed label plates that identify the gear and the intended use.

11. Stowage. Portable equipment, mobile handling equipment, tools and accessories shall be stowed in locations convenient for their use. Stowage arrangements shall be protected from the weather and prevent damage to the stowed items.

12. Coatings. Equipment coatings shall be in accordance with Coatings and Colors Manual, COMDTINST M10360.3 (series). Wear areas may be painted or coated with modified inorganic zinc primer only.

C. **CHARTS.** An instruction chart and a lubrication chart shall be provided for each installed equipment or system. Charts shall be mounted on the equipment, or in a convenient location visible from the equipment. For portable equipment, charts shall be posted immediately adjacent to where the equipment is stowed. Instruction charts shall indicate operating procedures, the functions of the equipment and safety precautions. Lubrication charts shall show the equipment diagrammatically and shall contain instructions for its care and lubrication, including designation of lubricants and frequency of lubrication.

D. **LABEL PLATES.** Label plates shall be installed on or near each installed system or component. The plates shall provide the system or component rating, static load test load, dynamic test load (as applicable) and the date of last tests. Each cutter and boat shall maintain a log of their pads and padeyes with a notation of the rating and last static test date.

E. **INSPECTION AND TESTING.**

1. Loose Cargo Gear.

   a. Initial. All loose cargo gear shall be proof load tested to 200% of the WLL of the component. As prescribed by Title 46 CFR and ABS Cargo Gear Certification requirements, certificates of proof load testing shall be provided with all new equipment.

   b. Annual Inspection. In addition to routine visual inspection before actual use, loose cargo gear shall be visually inspected for cracks, corrosion or evidence of stress at least once annually. The eye span of loose hooks shall be measured to verify that the hook has not been stretched.

   c. Biennial (2 year) Inspection. All loose cargo gear shall be pull tested to 200% of the WLL of the component.

   d. Documentation. Cutters, and boat maintenance activities, shall maintain a document file on loose cargo gear, including copies of proof load testing certificates.

2. Padeyes and Tie-downs.

a. Level 1 - Annual Inspection. For "frequently used padeyes", annually conduct visual inspection of all fittings and their foundations. For "in-frequently used padeyes", visual inspection shall be conducted immediately prior to use. Damaged equipment shall be repaired or replaced. Where inspection indicates possible fractures, excessive wear, deformation or corrosion, Level 2 inspection is required.

b. Level 2. For "frequently used padeyes", the fittings shall be inspected by non-destructive examination methods or shall be pull tested at least once every 4 years. For "in-frequently used padeyes", non-destructive examination or pull test immediately prior to each use. Also for "in-frequently used padeyes", Level 2 inspection and testing may be waived when an acceptable Level 2 test memo has been completed within the prior 12 months and the fitting passes Level 1 inspection. Frequency of testing shall be documented in Cutter Class Maintenance Plans and other documentation distributed by the MLCs. Pull tests shall be to 150% of rated load.

c. Documentation. The unit shall maintain a list, along with an associated drawing or diagram, clearly identifying the fittings on the cutter and their load ratings. Individual pull-test or non-destructive examination test tags shall be maintained for each padeye and tie-down.

d. Repaired Fittings. After weld repairs, affected padeyes and tie-downs shall be inspected by non-destructive examination methods and shall be pull tested to 200% of rated load prior to being returned to service.

3. Installation Testing of Installed Systems. Installation testing is applicable to newly installed systems, and to overhauled systems that have been structurally welded. Installation testing includes No-Load Tests, Static Load Tests, Dynamic Load Tests and Full Load Tests. A No-Load Test shall be conducted prior to the other tests.

   a. When a static load test is conducted on a piece of equipment or system in which wire rope is subjected to loading, the wire rope shall be reeved through all the fairleads and fittings normally used to ensure that all fairleads, fittings, winch drums and foundations are subjected to loading during the test. Where a group of four or more identical static components, such as padeyes or lifting eyes, are being installed at the same time in a like manner, a representative sampling of these components may be static load tested (in lieu of testing all components) at the discretion of the cognizant MLC as long as the strength welds of all components are validated by NDT methods. This exclusion applies to initial installations only, and may not be used where components are replaced.

   b. When conducting Dynamic Load Tests, relief valves and pressure regulators shall not be adjusted solely to conduct the test, and electrical system components shall not be in an overload condition. Some systems are structurally adequate, but hydraulically limited by the original design of the equipment and can not self-conduct the dynamic test at 125% of WLL. Lack of system documentation, for confirmation to meet the nominal 125% of WLL test value, shall NOT be cause for derating the system solely to allow the 125% of WLL to be met. Units should consult with the cognizant MLC for additional guidance.

c. US Navy testing procedures suggest at least 40 complete continuous equipment cycles are needed to validate Full Load Tests.

4. Periodic Testing of Installed Systems. Periodic testing is applicable to newly installed systems, and to overhauled systems that have been structurally welded. Periodic testing includes Static Load Tests, Modified Static Load Tests, Dynamic Load Tests and Full Load Tests.

   a. With the exception of Loose Cargo Gear, Static Load Testing and Modified Static Load Testing is not required periodically unless other conditions warrant. If structural changes have occurred, a Static Load Test shall be conducted.

   b. Dynamic Load Testing shall be accomplished at least once every 4 years. Requirements in paragraph E.3.b above also apply.

   c. Full Load Testing shall be accomplished at least once annually, and after overhauls or invasive maintenance.

5. Inspection of Installed Systems. Routine inspection of systems shall be conducted in accordance with the applicable technical publications and MPCs. In the absence of an applicable technical documentation, equipment shall be visually inspected at least once annually. Equipment and components shall be inspected for cracks, corrosion, evidence of stress, proper installation, bent or crimped fluid lines, frayed electric cables, misaligned linkages, wear and tear. Wire rope shall be inspected and lubricated; see Chapter 613. Hoses shall be inspected; see Chapter 505. Bolted connections shall be inspected for fastener torque, equipment alignment and proper mating of components. Blocks shall be inspected for cleanliness, binding, corrosion, damage, excessive wear, and proper lubrication. Hooks shall be inspected for damage, and the throat opening shall be measured to verify that it has not stretched. Any deformation is cause for replacement. Shafts, couplings and bearings shall be inspected for alignment, keys, binding, excessive wear, lubrication and distortion. Brakes shall be inspected for wear, alignment and smoothness of operation. Unless otherwise directed, enclosed brakes shall not be disassembled unless there is evidence of impending failure. Gear reducers shall be inspected for lubricant levels, leaks, and worn gears. Coatings shall be maintained in accordance with COMDTINST M10360.3B (series). Wire rope or hawser wear areas may be painted or coated with modified inorganic zinc primer only.

CHAPTER 571. REPLENISHMENT-AT-SEA (RAS) SYSTEMS

A. **TESTING AND INSPECTION OF REPLENISHMENT AT SEA (RAS) FITTINGS.** This chapter pertains to all padeyes, booms, rigging, kingposts, fittings, and sockets, either fixed or portable, for use in the RAS system.

B. **FREQUENCY**. Inspection and testing of the RAS system shall be undertaken under the following circumstances:

1. A proof test (to 200% of Working Load Limit) shall be performed at the completion of all totally new installations, structural modifications or repairs to ship's fittings. Ship's wire used in service shall not be used for this test.

2. A static load test (to 150% of Working Load Limit) shall be performed when wire or rigging components are replaced

3. The RAS system shall be visually inspected before each use, but not less than annually.

C. **METHOD OF INSPECTION.** As applicable, the visual inspection of a RAS system shall include:

1. The RAS system wire rope and fittings shall be inspected IAW Naval Ships Technical Manual (NSTM), Chapter 613.

2. All fittings shall be visually inspected for cracks. All fittings with evidence of corrosion shall be wire brushed and painted, or shall be replaced, as appropriate.

3. All booms and kingposts shall be inspected for deformation, such as dents, cracks, and bends.

4. All sheaves, swivels, blocks, block hangers, padeyes, connecting links, shackles, and associated pins should be visually inspected for corrosion, wear, deformation, surface cracks, or any other condition that may lead to failure.

5. The standing rigging shall be inspected for proper tension.

6. Guidance for such inspections is contained in NSTM, Chapter 571, and Replenishment-at-Sea, NWP-14,

7. When visual inspections reveal the need for further testing, the part of the RAS system in question shall be proof-tested in accordance with the individual ship's plan, NWP-14, and applicable preventive maintenance manuals. Units shall request additional guidance from their respective MLC.

D. **LOAD TEST RECORDS.** Test results shall be entered and maintained in the unit's Hull History (CMplus for those CMplus equipped units). Upon successful completion of load testing, an anodized-hydrated aluminum label plate, stating the test date, test facility, and the test load, shall be affixed to or immediately near tested equipment.

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CHAPTER 573. CARGO HANDLING SYSTEMS

A. BOOMS AND FRAMES.

1. General.

   a. Applicability.

      (1) Capacities and Limits. This section describes the full rated capacities and Working Load Limits of booms and frames on Coast Guard cutters and boats. It also defines the purpose and extent of tests, inspections and safety precautions for this equipment.

      (2) USCG References. All cutters and boats having booms shall comply with the requirements of this chapter, except as noted herein.

         (a) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 505 provides inspection and replacement requirements for hoses.

         (b) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 583 provides information concerning boat handling gear (including davits and cranes).

         (c) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 591 provides information for oceanographic research equipment.

         (d) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 613 provides information on wire rope maintenance.

         (e) USCG Drawing FL 1204-3, Welded Padeyes and Links, provides guidance on padeye ratings and testing.

      (3) U.S. NAVY References.

         (a) The following chapters of Naval Ships Technical Manuals (NSTM) may be used for guidance:

            (i) Chapters 571 - Underway Replenishment

            (ii) Chapter 572 - Shipboard Stores and Provisions Handling

            (iii)Chapter 573 - Booms

         (b) If a conflict exists between this document and referenced documents, this document shall take precedence.

b. Policy Changes.

(1) Cranes have been separated from booms. See Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 589 for Cranes.

(2) Many inspection, overhaul and test practices have been based on fixed time schedules that were driven by relatively frequent dry-dockings and have become dated. Many of these practices were written with the presumption of higher manning levels. It is recognized that frequent overhauls of certain components, particularly hydraulic systems, have led to increased damage to systems and increased maintenance costs. Changes to dry-docking schedules and general reductions in personnel levels have led to review of inspection and test practices.

(3) Individual policy changes will be documented to the fleet by the promulgation of Equipment Support Plan (ESP), Preventive Maintenance System (PMS), Class Maintenance Plan (CMP), documents to provide direction regarding specific equipment or cutter classes. If a conflict exists between directions, the order of precedence shall be ESP, PMS and then this chapter.

(4) Development of ESP documents will require a team approach to changes in inspection requirements, logistics support, and maintenance practices and testing requirements in order to reduce total support costs and improve operational reliability without degradation of safety. The team will include ELC, MLC and deck plate representation. ESP documents will be promulgated by ELC. In general, ESPs will increase Level 1 and Level 2 inspection requirements, decrease the frequency of Level 2 inspection and overhaul requirements, eliminate Level 3 inspections in favor of overhauls based on inspection recommendations, and increase the use of condition based maintenance. Reduction in testing frequency without thorough review and adjustment of inspection requirements may lead to a reduction in equipment safety and reliability.

c. Definitions.

(1) Booms and Frames: A structural member used for lifting, transferring or supporting heavy weights. The lower part of the boom or frame is supported by a bracket or step, which allows the boom or frame to pivot while transferring loads to structure. Rigging mounted on ships structure supports booms and frames.

(2) Working Load Limit (WLL): This is the maximum weight which can be handled by the equipment, with the maximum authorized number of parts in the main purchase, as listed in Table 573-2.

2. Boom and Frame Inspections. Unless more specific guidance is provided, inspections and overhauls shall be conducted using guidance contained herein.

a. Inspection Schedule. Inspection frequency shall be in accordance with Table 573-1, or as directed by the cognizant MLC. Where ESP or PMS documentation exists, it shall take precedence.

b. Level 1 Inspection and Test Requirements.

(1) General. The intent of this inspection is to ascertain the safety of the rigging and other critical equipment parts that could result in loss of life or equipment damage if failure occurs.

(a) In general, the inspection shall include all wire rope and fittings, block fittings, hooks, links, shackles and associated pins, swivels, boom and frame padeyes, hoist control linkages, and brake springs and linkages.

(b) Any visible permanent set of deformation, in the form of bent pins, elongated holes, bent or distorted staples and padeyes, are clear indications of overload or improper rigging. Their incidence should be reported, and the rig should not be used until the cause is found and corrected. Both the inspector and the operator should also be aware of recurring cracks in paint, particularly in areas of high stress corrosion. To inspect for surface cracks, paint shall be removed and surfaces wire brush cleaned.

(2) Inspection. The following requirements are generic in nature, and shall be included in inspections as applicable. Specific guidance in an ESP or PMS shall take precedence.

(a) Cradle the boom or frame and remove all wire rope. Inspect the wire rope in accordance with Chapter 613.

(b) Visually inspect all sheaves, swivels, blocks, block hangers, padeyes, connecting links, shackles, hooks, winches and associated pins for corrosion, wear, deformation, cracks and any other condition that may lead to failure. Inspection of sheaves shall include sheave gage wear measurement; see Chapter 613.

(c) Do not disassemble blocks, topping lift, vang swivels or equivalent devices unless there is reason to suspect damage, wear, corrosion or marginal condition when last overhauled. Inspect hoist and rotating gear brake springs and linkage, where appropriate. Carefully check brake springs for permanent set and compression, and replace if necessary. NOTE: Failure of brake springs in service can result in loss of control or release of load. Inspect hydraulic or pneumatic hoses for ballooning, cracking and corrosion. Inspect electrical wiring and connections for corrosion. Inspect brake solenoids and switches for corrosion and contact wear.

(d) Inspect and lubricate all moving parts and wire rope in accordance with PMS and Chapter 613 of this manual, as applicable.

(e) Self contained reservoir gearboxes with less than five gallons of lube oil shall have the gear lube replenished. If possible, drains will be opened and the boxes checked for condensation at the bottom of the tanks. Check any magnetic plugs, if equipped, for particles. Gearboxes with capacities in excess of five gallons shall have oil samples drawn for analysis in accordance with Chapter 262 of this manual.

(f) Visually inspect all deck and bulkhead padeyes, links, chocks, cleats, bits, and mounting bolts. Where inspection indicates possible fractures, deformation or corrosion, a more detailed inspection shall be conducted.

(g) Conduct dynamic load test

c. Level 2 Inspection and Overhauls.

(1) General. The intent is to accomplish the Level 1 inspection above, and concurrently disassembly, inspect and overhaul all major components whose performance or mechanical condition may have deteriorated. Disassembly shall also be carried out to inspect other components whose performance is not affected by normal wear but whose failure could result in damage, injury or loss of life. Examples of these are reduction gears, goosenecks, topping fittings, and sheave pins. Disassembly of such items need be carried out only to the extent required to conduct the inspection. For example, it is not necessary to totally disassemble a reduction gear equipped with inspection plates that permit measurement of backlash and observation of wear patterns. Outside appearance is not necessarily indicative of the mechanical condition of the equipment and, as such, disassembly for the purpose of recoating is prohibited.

(2) Inspection. The following requirements are generic in nature, and as shall be included in inspections as applicable. Specific guidance in an ESP or PMS shall take precedence.

(a) Unship the boom or frame, disassembling the connection, between the boom or frame and the vessel that allows slewing motion.

(b) Disassemble and inspect topping lifts, vangs, swivels, all blocks, hoist brakes, locking pawls, slewing gear, and pinion gear shafts and bearings. All pin, bearings, gears and sheaves shall be checked for compliance with dimensional tolerances shown on the original equipment drawings.

(c) Replace wire rope, as required. See NEM Chapter 613.

(d) Renew "O" rings and inspect brake linings and brake discs.

(e) Gear boxes that are equipped with inspection plates shall have backlash and gear pattern inspected in accordance with manufacturer's instruction manuals or NSTM Chapter 589.

(f) Perform a static test (150% of Working Load Limit) on all equipment or bulkhead mounted links and padeyes used in the boom and frame systems. See FL 1204-3 for information on generic welded padeyes. Following testing, perform non-destructive inspection using magnetic particle or dye penetrant tests prior to further usage.

(g) Cleats and bitts associated with boom and frame systems shall be visually inspected and non-destructively examined using magnetic particle, dye penetrant, eddy current or other method deemed suitable by the cognizant MLC.

(h) Conduct dynamic load test.

(1) Overhauls: Overhaul of components shall be based on equipment condition or evidence of problems.

d. <u>Level 3 Inspection and Overhaul</u>.

(1) <u>Policy Change</u>.

(a) This level of inspection and testing may be waived, on a case by case basis, by the cognizant MLC, provided that the conditions of the systems are evaluated by diagnostic means.

(b) The development of Equipment Support Plans will typically eliminate this inspection and testing in favor of increased maintenance, increased inspections, condition based maintenance, and overhauls based on inspection recommendations.

(2) <u>General</u>. This level is to accomplish the requirements of the Level 1 inspection and Level 2 inspection and overhaul, plus the requirements listed herein.

(3) <u>Inspection</u>. In addition to Level 1 inspection, and Level 2 inspection and testing, inspect and overhaul the following items, as applicable, based on condition.

(a) Disassemble and overhaul all pneumatic components.

(b) Disassemble and overhaul all hydraulic components to include pumps, motors, control valves, accumulators, rams, etc.

3. <u>Boom and Frame Tests</u>.

a. Dynamic Load Tests shall be conducted at the pier with a test load equivalent to 125% of the Working Load Limit of the boom or frame. The test shall include rotation of the test load through a range of motion that the equipment is required to perform in service. The weight handling system must be able to stop, start and hold the test load at any position within the service area.

b. Rated Load Tests (100% of Working Load Limit) shall be conducted while underway to prove the installation of a wire rope fitting or other repair conducted underway. Upon return to dockside, the Dynamic Load Test shall be completed as above.

c. Dynamic test load requirements may be reduced by the ELC or cognizant MLC to address equipment design constraints or limitations. Detailed guidance should be promulgated in an ESP, CMP.

4. Safety.

a. Stability Documentation.

(1) All cutters and boats with booms or frames shall have vessel stability documentation (Stability and Loading Data Booklet or equivalent), which addresses the stability of the vessel with the weight handling equipment in use. See NEM Chapter 079.

(2) Where the stability of the vessel limits the operational capability of the weight handling equipment, a graphic safety placard shall be prominently displayed at the equipment operator's station to describe the limitation, and graphically show the safe working zone and safe working load while operating at sea.

(3) When considering a unit's stability characteristics during testing procedures, specified test loads shall be maintained within limits that can be handled safely. If any of the test loads result in an excessive list (generally 15 degrees) or the immersion of the deck edge, the load shall be reduced accordingly to stay within those limits. In such cases, ELC (02) shall be advised by letter or message of the load actually handled and the loading condition of the unit at the time of the test.

b. Label Plates. Engraved label plates shall be installed on cutter and boat booms and frames to document the Working Load Limit , test weights, and date of certification of the load and corresponding parts of the purchase. The information shall be engraved in such a manner as to prevent eradication when the boom or frame is painted.

c. Safety Precautions. The following safety precautions must be observed when conducting weight handling equipment tests.

(1) Specified Dynamic Load Tests are designed to account for dynamic service conditions. Therefore, conditions that would cause sudden application of test loads should be avoided.

(2) To prevent excessive damage in the event of equipment failure during tests, dunnage shall be placed under test loads and each load shall be kept as close to the deck as possible.

(3) To prevent loads from moving off center in the event of a casualty, preventer lines or cables shall be rigged athwartships from the test load. At minimum, the breaking strength of the preventers must be greater than or equal to the test load.

d. Documentation of Test Results.

(1) The results of the inspections and tests prescribed shall be entered in the cutter or boat's Hull History record (CMplus if equipped with CMplus). The maximum list of the cutter observed during the testing shall also be recorded and posted in the pilothouse for a ready reference to indicate the approximate loading on the boom, crane or frame during unusual operating conditions such as removing mudded-in sinkers, pilings, sunken buoys, etc.

(2) The date and level of the most recent Level 1 and Level 2 tests conducted in accordance with this chapter shall be stenciled on the boom or frame in the vicinity of the Label Plate, in a position clearly legible from the buoy deck.

B. CHAIN STOPPERS

1. Mechanical Type Buoy Chain Stoppers.

a. Applicability. The following tests are applicable to dumping type, mechanical chain stoppers.

b. NDT Testing. NDT testing shall be conducted as part of Level 2 inspections. May be performed as part of Level 1 inspections, based on results of visual inspection. The structure of the stopper and attachment to the vessel shall be tested by non-destructive (NDT) means in conjunction with the following tests.

c. Operational Test. Units shall conduct an annual operational test to ensure proper operation of the stopper. The test load shall be externally applied (by crane) to the chain stopper using chain. The test weight shall be suspended and held for several minutes, and the test load shall be released using the normal release mechanism.

1. Units with a nominal 1-1/2 inch or larger mechanical chain stopper shall utilize a test weight of approximately 25,000 lbs.
2. Units with a nominal 1-1/4 inch or 1-1/8 inch mechanical chain stopper shall utilize a test weight of approximately 15,000 lbs.
3. Units with smaller chain stoppers shall utilize a test weight equivalent to approximately 125 percent of the sum of the maximum sinker and chain that would be suspended from the stopper. Due to the potential for operational area changes, this weight should not be limited by the maximum chain or

weight that an individual cutter normally handles. The cognizant MLC will provide additional guidance, as necessary.

d. Static Test. Static testing of the chain stopper is required only on initial installation or after structural modifications to the chain stopper or changes to its supporting structure.

2. Power Assisted Chain Stoppers.

a. Applicability. The following tests are applicable to the hydraulic power assisted chain stoppers installed on 225 ft WLB and 175 ft WLM class cutters.

b. NDT Testing. NDT testing shall be conducted as part of Level 2 inspections. They may be performed as part of Level 1 inspections, based on results of visual inspection. The structure of the stopper and attachment to the vessel shall be tested by non-destructive (NDT) means in conjunction with the following tests.

c. Operational Test. The hydraulic power assisted chain stoppers shall be tested annually, and after major maintenance to or replacement of load bearing parts. The chain stoppers shall be tested in conjunction with tests on the buoy chain winch (at the rated winch load of 16,500 lbs), and shall demonstrate normal operational use of the stopper. The test load shall be applied by picking up the test weight with the chain winch, setting the chain stopper, lowering the load against the stopper, slacking the chain between the winch and stopper, and then retrieving the test load with the chain winch in the normal manner. This test demonstrates normal operational use of the stopper.

d. Static Test. Static testing of the chain stopper is required only on initial installation or after structural modifications to the chain stopper or changes to its supporting structure. A test weight of 25,000 LB shall be lifted by crane and suspended on chain in the stopper; the chain winch shall not hold the chain. After holding for 10 minutes, remove the test weight with the crane.

3. BUSL Chain Stoppers.

a. Applicability. The following generic tests are applicable to the chain stoppers installed on stern loading utility boats (BUSL). More specific guidance may be promulgated in applicable CMPs or ESPs.

b. NDT Testing. NDT testing shall be conducted as part of Level 2 inspections. May be performed as part of Level 1 inspections, based on results of visual inspection. The structure of the stopper and attachment to the vessel shall be tested by non-destructive (NDT) means in conjunction with the following tests.

c. Operational Test. Units shall conduct an Operational Test at 110% of Rated Load to ensure proper operation of the stopper. This test shall be conducted annually, or after any maintenance or replacement of load bearing components. A test load of 5000 lbs. shall be suspended from the stopper for 10 minutes, and then the stopper released using the normal release mechanism.

d. Static Load Test. Units shall conduct a Static Load test using a test load equivalent to 125% of Rated Load at least once every four years, or after overhaul of the stopper, whichever comes first. The test load shall be externally applied, held for 10 minutes, and then removed by crane.

C. ATON WEIGHT HANDLING FITTINGS.

1. General. This section describes the maintenance, repair, inspection and testing requirements for chocks, cleats, staples, bitts, blocks, padeyes, tie-downs, and similar ATON weight handling fittings installed on an ATON cutter buoy deck or on the barge deck of a construction tender. For definitions as well as requirements for other similar weight handling fittings, see Chapter 570.

2. References. Individual Cutter Class structural drawings, Individual Cutter Class PMS and USCG Drawing FL-1204-3, Welded Padeyes and Links, provide guidance on these fittings.

3. Maintenance and Repair.

   a. The working surfaces of bitts, chocks, cleats, staples, flag blocks, padeyes and tie-downs shall be maintained to surface smoothness levels appropriate for the wire rope, synthetic line or chain utilized.

   b. Coatings shall be in accordance with Coatings And Color Manual, COMDTINST M10360.3 (series). Wear areas may be painted or be coated with modified inorganic zinc primer only.

   c. Weld repairs shall be inspected by non-destructive examination methods. These methods include the use of magnetic particle, ultrasonic, dye penetrant, eddy current or other methods deemed suitable by the cognizant MLC.

   d. Repair and test actions shall be recorded in the cutter's Machinery History.

4. Inspection and Testing.

   a. Level 1 - Annual Inspection. Conduct visual inspection of all fittings, their mounting bolts and their foundations. Conduct manual inspection of fittings having moving parts, such as rolling chock and flag block units, to ensure proper rotation and movements. Damaged equipment shall be repaired or replaced. For padeyes and tie-downs, where inspection indicates possible fractures, excessive wear, deformation or corrosion, Level 2 inspection is required.

   b. Weight Testing.

      1) Routine weight or load testing is not required for bitts, chocks, cleats, staples and rolling chocks.

2) When repaired or overhauled, flagging blocks shall be tested as prescribed in Chapter 570 for Modified Static Load Test and be subjected to a routine in-place load testing of the rigging.

3) Static Load Testing to 200% of rated load is required for repaired fittings and when a fitting is replaced. Test loads shall be applied in the direction of the working load except for padeyes and tie-downs the test load shall be applied in a direction perpendicular to the structure on which installed.

c. Level 2 - General. Padeyes and tie-downs shall be inspected by non-destructive examination methods or shall be pull tested at least once every 4 years. The actual frequency of testing shall be documented in Cutter Class Maintenance Plans and other documentation distributed by the MLCs. Routine pull-tests shall be to 150% of rated load. D-ring type padeyes installed on the buoy decks of 175 ft WLM, 225 ft WLB and 240 ft WLBB cutters cannot be completely inspected by non-destructive examination methods, and shall be pull tested.

d. Level 2 - Critical or Highly Loaded Padeyes and Tie-downs. The cognizant MLCs may identify certain critical or highly loaded padeyes and tie-downs on specific cutter classes that require special attention and Level 2 testing on a more frequent basis. Frequency of testing shall be documented in Cutter Class Maintenance Plans and other documentation distributed by the MLCs. Such critical padeyes or tie-downs should generally not exceed 10 percent of the total number of padeyes or tie-downs.

e. Padeye and Tie-down Documentation. The unit shall maintain a list, along with an associated drawing or diagram, clearly identifying the padeyes and tie-downs on the buoy deck or barge deck and their load ratings. Unless otherwise directed by Cutter Class Maintenance documentation or the cognizant MLC, these fittings shall be assumed to be "frequently used" for testing purposes. Individual pull-test tags, per Chapter 570, are not required for each padeye and tie-down, provided:

1) A master pull-test tag is maintained on buoy deck ship structure, such as a bulwark or crane foundation, identifying when the fittings (as a whole) were tested; and

2) The padeye list, along with the associated drawing or diagram, are maintained to capture the pull-test dates and loads.

TABLE 573-1, INSPECTION AND OVERHAUL FREQUENCY FOR BOOMS AND FRAMES

VESSEL TYPE	LVL 1	LVL 2	LVL 3	NOTES
WAGB (All)	B	Q	CBM	
180 FT WLB	A	Q	CBM	SEE ESP
133 FT WLM	A	Q	CBM	
WLI	A	Q	CBM	
BUSL	A	Q	CBM	

Level 2 inspections may be accelerated by the MLC based on condition based maintenance.

TABLE 573-2. WORKING LOAD LIMITS AND DYNAMIC TEST WEIGHT CHART FOR BOOMS AND FRAMES

	5-PART		3-PART		SINGLE PART			
VESSEL TYPE	WWL	TEST	WWL	TEST	WWL	TEST	REMARK	WIRE ROPE
180’ WLB	40,000	50,000	30,000	37,500	10,000	12,500	SEE NOTE 3	7/8” 6X37 RRL EIP IWRC
133’ WLM			20,000	25,000	8,000	10,000		3/4” 6X37 RRL EIP IWRC
100’ WLI	10,000	12,500	6,000	7,500	2,000	2,500		7/16” 6X37 RRL EIP IWRC
65’ WLI			4,000	5,000	1,400	1,750	BAYBERRY	3/8” 6X37 RRL EIP IWRC
BUOY BOATS								
49’ BUSL (SERIES)					4,500	5,000	BOTH WHIPS, NOTE 4	3/8” 6X37 RRL/LRL EIP, IWRC
(cont.)					2,250	2,500	EACH WHIP, NOTE 4	
BUSL 46301-46315					4,000	5,000	BOTH WHIPS	3/8” 6X37 RRL EIP, IWRC
(cont.)					2,000	2,500	EACH WHIP	

NOTE 1: Wire rope grade shall not be upgraded without ELC (01) authorization. For wire rope discrepancies between original drawings and this table, this table shall be used. Wire rope procurement reference is API SPEC 9A.

NOTE 2: USCG marine boom and frame ratings are at a maximum (or identified) working radius for that installation. The ratings take into account the effect of ships motions; see applicable technical publication or arrangement drawing. Typical OEM commercial ratings are dependent on boom and frame angle, outreach, boom or frame extension and wire strength; maximum SWL is typically at minimum working radius and/or minimum boom and frame extension, unless the arrangement is limited by wire rope strength. Commercial ratings shall not be used unless directed by ELC (01).

NOTE 3: Annual weight tests of the 5-Part Rig no longer required unless specific cutter is required to rig the 5-Part to fulfill operational commitments. See 180’ WLB Equipment Support Plan.

NOTE 4: Dynamic Load Testing is at 110% of Working Load Limit. Static load testing at 125% of RL is required at 4-year intervals.

EIP = Extra improved plow steel, RRL = Right Regular Lay, LRL = Left Regular Lay

IWRC = Independent Wire Rope Core, SC = Solid Core, FC = Fiber Core

Table 573-3 SCIENCE FRAME RATINGS AND TEST REQUIREMENTS

VESSEL TYPE	FRAME LOCATION	TEST REQUIREMENT
420 FT WAGB	STBD A FRAME	(TBD)
	AFT A FRAME	(TBD)
400 FT WAGB	PORT J FRAME	(TBD)
	AFT J FRAME	(TBD)

NOTE: Frames are used to deploy science packages using various oceanographic research winch wires from independent science research winches. Frames are rated for structural capability to resist vertical overloads, and to resist towing loads when in the fully deployed position. Frames also have the capability to rotate lighter loads between inboard assembly and outboard working positions. Testing of science wires and sheaves attached to the frames are independent of the frame testing.

CHAPTER 581. ANCHOR (S) AND ANCHOR CHAIN MAINTENANCE

A. **GENERAL.** Each MLC shall develop and promulgate detailed guidance on the inspection, overhaul, replacement, and preservation of anchor(s) and anchor chain. Procedures outlined in NSTM, Chapter 581, and the Coatings and Color Manual, COMDTINST M10360.3 (series), may be used for guidance.

B. **PERIODICITY.**

1. Inspection. To ensure that anchor chain is free for running, all anchors shall be lowered (semiannually) until two shots remain on board. This shall be done in anchorage-depth water, with the chain payed out to prevent fouling. While anchor chain is being hoisted aboard, it shall be hosed off and visually inspected.

2. Maintenance. Major maintenance of anchor(s) and anchor chain as indicated by CCMP shall be accomplished during the cutter's scheduled drydock.

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CHAPTER 583. LIFE RAFTS, LIFE FLOATS, AND BOAT HOISTING EQUIPMENT

A. **INFLATABLE LIFE RAFTS AND LIFE FLOATS.** Procurement, inspection, testing, and maintenance of life rafts, hydrostatic release devices and life floats shall be in accordance with the Coast Guard Rescue and Survival Systems Manual, COMDTINST M10470.10 (series). Annual life raft inspections shall be recorded on the Cutter Engineering Report (CG-4874) or Boat Inspection Report (CG-3022). Requests for removal, installation or alteration to individual life rafts or containers shall be submitted to ELC (01) in the Engineering Change format outlined in Chapter 041.

1. Hydrostatic Releases On Cutter Life Rafts. Hydrostatic releases are depth (pressure) actuated devices that are factory set to activate at a predetermined depth. National Stock devices are set to activate at 10-40 feet of water, where as commercial devices are set to activate at 5-15 feet. Coast Guard cutters below 180 feet are required to carry actuating devices set for 5-15 feet, and shall procure their devices from the commercial vendors listed in Equipment Lists, COMDTINST M16714.3 (series). Cutters 180 feet and greater may procure hydrostatic release devices from either the National Stock System or from commercial sources listed in Equipment List, COMDTINST M16714.3 (series).

2. Installation Of Hydrostatic Release Devices. A hydrostatic release device shall be installed in such a manner that it can be manually activated in a time of emergency. In order to ensure life raft separation at the proper depth, the hydrostatic release must be preloaded. Illustrations of proper tensioning requirements are outlined in Navigation and Vessel Inspection Circular (NVIC) 4-86.

3. Life Raft Gripes. Authorized life raft gripes shall be of a plastic covered corrosion resistant steel (CRES) cable or a nylon-covered stainless steel strap, installed in accordance with CG Drawing FL-8201-86.

B. **TESTS AND INSPECTION OF BOAT HOISTING EQUIPMENT.** Structural weaknesses of hoisting fittings and associated equipment may be revealed by periodic test loading and inspection. In general, tests will be conducted with boats that are normally hoisted. These boats include shipboard boats and boats attached to shore facilities that are usually suspended by hoisting fittings or slings. The tests are intended to establish the adequacy of the boat structure, davits, boat crane, rigging, slings, attachments, and hoisting equipment.

1. Frequency of Testing and Inspection of Shore Facilities' Boat Hoisting Equipment.

   a. In accordance with the Civil Engineering Manual, COMDTINST 11000.11 (series), boat hoisting equipment maintained by shore facilities shall be load tested once every two years, and prior to use after any alteration or repair to the equipment which affects the ability of the equipment to lift.

b. The following list gives weights of boats that are occasionally hoisted for repairs. Trans-shipment hoist tests are not required for these boats. The weight listed is that of the boat with outfit, fuel and water.

Boat Type	**Full Load Displacement (lbs)**
30' Surf Rescue Boat	11,500
41' Utility Boat	30,000
44' Motor Lifeboat	39,500
45' Buoy Boat	47,800
46' Buoy Boat Stern Loading	43,800
47' Motor Lifeboat	40,000
49' Buoy Boat Stern Loading	87,000
52' Motor Lifeboat	70,000
55' Aids to Navigation Boat	78,400

2. Frequency of Testing and Inspection of Shipboard Boat Hoisting Equipment.

a. Load tests shall be conducted annually, or after any modifications of hoisting fittings, slings, cranes, booms, or davits and falls that form a part of the boat handling gear. Tests may also be conducted at any other time considered advisable by Commanding Officer/Officer-in-Charge (CO/OIC). A label plate stating the date tested, test facility, and the test load shall be provided for the boat hoisting assembly upon successful completion of load testing.

b. Frequently used boat davits and boat cranes shall be scheduled for disassembly, inspection, and overhaul in accordance with MLC Class Maintenance Plans (CMPs).

c. Units that have PMS procedures for the testing and inspecting of boat davits or cranes shall follow the interval and procedure specified in the PMS. Otherwise, manufacturer recommended procedures shall be followed.

d. Boat hoisting equipment shall be visually inspected prior to each use.

3. Inspection and Load Test Procedures.

a. Inspection. Each MLC shall develop and promulgate detailed guidance on the disassembly, inspection and repair of motor surf boat davits and single point davits.

(1) Wire rope falls and wire rope slings shall be thoroughly inspected annually. The falls cable shall be completely removed from the davit or crane assembly for inspection. Visually inspect the entire rope length for worn or abraded wires, broken wires, corroded wires, nicks, cuts, distortion, crushing, heat damage, fraying, bird caging and kinks. **NOTE:** Any one of the above conditions warrants rope replacement.

(2) Units with PMS procedures for wire rope inspection and lubrication shall follow the interval and procedure specified. Other units shall use Chapter 613, of this manual, as a guide for wire rope inspection and lubrication.

b. Load Test Procedures. In order to minimize strain on the boat, the test load shall be applied to the boat one-half forward and one-half aft (as near to the hoisting fittings as possible). The test load is, in general, equal to 150 percent of the normal hoisting load. TABLE 583-1 provides weight criteria for testing davits and boat lifting gear of frequently hoisted Coast Guard boats. The boat, with test load, shall be lifted by its normal hoisting equipment and suspended for at least 10 minutes (just clear of the water) to minimize damage in the event of failure.

4. Rigid Inflatable Boat (RIB) Lifting Slings and Lifting Points. Upon receipt and prior to use, units shall review the certification and test examination documentation to ensure that both lifting sling and lifting points (transom mounted, deck mounted) have been examined, proof load tested, and determined fit for service life at the safe working load stated. Manufacturer Safe Working Loads shall not be exceeded during operations.

a. Visual Inspection. The lifting sling and lifting points shall be visually inspected prior to each use for excessive wear, corrosion, surface cracks, and loose deck mounts. Worn lifting slings shall be replaced by manufacturer or manufacturer recommended lifting slings for the respective RIB.

b. Subsequent Proof Load Tests. Subsequent proof load tests shall be conducted whenever the lifting points sustain damage and are repaired, or whenever additional lifting points, modifications to lifting points, or changes to their supporting structures have been completed. Manufacturer recommended procedures and test weights shall be used for proof testing.

5. Responsibility for Tests. The tests, inspections, and maintenance of weight handling equipment are the responsibility of the CO/OIC.

6. Records. A record of the tests and inspections shall be entered in the Inspection Team Comments section of the Boat Inspection Report (CG-3022) for each inspection period. This record shall show the date of the test and inspection, the weights added to the boat, and the total hoisted weight. Comments should be made on any component involved in hoisting that appeared stressed or in need of repair or replacement, and any improper functioning of equipment. Units maintaining a Hull History shall record the test on the boat's history card. (Cmplus for those cutters equipped with Cmplus.)

7. Safety Precautions. The following safety precautions shall be observed during testing:

a. Avoid dynamic loading during the test.

b. Keep the boat low to reduce damage if the boat drops.

c. Do not test-hoist the boat with personnel aboard.

d. Do not exceed the specified test weights.

e. When hoisting with a sling, use adequate sling length or suitable spreaders to avoid placing excessive stress on the hull.

TABLE 583-1 WEIGHTS FOR TESTING DAVITS AND BOAT LIFTING GEAR

LENGTH	TYPE	Weight with Outfit, Fuel and Water	Normal Crew During Hoisting	Normal Hoisting Weight	Weight for Weight Test	Weight to Add to Boat for Weight Test
15'9"	Cutter Boat Small (CB-S)	900	0	900	1350	450[1]
18'6"	Cutter Boat Medium (CB-M)	1395	1	1575	2362	967[1]
24'	Cutter Boat Large (CB-L)	3960	3	4500	6750	2790[1]
19'	6M AVON (RIB)	2300	2	2700	4050	N/A[2]
21'	6.4M AVON SEARIDER/ ZODIAC HURRICANE (RIB)	4100	2	4500	7500	N/A[3]
21'	TANB	3700	-	3700[4]	5550	1850
25'8"	MK-V Motor Surfboat	5000[5]	8	7000	10500	5500
25'8"	Motor Cargo Boat	6050[5]	3	6600[6]	9900	3850

SEE NOTES NEXT PAGE

TABLE 583-1 NOTES

NOTE 1: The Cutter Boats are the new standard Rigid Inflatable Boats. The length and weight data provided represent the maximum allowances for that Cutter Boat class. The allowable weights are 10% less than the davit capacities to accommodate future weight growth. In no case should the hoisting weight exceed the safe working load of the davit. The actual numbers of the Cutter Boat may be less. Hoisting Test weights should be calculated based on the weight of the specific boat provided. For example: A CB-L weighing 4,000 lbs with fuel and outfit has a hoisting weight with 3 crew of 4,540 lbs, a test weight of 6,810 lbs, therefore it requires 2,810 lbs added for the test.

NOTE 2: In accordance with PMS, when conducting the Load Test, the RIB is to be cradled and replaced by 4050 pounds of weights.

NOTE 3: In accordance with USCG TP 2753A, when conducting the Load Test, the RIB is to be cradled and replaced by 7500 pounds of weights.

NOTE 4: Weight does not include cargo or crew.

NOTE 5: No more than two weeks prior to weight testing the davits, units should determine the actual weight of their MCBs/MSBs to determine loading capacities for actual boat lifting operations and testing.

NOTE 6: Weight does not include 2000 pound cargo.

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CHAPTER 588. HELICOPTER HANDLING

A. HELICOPTER DECK TIE-DOWN FITTING TESTING.

1. Certified Pull Test. Helicopter deck tie-down fittings (Cloverleaf-type, Bar-type) shall be load tested and meet the certification requirements of Air Capable Ship Aviation Facility Bulletin No. 1 (series). Future revisions to the Bulletin No. 1 (series) shall be reviewed by ELC (02) to verify compliance with changes in load testing requirements that would affect tie-down system design strengths on Coast Guard cutters.

   NOTE: Tie-down channels on the 400 FT WAGB shall be load tested per the requirements of USCG drawing 400-WAGB-8301-7.

2. Certified Pull Test Records. Pull test records shall be maintained as part of a unit's Hull History. (CMplus for those cutters equipped with CMplus.) The certified pull test record shall be made available to the helicopter deck certification team at their request. The test record shall contain the following information:

   a. Date, name, and location of testing facility

   b. Test procedure

   c. Equipment used

   d. Load to which each tie-down fitting was tested

   e. Time period the load was held on each fitting

   f. Date of the last certification of the load-measuring device

3. Additional Pull Testing Requirements. If there are cracks present or if the fitting is distorted such that structural integrity is suspect then a certified pull test should be performed in accordance cutter PMS.

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CHAPTER 589. CRANES

A GENERAL.

1. Applicability.

   a. This section describes the full rated capacities and Working Load Limits (WLL) of power driven cranes on Coast Guard cutters, boats and barges. It also defines the purpose and extent of tests, inspections and safety precautions for this equipment.

   b. USCG references for all cutters, boats and barges having cranes shall comply with the requirements of this chapter, except as noted herein.

      (1) Maintenance and Logistics Commands (MLC) are authorized to provide instructions for miscellaneous barge cranes not listed.

      (2) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 505 provides inspection and replacement requirements for hoses.

      (3) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 583 provides information concerning boat handling gear (including davits and cranes).

      (4) Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 613 provides information on wire rope maintenance.

   c. U.S. NAVY References.

      (1) The following chapters of Naval Ships Technical Manuals (NSTM) may be used for guidance: Chapter 589 - Cranes

      (2) If a conflict exists between this document and referenced documents, this document shall take precedence.

2. Policy Changes.

   a. Cranes have been separated from booms and frames. See Naval Engineering Manual, COMDTINST M9000.6 (series) Chapter 573 for booms and frames.

   b. Many inspection, overhaul and test practices have been based on fixed time schedules that were driven by relatively frequent dry-dockings and have become dated. Many of these practices were written with the presumption of higher manning levels. It is recognized that frequent overhauls of certain components, particularly hydraulic systems, have led to increased damage to systems and increased maintenance costs. Changes to dry-docking schedules and general reductions in personnel levels have led to review of inspection and test practices.

c. Individual policy changes will be documented to the fleet by the promulgation of Equipment Support Plan (ESP), Preventive Maintenance System (PMS), or Class Maintenance Plan (CMP) documents to provide direction regarding specific equipment or cutter classes. If a conflict exists between directions, the order of precedence shall be ESP, PMS then this chapter.

d. Development of ESP documents will require a team approach to changes in inspection requirements, logistics support, and maintenance practices and testing requirements in order to reduce total support costs and improve operational reliability without degradation of safety. The team will include ELC, MLC and deck plate representation. ESP documents will be promulgated by ELC. In general, ESPs will increase Level 1 and Level 2 inspection requirements, decrease the frequency of Level 2 inspection and overhaul requirements, eliminate Level 3 inspections in favor of overhauls based on inspection recommendations, and increase the use of condition based maintenance. Reduction in testing frequency without thorough review and adjustment of inspection requirements may lead to a reduction in equipment safety and reliability.

3. Definitions.

a. Crane: A machinery arrangement or self-contained structure, with associated reeving suitable for lifting loads through several dimensions of motion.

b. Working Load Limit (WLL): This is the maximum weight to be handled by the purchases with the authorized number of parts as listed in Table 589-2.

B CRANE INSPECTIONS. Unless more specific guidance is provided, inspections and overhauls shall be conducted using guidance contained herein.

1. Inspection Schedule. Inspection frequency shall be in accordance with Table 589-1, or as directed by the cognizant MLC. Where ESP or PMS documentation exists, it shall take precedence.

2. Level 1 Inspection and Test Requirements.

a. General. The intent of this inspection is to ascertain the safety of the rigging and other critical equipment parts that could result in loss of life or equipment damage if failure occurs.

(1) In general, the inspection shall include all wire rope and fittings, block fittings, hooks, links, shackles and associated pins, swivels, boom padeyes, hydraulic controls and fittings, hydraulic hoses, hydraulic rams, wear pucks, bearings, motors, and brake springs and linkages.

(2) Any visible permanent set of deformation, in the form of bent pins, elongated holes, bent or distorted staples and padeyes, are clear indications of overload or improper rigging. Their incidence should be reported, and the rig should not be bused until the cause is found and corrected. Both the inspector and the operator should also be aware of recurring cracks in paint, particularly in areas of high stress corrosion. To inspect for surface cracks, paint shall be removed and surfaces wire brush cleaned.

(3) Visually inspect all foundation welds, gears and bolts for cracks, tightness, wear, deformation and corrosion.

b. Inspection. The following requirements are generic in nature, and shall be included inspections as applicable. Specific guidance in an ESP or PMS shall take precedence.

(1) Inspect the wire rope and fitting in accordance with Chapter 613.

(2) Visually inspect all sheaves, swivels, blocks, block hangers, padeyes, connecting links, shackles, hooks, winches and associated pins for corrosion, wear, deformation, cracks and any other condition that may lead to failure. Inspection of sheaves shall include sheave gauge wear measurement.

(3) Do not disassemble blocks, topping lift, hydraulic cylinders or equivalent devices unless there is reason to suspect damage, wear, corrosion or marginal condition when last overhauled.

(4) Inspect winch and rotating gear brake springs and linkage, where appropriate. Carefully check brake springs for permanent set and compression, and replace if necessary.
NOTE: Failure of brake springs in service can result in loss of control or release of load.

(5) Inspect hydraulic or pneumatic hoses for ballooning, cracking and corrosion. Inspect electrical wiring and connections for corrosion. Inspect brake solenoids and switches for corrosion and contact wear.

(6) Lubricate all moving parts and wire rope in accordance with PMS and Chapter 613 of this manual, as applicable.

(7) Self contained reservoir gearboxes with less than five gallons of lube oil shall have the gear lube replenished. If possible, drains will be opened and the boxes checked for condensation at the bottom of the tanks. Check any magnetic plugs, if equipped, for particles. Gearboxes with capacities in excess of five gallons shall have oil samples drawn for analysis in accordance with Chapter 262 of this manual.

3. Level 2 Inspection and Overhauls.

   a. General. The intent is to accomplish the Level 1 inspection above, and concurrently disassemble, inspect and overhaul all major components whose performance or mechanical condition may have deteriorated. Disassembly shall also be carried out to inspect other components whose performance is not affected by normal wear but whose failure could result in damage, injury or loss of life. Examples of these are boom, winch, luffing cylinder, topping fittings, and sheave pins. Disassembly of such items need be carried out only to the extent required to conduct the inspection. Outside appearance is not necessarily indicative of the mechanical condition of the equipment and, as such, disassembly for the purpose of recoating is prohibited.

   b. Inspection. The following requirements are generic in nature, and as such shall be included in inspections as applicable. Specific guidance in an ESP or PMS shall take precedence.

      (1) Unship the boom to inspect wear pucks, hydraulics, pins and other wear components. Overhaul luffing cylinders.

      (2) Remove winches for inspection of brakes, drum, gears and couplings. Overhaul of hydraulic motors should be condition based.

      (3) Disassemble and inspect topping lifts, swivels, and all blocks. Inspect slewing gear, and bearings. All pin, bearings, gears and sheaves shall be checked for compliance with dimensional tolerances shown on the original equipment drawings.

      (4) Renew "O" rings. Renew hoses as required.

      (5) Replace wire rope, as required. See Chapter 613.

   c. Overhauls: Components shall be overhauled based on equipment condition or evidence of problems.

   d. Tests. Conduct weight tests

4. Level 3 Inspection and Overhaul.

   a. Policy Change.

      (1) This level of inspection and testing may be waived, on a case by case basis, by the cognizant MLC, provided that the conditions of the systems are evaluated by diagnostic means.

      (2) The development of Equipment Support Plans will typically eliminate this inspection and testing in favor of increased maintenance, increased

inspections, condition based maintenance, and overhauls based on inspection recommendations.

b. General. This level is to accomplish the requirements of the Level 1 inspection and Level 2 inspection and overhaul, plus the requirements listed herein.

c. Inspection. In addition to Level 1 inspection, and Level 2 inspection and testing, inspect and overhaul the following items, as applicable based on condition. Disassemble and overhaul all hydraulic components to include pumps, motors, control valves, accumulators, rams, etc.

d. Tests: Conduct weight tests

C. CRANE TESTS.

1. General.

a. Historically, Coast Guard weight testing requirements for cranes have been developed based on an extension of boom technology and requirements. Typical weight tests have been a dynamic demonstration of the equipment at 125% of Working Load Limit to verify the safety of the equipment and its ability to handle working loads safely by proving the strength of the structure, rigging and mechanical equipment. Examples of the Dynamic Load Test loads are shown in Table 589-2. These test weights remain valid for cutters and barges identified in Table 589-1.

(1) Dynamic Load Tests conducted at the pier will typically utilize a test load equivalent to 125% of the Working Load Limit of the crane, or as shown on Table 589-2. The test shall include rotation of the test load through a range that the equipment is required to perform in service. The weight handling system must be able to stop, start and hold the test load at any position within the service area. The Dynamic test load may be reduced by the ELC or cognizant MLC to address equipment design constraints or limitations. Detailed guidance should be promulgated in an ESP or CMP.

(2) Dynamic Load Tests that are performed while underway, in order to prove the installation of a wire rope fitting or other repair conducted underway, may be reduced to 100% of rated load.

b. For 225 ft WLB and 175 ft WLM class cranes, ESPs are being developed. Revised testing and testing schedules will be invoked based on current commercial marine and USN crane testing practices. Weight tests will typically include a combination of rated load, dynamic and static test loading. See Table 589-3. Test load levels may be revised by ELC to address equipment design limitations

(1) Rated Load Tests will typically be at 100% of Working Load Limit for the equipment.

(2) Dynamic Load Tests will typically be at 125% of Working Load Limit. The test load may be reduced by ELC or cognizant MLC to address equipment design constraints or limitations. Detailed guidance should be promulgated in the ESP, CMP or CMP.

(3) Dynamic Load Tests which are performed while underway, in order to prove the installation of a wire rope fitting or other repair conducted underway, may be reduced to 100% of Working Load Limit for that particular component or feature.

(4) Static Load Tests will typically be at 150% of Working Load Limit for the structure.

2. Testing Frequency.

a. Cranes (except 225 ft WLB and 175 ft WLM classes).

(1) Dynamic weight testing shall be performed on all cranes as part of Level 1, Level 2 and Level 3 inspections. See Table 589-2. Whenever major equipment replacements are made, affected components shall be re-tested in accordance with applicable portions of the test procedure.

(2) When a purchase is disassembled and re-rigged with a different number of parts, the rig must be dynamic weight tested.

(3) Dynamic weight testing may be used as an indication of equipment condition.

b. 225 ft WLB, 175 ft WLM class cranes.

(1) Rated Load tests at Rated Speeds & Working Load Limits shall be required annually and in conjunction with Level 1 and Level 2 inspections. See Table 589-3. Whenever major equipment replacements are made, affected components shall be re-tested in accordance with applicable portions of the test procedure.

(2) Dynamic Load tests shall be required at intervals not exceeding 4 years, or when the equipment is overhauled. Dynamic Load tests are at no specified speed.

(3) Static Load tests shall be required at intervals not exceeding 4 years, or when the crane structure or braking system is repaired or overhauled.

(4) Dynamic Load Tests may be used as an indication of equipment condition.

c. Tests.

(1) Rated Load Test. This test is intended to verify that the equipment functions at rated load and rated speeds.

(a) The crane shall demonstrate the ability to pick up and move the Test Load through the range that the equipment is required to perform in service, including outreach beyond the cutter hull. Rotation, traversing, luffing, extension and traveling functions, as applicable, shall be demonstrated. At least 10 complete cycles shall be completed to demonstrate proper operation and repeatability of all functions w/o overheating, malfunction or degradation of brakes.

(b) Rated speeds of each function shall be verified. Loads shall be accelerated and decelerated smoothly, and slow speed shall be used near the end of each range of motion.

(c) Each individual lifting rig (main, whip, etc.) shall be demonstrated to pick up 100% of its Working Load Limit at rated speed.

(d) Where individual lifting rigs are intended to work together, they shall be demonstrated to pick up 100% of their combined Working Load Limits.

(e) During the tests, motor and pump parameters, hydraulic fluid parameters, speeds and test weights shall be recorded.

(2) Dynamic Load Test. This test is intended to verify that the equipment can properly function at Working Load capacity while underway. Operation at rated speed is not required.

(a) If the crane utilizes hydraulic power, relief valve settings shall be checked prior to conducting dynamic load tests. Relief valve and pressure compensator settings should not require adjustment in order to conduct this test. The cognizant MLC or ELC shall be advised if relief valve or pressure compensator adjustment is required in order to conduct this test.

(b) The crane shall demonstrate the ability to pick up and move the Test Load through the range that the equipment is required to perform in service, including outreach beyond the cutter hull. Rotation, traversing, luffing, extension and traveling functions, as applicable, shall be demonstrated. At least three complete cycles shall be completed, at no specified speed. The test load shall be stopped and held during each cycle to demonstrate braking action.

(c) Each individual lifting rig (main, whip, etc.) shall be demonstrated to pick up its Dynamic Test Load at no specified speed, to stop and hold the test load for 10 minutes, and to return the Test Load to the deck.

(d) Where individual lifting rigs are intended to work together, they shall be demonstrated to pick up their combined Dynamic Test Load at no specified speed, to stop and hold the test load for 10 minutes, and to return the Test Load to the deck.

(e) During tests, motor and pump parameters, hydraulic fluid parameters, and test weights shall be recorded.

(3) Static Load Test. This test is intended to verify structural integrity of the system, and the ability of the system and its individual components to hold against large loads.

(a) The crane shall be placed in the worst structural position; this is typically with the boom or frame fully extended. The Static Test Load shall be lifted and applied by external means to rigging on the crane, boom or frame. The test load shall be held, without damage or slippage, for 10 minutes.

NOTE: The use of alternative test weights, such as water bags, which can be adjusted in place to reflect the desired weight is acceptable, provided that the test weight is verifiable.

(b) Each individual lifting rig (main, whip, etc.) shall be Static Load tested to 150% of Working Load Limit, unless otherwise specified. The test weight shall be externally applied, and the weight held for 10 minutes.

NOTE: If the master test weight for the crane is applied to the main rigging only, this shall be considered a test of the main. Where the master test weight is applied to a combination of lift rigging, each rigging must also be tested individually.

(c) Test weights and rigging configurations shall be recorded.

D. SAFETY.

1. Stability Documentation.

a. All cutters, boats and barges with cranes shall have vessel stability documentation (Stability and Loading Data Booklet or equivalent), which addresses the stability of the vessel with the weight handling equipment in use. See Chapter 079.

b. Where the stability of the vessel limits the operational capability of the weight handling equipment, a graphic safety placard shall be prominently displayed at the equipment operator's station to describe the limitation, and graphically show the safe working zone and safe working load while operating at sea. For heavy lift conditions beyond those limits, units shall assess the cutter stability prior to conducting the lift.

c. When considering a unit's stability characteristics during testing procedures, specified test loads shall be maintained within limits that can be handled safely. If any of the test loads result in an excessive list (generally 15 degrees) or the immersion of the deck edge, the load shall be reduced accordingly to stay within those limits. In such cases, ELC (02) shall be advised by letter or message of the load actually handled and the loading condition of the unit at the time of the test.

2. Label Plates. Engraved label plates shall be installed on cranes or crane pedestals to document the safe working load, test weight, and date of certification of the load and corresponding parts of the purchase. The information shall be engraved in such a manner as to prevent eradication when the crane is painted.

3. Safety Precautions. The following safety precautions must be observed when conducting weight handling equipment tests.

   a. Specified Dynamic Test Loads are designed to account for dynamic service conditions. Therefore, conditions that would cause sudden application of test loads should be avoided.

   b. To prevent excessive damage in the event of equipment failure during tests, dunnage shall be placed under test loads and each load shall be kept as close to the deck as possible.

   c. To prevent loads from moving off center in the event of a casualty, preventer lines or cables shall be rigged athwartships from the test load. At minimum, the breaking strength of the preventers must be greater than or equal to the test load.

4. Documentation of Test Results.

   a. The results of the inspections and tests, including rigging configurations, prescribed shall be entered in the cutter or boat's Hull History record (or CMPlus for CMPlus equipped cutters) and rigging log. The maximum list of the cutter observed during the testing shall also be recorded and posted in the pilothouse for a ready reference to indicate the approximate loading on the boom, crane or frame during unusual operating conditions such as removing mudded-in sinkers, pilings, sunken buoys, etc.

   b. The date of the most recent Level 1 and Level 2 Tests conducted in accordance with this chapter shall be stenciled on the boom, crane or frame in the vicinity of the Label Plate, in a position clearly legible from the buoy deck.

TABLE 589-1

INSPECTION AND OVERHAULFREQUENCY FOR CRANES

VESSEL TYPE	LVL 1	LVL 2	LVL 3	NOTES
420 FT WAGB	A*	Q	CBM	*Prior to departure for major deployment.
400 FT WAGB	A*	Q	CBM	*Prior to departure for major deployment.
270 FT WMEC	NA	NA	NA	AFT CRANE/DAVIT SEE 583
225 FT WLB	A	Q	CBM	SEE ESP (DISTRIBUTION PENDING)
175 FT WLM	A	Q	CBM	SEE ESP (DISTRIBUTION PENDING)
160 FT WLIC (1,3)	A	Q	CBM	SEE ESP (DISTRIBUTION PENDING)
WLI/WLIC (3)	A	Q	CBM	
WLR	A	Q	CBM	
ANB (55 FT)	A	Q	CBM	
BARGES (2)	A	Q	CBM	

Level 2 inspection frequency may be increased by the MLC based on condition based maintenance.

(1): And barges with Weatherford cranes.

(2): Allied, Appleton and Alaska cranes.

(3): DELMAG hammer and lead shall be overhauled at 3 year intervals.

(4): Q represents the interval for a level 2 inspection should be quadrennial. (every 4 years)

TABLE 589-2. WORKING LOAD LIMIT AND DYNAMIC TEST WEIGHT CHART FOR CRANES [Notes 1 & 2]

	5-PART		4-PART		3-PART		2-PART		SINGLE PART			
VESSEL TYPE/CRANE	WLL	TEST	WWW	TEST	WWW	TEST	WWW	TEST	WWW	TEST	REMARK	WIRE ROPE
420' WAGB/TB 60-65									6,720	8,400	At 65' ext	5/8" 6x37 RRL EIPS IWRC
420' WAGB/TB 100-55					38,000	47,500					Main at 38' ext	7/8" 6x37 RRL EIPS IWRC
					11,200	14,000					Main at 55' ext	
									6,720	8,400	Whip at 55' ext	5/8" 6x37 RRL EIPS IWRC
420' WAGB/KB 40-55					38,000	47,500					Main at 38' ext	7/8" 6x37 RRL EIPS IWRC
					11,200	14,000					Main at 55' ext	
									6,720	8,400	Whip at 55' ext	5/8" 6x37 RRL EIPS IWRC
420' WAGB/KB 15-45							11,200	14,000			At 45' ext	5/8" 6x37 RRL EIPS IWRC
400' WAGB/3T									6,600	8,300		1" 6X37 FC IPS
400' WAGB/15T									33,100	41,400		1-1/2" 6X37 FC IPS
400' WAGB/HIAB									4,000	5,000	SEA CRANE	1/2" 6X37 RRL EIP IWRC

290’ WAGB			6,720	8,400			4,500	5,625				1/2” 6X37 RRL EIP IWRC
230’ WMEC									3,000	3,750		1/2” 6X37 RRL IPS IWRC
160’ WLIC							16,500	20,600	8,250	10,300	CRANE 18,000	5/8” 6X25 OR 6X37 RRL EEIP, IWRC
(cont.)								20,600		10,300	TEST 22,500	SEE ESP
100’ WLI fr 26	11,100	13,875	8,900	11,125	6,700	8,375	4,500	5,625	5,300	6,625	BLUEBELL	3/8” 6X37 RRL EIP IWRC
65’ WLI					4,000	5,000			1,250	1,562	BLACK/CHOKEBERRY	3/8” 6X37 RRL EIP IWRC
65’ WLI					4,000	5,000			1,400	1,750	ELDERBERRY	3/8” 6X41 RRL EIP IWRC
BUOY BOATS												
ANB 55101-55112									1,000	1,250	SEE NOTE 4	1/2” 6X19 IWRC RRL EIP
ANB 55113-55119									2,000	2,500	SEE NOTE 5	1/2” 6X19 IWRC RRL EIP
ANB 55120-55122									2,000	2,500	SEE NOTE 5	1/2” 6X19 IWRC RRL EIP
BU 45301-45317									4,000	5,000		5/8” 6X19 IWRC RRL EIP
BUSL 44302									3,000	3,750	BOTH WHIPS	1/2” 6X19 IWRC RRL EIP
(cont.)									2,000	2,500	EACH WHIP	1/2” 6X19 IWRC RRL EIP

BARGES												
CGB 12001-12002			40,000	50,000								MAIN: 3/4” 19 STRAND ROTATION RESISTANT, EEIP
CGB 12001-12002									10,000	12,500		WHIP: ¾”6X37 RRL IWRC EIP
CGB 67-77							20,000	25,000	3,000	3,750	SEE NOTE 3	3/4“ 6X37 RRL EIP IWRC
CGB 36									2,000	2,500	SEE NOTE 6	5/8” 6X37 RRL IPS IWRC
CGB 60044									3,000	3,750	AT MAX RADIUS	9/16” 6X37 IWRC RRL IPS
CGB 68012-68020							16,500	20,600	8,260	10,300	SEE 160 WLIC	5/8” 6X25 OR 6X37 RRL XXIP IWRC
CGB 70018							16,500	20,600	8,260	10,300		5/8” 6X25 OR 6X37 RRL XXIP IWRC
CGB 76006-76009					6,000	7,500			2,000	2,500		1/2“
CGB 84001-84002							16,500	20,600	8,260	10,325	SEE 160 WLIC	5/8” SEE CGB 68012-68020
CGB 90013							20,000	25,000	3,000	3,750	SEE NOTE 3	3/4” 6X37 RRL XIP IWRC
CGB 99002-99005							20,000	25,000	3,000	3,750	SEE NOTE 3	3/4” 6X37 RRL XIP IWRC
CGB 99008							20,000	25,000	3,000	3,750	SEE NOTE 3	3/4” 6X37 RRL XIP IWRC

NOTE 1: Wire rope grade shall not be upgraded without ELC (01) authorization. For wire rope discrepancies between original drawings and this table, this table shall be used. Wire rope procurement reference is API SPEC 9A.

NOTE 2: USCG marine crane ratings are at a maximum (or identified) working radius for that installation. The ratings take into account the effect of ships motions; see applicable technical publication or arrangement drawing. Typical OEM commercial crane ratings are dependent on boom angle, outreach, boom extension and wire strength; maximum WLL is typically at minimum working radius and/or minimum boom extension, unless the crane arrangement is limited by wire rope strength. Commercial crane ratings shall not be used unless directed by ELC (01).

NOTE 3: 2 Part WLL is 10 ft Max radius, Single Part WLL is 50 ft Max radius.

NOTE 4: Applicable to Husky M45 cranes. SWL and Test Weight are for operating the boom throughout the operating envelop regardless of how far the boom is extended with the exception of directly over the notch at not more 13' outreach calls for a WLL of 2000 and TEST of 2500.

NOTE 5: Applicable to Husky M60 cranes. WLL and Test Weight are for operating the boom throughout the operating envelop regardless of how far the boom is extended with the exception of directly over the notch at not more 13' outreach calls for a WLL of 3000 and TEST of 3750.

NOTE 6: See manufacturer's documents for test requirements.

IPS = Improved Plow Steel, EIP = Extra improved plow steel, EEIP = Extra Extra improved plow steel, RRL = Right Regular Lay, LRL = Left Regular Lay

IWRC = Independent Wire Rope Core, SC = Solid Core, FC = Fiber Core

TABLE 589-3

WORKING LOAD LIMIT & TEST WEIGHTS FOR 225 FT WLB AND 175 FT WLM CRANES

VESSEL TYPE	TWO PART		SINGLE PART		REMARKS	WIRE ROPE
	WLL	TEST	WLL	TEST		
225 FT A CLASS WLB	40,000	40,000 Rated			Main Hoist, See ESP (distribution pending)	1-1/8 inch 6x37 RRL, XIP, IWRC
		45,000 Dynamic (1)				
		60,000 Static				
			10,000	10,000 RATED	Whip Hoist	7/8 inch 6x37 RRL, XIP, IWRC
				12,500 DYNAMIC		
				15,000 STATIC		
175 FT WLM	20,000	20,000 Rated			Main Hoist, See ESP (distribution pending)	3/4 inch 6x37 RRL, IWRC, Compacted Construction
		25,000 Dynamic				
		30,000 Static				

			9,000	9,000 Rated	Whip Hoist	5/8 inch 6x37 RRL, IWRC
				11,250 Dynamic		
				13,500 Static		

(1) Limited due to hydraulic design of system.

CHAPTER 591. OCEANOGRAPHIC RESEARCH EQUIPMENT

A. GENERAL.

1. General information on oceanographic research wires and winch technology can be found in the Handbook of Oceanographic Winch, Wire and Cable Technology, edited by Alan H. Driscoll and available through National Technical Information Service (NTIS), U.S. Department of Commerce. This book, funded by the National Science Foundation (NSF) and U.S. Navy, Office of Naval Research (ONR), is a series of technical chapters authored by experts in their individual fields.
2. Oceanographic research weight handling equipment is intended to be used in support of various oceanographic research programs. Typical factors of safety for weight handling type wire rope systems do not apply to science wire systems. It is not uncommon to operate with a factor of safety of 1.5 on science wire systems. It is not unheard of to overload and "snap" science wires.
3. As background guidance information, it is G-SEN policy that all science wire handling system components shall, as a minimum, meet the design requirements of 46 CFR Subchapter U - Oceanographic Research Vessels, Part 189-35.9. Additional detailed testing criteria is provided herein.

B. STANDARD LOADS.

For equipment testing purposes, all loading conditions shall be based upon the nominal Rated Breaking Strength (RBS) of the strongest type of wire rope used by the system. The following definitions shall apply:

1. The Normal Working Load (NWL) of the equipment (e.g. working load typically expected) shall be defined as the application of a load equivalent to 50 percent of the strongest wire RBS.
2. The Safe Working Load (SWL) of the equipment shall be defined as the application of a load equivalent to 70 percent of the strongest wire RBS.
3. The Rated Load of the equipment, for structural design purposes, shall be defined as the application of a load equivalent to 80 percent of strongest wire RBS.
4. The Test Load for the equipment shall be defined as the application of a load equivalent to not less than the RBS of the strongest wire to be used by the system.

C. WEIGHT HANDLING SYSTEM STRUCTURAL DESIGN AND TEST POLICY.

1. All structural elements, including cranes, frames and wire rope sheaves shall be statically tested to not less than 125 percent of the Rated Load for the system, or to the Test Load for the system (as defined above). Static load testing shall be conducted prior to initial use of the equipment, and shall be repeated quadrennially. Individual elements may be tested independently.
2. All science winches are structurally tested at the factory to loads in excess of the installed system criteria. The winch installation (e.g. foundation attachment) shall be static load tested upon installation, pulling against structural elements of the frame.

Removal of installed science wires to static load test against the winch drum after installation is not required.

3. Static load testing shall be conducted with special test wires, which shall not be used for other rigging purposes. Wires shall be new, clean, rust-free, and have no kinks, broken outside wires or other defects. Fittings shall be no less than 90 percent efficient. Test loadings shall be achieved slowly and carefully with appropriately calibrated instrumentation. Under these conditions, test wires may be loaded to 65 percent of the wire RBS; loading levels of 50 percent of wire RBS or less are preferred. Test wires shall not be used for more than one ship test.

D. **<u>DYNAMIC TEST LOADING</u>.** Dynamic load testing of science wires and of wire reeving elements (sheaves, etc.) shall be conducted with the rigged science wire.

1. Science wires shall be dynamically tested to 70 percent of the reeved wire RBS when a wire is reeved, and if the wire is not changed out it shall be retested at biennial inspections. Testing shall include lifting and deployment (at no specified speed) of a test load for at least 50 feet, holding the load for several minutes and retrieval. Proper sheave rotation and motion shall be verified. To minimize wire damage, more frequent dynamic testing to this level is not encouraged.

2. Science wires shall be dynamically tested to at least 50 percent of the reeved wire RBS when a wire fitting is changed or installed. Testing shall include lifting and deployment (at no specified speed) of a test load for several feet, holding the load for several minutes, then retrieval.

E. **<u>SCIENCE WIRES</u>.**

1. Science wires installed on Coast Guard cutters shall generally meet University National Oceanographic Laboratory System (UNOLS) standards; such standards are typically promulgated by Woods Hole Oceanographic Institute on behalf of UNOLS and NSF. Use of any other wires shall be at the direction of the cognizant MLC, G-OCU, and the ELC. Wire identification numbers shall be assigned to all science wires. The identification numbers shall be in the format recommended in the chapter on Cable and Winch Documentation in the Handbook of Oceanographic Winch, Wire and Cable Technology.

2. The NWL and SWL for each science wire shall be calculated and noted on cast documentation. These loads are initially 50 and 70 percent of the wire RBS, but may be downgraded as necessary. The winch operator or test director shall calculate (or estimate to the extent practical) the expected static or quasi-static tensile loads, wave induced dynamic loads, zero/slack loads, and snap loads. From these loads, the expected worst loading condition shall be calculated. The predicted static or quasi-static tensile loads shall not exceed the NWL. The predicted worst loading condition shall not exceed the SWL.

3. The winch operator shall take all precautions to prevent the wire loading from exceeding SWL. If a problem occurs and higher loads become necessary, in no case shall the load exceed 75 percent of the wire RBS.

4. All science wire activity, including tests, casts, wire on-load, wire off-load, and other events (cleaning, lubrication, loss of wire, etc.), shall be documented. The objective is to develop as complete a wire loading history as possible, in order to support effective wire condemnation and replacement.

5. The electronic Data Acquisition System (DAS) provided on all WAGB science winch systems shall be utilized for all wire movements other than wire staging for a cast. Cast, test, on/offload and other data shall be post-processed with the DAS software.

   a. On cutters without a DAS, wire movements and loadings shall be recorded in accordance with the recommendations in the chapter on Cable and Winch Documentation in the Handbook of Oceanographic Winch, Wire and Cable Technology.

F. Science wires which have been utilized, shall be pressure washed at the end of each major deployment; the wires shall not be stowed for extended periods in an unwashed condition. Science wires shall generally be pressure lubricated at the same time, or as required, with a special oceanographic service compatible lubricant identical to or compatible with the original factory lubricant.

G. Units fitted with oceanographic equipment shall maintain wire rope documentation and histories in CMplus if equipped. Units shall use the criteria outlined in paragraph D of this chapter and the information outlined in the Handbook of Oceanographic Winch, Wire and Cable Technology as guidance for determining when to request wire rope renewal. Recommendations for renewal shall be forwarded to the MLC for review and approval**.**

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CHAPTER 593. ENVIRONMENTAL POLLUTION CONTROL SYSTEMS

A. **GENERAL.** The Coast Guard is fully committed to responsible environmental stewardship. As such, all vessels shall comply with all federal pollution prevention laws, including MARPOL, the Clean Air Act, and the Clean Water Act. Further, sovereign immunity has been waived regarding most state standards. In cases where Federal, Coast Guard, state, or local regulations vary, the most stringent regulations shall be the preferred level of compliance.

B. **SHIPBOARD REGULATIONS.** Shipboard Regulations Manual, COMDTINST M5000.7 (series) provides shipboard policy and procedures for water pollution and refuse disposal. Hazardous wastes generated aboard ship shall be properly managed in accordance with Hazardous Waste Management Manual, COMDTINST M16478.1 (series).

C. **CONTRACT PROVISIONS.** For vessels undergoing repair by a commercial contractor at the contractor's facility, the MLCs shall develop contract specifications that specifically state the disposal (to the end point disposal site) of all hazardous wastes generated as a result of the contract will be performed by the contractor. Furthermore, the contractor shall meet all federal and state requirements including the possession of a state or EPA generator identification number. For vessels undergoing repair by a commercial contractor at a Coast Guard facility, all hazardous wastes generated as a result of the contract will be turned over to the local Coast Guard Hazardous Waste Coordinator for disposal.

D. **POLYCHLORINATED BIPHENYLS (PCB).** NAVSEA S95930A1-MAN-0101, Shipboard Management Guide for Polychlorinated Biphenyls, prescribes policies and procedures for handling PCBs and PCB items. Similar to asbestos, PCBs present minimal health risk while they are intact. To date, there have been no known PCB-induced health problems for personnel operating and maintaining Coast Guard vessels. When PCBs are burned in air, extremely hazardous decomposition products such as hydrogen chloride, dibenzofurans, and dibenzodioxins are released.

1. Although transformers containing PCBs have been removed from vessels and PCB items are no longer installed on vessels, many older vessels were constructed with materials containing PCBs. Specifically, PCBs have been found on:

    a. 41' UTB

    b. 44' MLB

    c. 65' WYTL

    d. 75' WLR

    e. 133' WLM

    f. 180' WLB

2. On these vessels, PCBs were identified in the following material/places:
   a. Ventilation (felt gasket material)
   b. Electrical cables
   c. Di-electric metal insulators
   d. Lighting ballast
   e. Insulation (bulkhead, piping, panel, overhead, pipe hangers)

3. Before beginning any hot work on the areas identified above, crews must consult the NAVSEA Manual or request guidance from their respective MLC. Furthermore, PCB containing materials must be disposed of in accordance with local, state, and federal laws. Consult the servicing Civil Engineering Unit for disposal guidance.

E. INCINERATORS.

1. General. This section serves to provide guidance and Coast Guard policy with regard to incinerator operation and maintenance. This policy includes both legal requirements and requirements the Coast Guard has adopted as a matter of policy to enhance protection of the environment, human health, and safety. Manufacturer's instruction manuals and cutter-specific PMS provide additional guidance on operation and maintenance requirements.

2. Policy. The preference of incineration over disposal of garbage at sea supports the Coast Guard's environmental vision statement, "Our business values the environment." Therefore, incinerators shall be used to dispose of garbage at sea to the maximum extent possible, consistent with the guidance below.

3. Operation while underway. Cutters may operate incinerators when outside state territorial seas, which extend 3 nm from shore, with the exception of the west coast of Florida and the Texas coast, where there is a territorial sea of 9 nm. Additionally, cutters shall not operate shipboard incinerators off the southern CA coast when transiting through the area bounded by latitudes 34 deg 2.5 min N and 33 deg 24.5 min N and within 12 nm of shore. Cutters having an operational necessity to operate incinerators within state territorial seas should contact MLC(V) for assistance in obtaining authorization. This provision does not apply to cutters operating in the Antarctic region (areas south of 60 degrees south latitude). Use of incinerators for waste disposal while inport is prohibited.

4. Test operations while inport. Operation of incinerators while inport for the purpose of maintenance and testing is an activity regulated by non-federal legislation (state, city, or local air district). MLC(v) is responsible for establishing, with state and local air quality regulators, a localized incinerator testing policy for cutters while in homeport. MLC shall promulgate that policy to cutters in the form of a message. Should a cutter be inport but away from homeport, they shall comply with the local laws and regulations. Because this may require obtaining a permit or exemption from local regulators, cutters desiring to test in a port away from homeport shall consult

with their MLC Type Desk prior to testing. Cutters should contact their MLC Type Desk with any questions in reference to test burning policy.

5. Flight Operations. For helo-capable cutters, the incinerator may be operated while conducting flight operations. WHEC cutters must operate the incinerator with the spark arrester (p/n 5702) in the flue gas line installed at all times Using the incinerator during flight ops is not authorized with spark arrester removed or not operating effectively (precluding hot particles from being ingested into aircraft engines). WHECs must have stainless steel netting in place on the net frame above the incinerator exhaust port in order to conduct incinerator ops and flight ops simultaneously.

6. Incinerator Residue Disposal. Incinerator ash may be treated as a MARPOL Annex V waste and disposed of into the sea in accordance with the following guidelines:

   a. Inspect ash for plastic clumps commonly referred to as “clinkers,” if found separate and retain onboard for disposal ashore. Plastic garbage must be retained on board ship unless reduced to ash by incineration.

   b. Ash may be disposed of into the sea at distances of 3 nm to 12 nm from the nearest land provided the ash is absent any non-plastic chunks larger than one inch in size.

   c. Ash and non-plastic chunks (regardless of size) may be disposed of into the sea at distances greater than 12 nm from the nearest land.

   d. Ash may not be disposed of into the sea in the Antarctic Region (Areas South of 60 Degrees South Latitude).

7. Waste.

   a. Hazardous Waste. The burning of hazardous waste and material normally disposed of via shoreside hazmat receiving service is prohibited with the following exceptions: waste oil, oily rags and oily filters. When incinerating these materials, ensure that other, low-heat value waste is commingled before introduction into the combustion chamber. This will prevent the incinerator from overheating.

   b. Medical Waste. Incineration of medical waste is prohibited.

   c. Glass. Incineration of glass is prohibited. Glass will only melt and removal may cause damage to the incinerator.

   d. Pressurized Cans. Incineration of pressurized or aerosol cans are prohibited. Such material may explode inside the incinerator posing a safety hazard.

e. Food Waste. Food waste has a low heat value and therefore burns at a slow rate. Food waste also biodegrades at a faster rate than other types of garbage and therefore has little adverse effect on the environment. Processing food wastes through galley and scullery grinders is more efficient and sanitary than using the incinerators. For these reasons, it is recommended that food waste be disposed of overboard in accordance with Part 66 of the Shipboard Regulations Manual, COMDTINST M5000.7 (series). Should a cutter choose to incinerate food waste, best results will be achieved when the food waste is commingled with other waste to compensate for its low heat value.

f. **Plastics**. Only common plastics (domestic waste) may be incinerated. Plastics that are industrial or unique in nature (i.e. insulation and pvc piping) are to be stored onboard and disposed of shore-side. When it is unclear whether a plastic is of the "common" type, ships shall err to the side of caution and dispose of it shore-side.

CHAPTER 613 - RIGGING

A WIRE ROPE.

1. General. This section provides guidance for the inspection and maintenance of wire rope used throughout the Coast Guard.

   a. NSTM Chapter 613 provides additional guidance for wire rope selection, construction, maintenance, inspection, splicing and stowage.

   b. Wire rope procurements shall reference API Specification 9A Specification for Wire Rope (as applicable), in lieu of reference to Federal Standard RR-W-410. Where special construction wire ropes are used, such as rotation resistant type, the appropriate specification shall be referenced.

   c. Refer to Chapter 591 of this manual for Science wire applications.

   d. Aides to Navigation Manual-Seamanship, COMDTINST M16500.21 (series), may be used for additional technical information.

   e. The following definitions apply within this section:

      (1) Weight Handling Systems: includes cranes, booms, davits, elevators and crossdeck winches.

      (2) General Purpose lifting equipment: includes fixed and portable hoists, boat slings and lifting slings.

      (3) Standing Rigging: includes fixed rigging, guys, boom pendants and mooring lines.

      (4) Life Lines: includes bulwark lifelines, helicopter safety net lines, etc.

2. Planned Maintenance System. All wire rope shall be inspected and maintained, where applicable, in accordance with cutter specific PMS, manufacturer's technical publications, and the cognizant MLC Standard Specifications.

3. Use Limitations.

   a. Stainless steel or galvanized wire rope should not normally be used in weight handling systems. The additional expense and reduced strength of these wires to improve corrosion resistance cannot typically be justified, since these wires MUST be routinely lubricated in weight handling applications.

      (1) If stainless steel or galvanized wire rope is provided as part of a new piece of equipment, this initial wire shall be replaced only at the end of its life cycle. Stainless steel and galvanized wire rope in running rigging shall be routinely lubricated.

(2) Where the use of stainless steel or galvanized wire rope is required in these applications, cutter class specific guidance shall be provided by the cognizant MLC. Stainless steel and galvanized wire rope in running rigging shall be routinely lubricated.

b. Galvanized wire rope, where used, shall be of the drawn galvanized type. This process galvanizes the individual wires before the final drawing process and before assembly of wires into individual cables.

c. Galvanized wire rope may be used in general purpose lifting equipment, standing rigging, boat ladders and similar applications.

d. Stainless steel wire rope may be used for certain standing rigging and lifelines. See NSTM 613.

e. Wedge socket type wire terminal assemblies are authorized for use on WEATHERFORD lattice boom crane systems only.

f. The essential nature of rotation resistant wire rope designs impose certain limitations on their application and necessitate special handling requirements not encountered with other rope constructions. The use of rotation resistant wire rope shall be limited to applications specified in Chapter 589, and as directed by ELC-01.

4. Inspections.

a. Inspection Frequency for Weight Handling Wire and General Purpose Lifting Ropes: The following requirements are applicable to wires in weight handling systems and general purpose applications only.

(1) Wire ropes shall be visually inspected for obvious deficiencies or defects daily or prior to use if the equipment is not used daily.

(2) External Inspections: A qualified person shall perform external inspection of all wire rope in use at least quarterly, and external inspections of all general purpose lifting equipment wire rope at least semi-annually, to determine the condition of the wire and avoid a possible safety hazard.

(3) Internal Inspections: Internal inspections of wire ropes shall NOT be performed on a routine basis. Pending revisions to USN technical policy will recommend that internal inspections NOT be performed on a routine basis, and then only by qualified personnel to determine the internal condition of wire rope when damage is suspected.

(4) If a weight handling system wire has been idle for more than 30 days, a quarterly inspection shall be conducted.

(5) Inspection frequencies may be modified, based on operational experience and direction from the cognizant MLC and/or ELC, or promulgation of an Equipment Support Plan for the particular equipment or system.

(6) All wire rope associated with weight-handling systems in the weather shall be un-shipped annually, or as directed by an Equipment Support Plan, for a more thorough inspection and pressure lubrication.

b. Inspection Frequency for Standing Rigging and Lifeline Applications. The following requirements are applicable to wire rope used in standing rigging and lifeline applications.

(1) Wire ropes shall be visually inspected for obvious deficiencies or defects on an appropriate routine basis. Wire rope that may come in contact with personnel shall be inspected more frequently.

(2) External Inspections: A qualified person shall perform <u>external</u> inspections of all wire rope at least annually to determine the condition of the wire and avoid a possible safety hazard.

(3) Internal Inspections: Internal inspections are not required, unless there is evidence of problems.

(4) Inspection frequencies may be modified, based on operational experience and direction from the cognizant MLC and/or ELC.

c. External Inspection. External inspections shall be conducted to locate deficiencies or defects including but not limited to the following areas:

(1) Reduction of rope diameter below the nominal diameter due to wear of outside wires, loss of core support or internal, or external corrosion. The diameter shall be measured in a circumscribing circle in six or more places on the rope. The diameter shall be measured across the largest radial line.

(2) The number of broken outside wires and the constriction of the broken wires. Attention should be given to valley breaks where the breaks are at the strand to strand contact point.

(3) Worn outside wires.

(4) Corroded or broken wires at the end connection. Corroded, cracked, bent, worn, or improperly applied end connections.

(5) Kinking, crushing, cutting, un-stranding, bird caging or fishhooks. NOTE: Heavy wear and/or broken wires occur in rope sections in contact with certain components of the equipment. Carefully inspect the rope at these points.

(6) Areas where the ropes travel are limited. As an example, where wire goes over fixed guides or sheaves.

(7) End connections, including socket and end attachments to running ropes, boom pendants and other standing ropes.

(8) Sections of the rope where the rope is continually running over sheaves within the various hoist systems. The inspection is particularly important where boom angle and load block changes are frequent and limited to short distances.

(9) At crossover and flange points of the rope on the hoist drums.

(10) When wire rope is removed for inspection and lubrication, care must be taken to ensure the rope is temporarily stowed to prevent kinking or damage.

(11) When reinstalling wire rope that has been removed for inspection it shall be installed in the same direction it was removed. The practice of swapping ends is not approved.

d. Internal Inspection. Internal inspections shall only be accomplished by qualified personnel, and shall be conducted only when then there is evidence of problems. Local commands shall determine which personnel are qualified to open the lay of the rope without nicking the individual wires or disturbing the lay of the strands. Wire can be easily damaged by improper inspection procedures.

(1) Wire rope can be opened for internal inspection only when the wire is completely relaxed. To properly relax the wire and perform a thorough internal inspection of the entire rope, the rope must be un-shipped from the equipment. Extreme care must be taken when inspecting areas that are still attached or are in the vicinity of drums to avoid inspecting wire under tension.

(2) Procedure:

(a) Using care to avoid damaging the strands or core, open the wire rope by working a marlin spike beneath two strands. Carefully rotate the spike to expose the core and underside of the strands.

(b) Inspect for evidence of internal corrosion, broken wires, or core failure. Particular attention shall be given to the wire rope in areas close to end fittings, wire lengths that pass over sheaves, onto drums, and wire which remains exposed to or immersed in seawater.

(c) If a wire rope has been opened properly and carefully, and internal condition does not show cause for removal, the strands can be returned to their original working positions without distorting the wire rope or impairing future usefulness.

(3) Internal inspection of Rotation Resistant wire rope shall be done only in accordance with the wire manufacturer's instructions.

5. Replacement Criteria.

a. Replacement of the wire rope is required if one or more of the following conditions exist:

(1) Where the rope diameter has been reduced below allowable limits:

Nominal Rope Dia	Max Allowable Dia Reduction
5/16" and smaller	1/64"
3/8" to 1/2"	1/32"
9/16" to 3/4"	3/64"
7/8" to 1 1/8"	1/16"
1 1/4" to 1 1/2"	3/32"
1 9/16" to 2"	1/8"
2 1/8" to 2 1/2"	5/32"

(2) Six broken wires in one rope lay length or three wires in one strand lay length of weight handling system or general purpose wire. Three broken wires in one rope lay length for all standing rigging wire.

(3) One broken wire within one rope laid length of any end fitting.

(4) Wear of 1/3 the original diameter of outside individual wires.

(5) Evidence of large areas of pitting due to corrosion.

(6) Evidence of heat damage on an area of the wire where the load is carried. Passing a rope over a frozen or non-turning sheave or contact with structural members of the equipment can generate heat.

(7) Kinking, crushing, or any other damage resulting in deterioration of the rope structure.

(8) Evidence of internal corrosion, broken wires on the underside of strands, excessive nicks or core failure.

(9) The rope construction has been distorted by kinking, crunching, bird-caging or other distortion damage.

b. Wire rope shall not normally be replaced on a routine scheduled basis more frequently than once every four years for most installations, or more frequently than once every two years on weight handling systems on WLB, WLM, WLI, WLIC, and WLR cutters and related barges.

(1) The cognizant MLCs may establish routine wire replacement schedules for particular cutter classes or equipment, based on operational experience.

(2) Specific guidance for WLB, WLM, WLI and WLIC cutters will be provided in ESPs and individual CCMPs.

(3) Units that routinely condemn wire rope on a more frequent basis than the above shall report this to their cognizant MLC for investigation, action and/or direction.

(4) Condemnation of wire rope based on inspection criteria above shall supercede scheduled replacement cycles.

c. Diligent use of pressure type lubrication systems can increase the service life of wire rope.

6. Cleaning.

a. The use of a wire rope maintenance system that includes a scraper assembly is preferred. This minimizes the need for cleaning and the hand application of solvents.

b. Wire ropes shall be hand cleaned, if necessary, before lubrication in order to reduce the amount of residual contaminant forced between the wires. Hand cleaning includes use of pressure wash systems, compressed air systems, and application of manufacturer approved wire cleaning solvent using a wire brush.

(1) The use of environmentally friendly solvents is strongly recommended. Solvents should be compatible with the selected lubricant. The lubricant manufacturer should be consulted.

(2) After the use of any solvent, wire rope shall be pressure washed to ensure the solvent is removed.

c. Wire shall not be soaked in solvent. The objective is to loosen or soften contaminated lubricant on the outside of the wire to ease removal. Over application of solvent, or soaking, may remove internal wire lubrication and may lead to accelerated wire rotting.

d. Wire rope that is received coated with Cosmoline, shall be cleaned and lubricated before being placed into service.

7. Lubricants.

a. Type/Grade.

(1) Wire rope lubricant shall be a commercial, marine grade, wire rope lubricant that is compatible with salt water applications, and is compatible with the

pressure lubrication equipment that will be used for standard application. Environmentally friendly lubricants are preferred.

(2) Use of MIL-G-18458 - Grease, Wire Rope and Exposed Gear, as recommended by USN documentation, may provide a generic grade lubricant that contains lead products. USN studies on acceptable replacement wire rope lubricants are in progress. The current document is frequently used as a baseline for saltwater performance comparison, and lubricants that are both more environmentally friendly and radically exceed MIL-G-18458 rev B performance requirements are commercially available. MIL-G-18458 grease shall not be used; this restriction does not apply to commercial grade grease that exceeds the performance of the military specification.

(3) Dynagard Blue™ and Dynagard E™, as distributed by The Kirkpatrick Group, are known to be more environmentally friendly, exceed MIL-G-18458 performance requirements, and have a history of use on Coast Guard cutters. Superior performance of these lubricants has been documented by Carderock Division Naval Surface Warfare Center study NSWCCD-63-TR-1999/32 December 1999: Environmentally Preferable Wire Rope Lubricants.

(4) Use of canned, spray type cleaner/lubricants is prohibited.

b. Lubricant Application.

(1) Surface or topical application of wire rope lubricant, by hand, shall be limited to coating renewal between pressure lubricant applications; this process shall not be the primary source of wire lubrication. It does not ensure lubrication to the inner, working core of the wire rope.

(a) Where lubricant is hand applied, it shall be worked into the valleys and between strands. Sufficient lubricant shall be used to coat the outer wires, but the wires shall not be excessively greased.

(b) Wire rope shall be thoroughly lubricated at the base of end fittings and in other areas subject to high working stresses. Wire is not necessarily lubricated internally when the outside appears greasy.

(2) Wire rope lubricant shall normally be applied with a pressure type lubrication system. The system shall include (at least) a groove cleaner, a scraper, an applicator w/seals, and a pressure pump. The seals shall be specifically sized for use with individual wire sizes to ensure pressure buildup within the applicator and to minimize waste products. The system shall scrape excess lubricant from the incoming cable, shall inject lubricant under pressure into the core of the wire rope, and shall minimize excess lubricant on the wire as it exits the lubricator.

(a) Pressure lubrication systems should be modular in design, to provide for different scraper and cleaner systems as necessary to support different wire rope constructions.

(b) Wire rope pressure lubrication systems with a proven history of performance in Coast Guard applications include systems distributed by The Kirkpatrick Group, Dallas Texas; **www.thekirkpatrickgroup.com**. These systems are available on the open market and through the Federal stock system.

(3) Wire rope pressure type lubrication systems may be maintained at the unit level, at maintenance facilities servicing multiple cutters, and at other facilities as directed by the cognizant MLC.

(a) Cutters with major weight handling equipment [WLB, WLM, WLI, and WLIC] and cutters with long deployment cycles [WAGB] can typically justify ownership of a lubrication system. Other cutters shall share usage of a system at their home port, or shall seek support guidance from their cognizant MLC.

(b) Lubrication system owners shall ensure that consumable components, such as wire seals, are replaced as needed and that the equipment is maintained in good working order with accessory components for all sizes of wire on the cutter.

(c) Use of a lubrication system with seals that are worn or have failed may result in development of lower lubricant injection pressure and failure of the lubricator to properly lubricate the inner core of the rope.

(d) Lubrication system owners shall maintain copies of the Technical Operating Instructions both WITH the equipment (for immediate use by any personnel using the equipment), and with other documentation aboard the cutter.

(4) Lack of access to a pressure type lubrication system in good repair will not be accepted as sufficient reason for non-compliance with the requirement below to pressure lubricate wire ropes.

c. Lubrication of Weight Handling and General Purpose Wire.

(1) The manufacturer initially lubricates wire rope during fabrication. This initial lubrication is compounded with additives to provide lubrication qualities and corrosion protection during storage, shipping, and handling. This factory lubrication alone is inadequate for initial installation without additional lubrication. Units shall pressure lubricate all new wire rope at installation.

(a) Contractually requiring wire rope to be "pressure lubricated" by the local vendor prior to delivery may not achieve the desired result. All wire rope lubrication systems are not created equal; some systems slush the outside of the wire rope and do not inject grease under pressure into the wire core. Units shall ensure that the vendor is using a Kirkpatrick Group ™ pressure type lubrication system, or equal, and shall inspect the wire rope carefully on delivery.

(2) Periodic lubrication is required because wire rope is really a mechanical device with many moving parts. Each time a rope bends or straightens, the wires in the strands and the strands in the rope slide upon each other. A film of lubricant is needed on each moving part. There is no known method to determine the strength of corroded wire. A rusty rope is a liability.

(3) Wire rope shall be thoroughly lubricated at the base of end fittings and in other areas subject to high working stresses.

(a) In addition to being pressure lubricated before installation, wire rope (including stainless steel and galvanized wire rope) shall be lubricated per the following schedule:

(a) Specific wire lubrication schedules will be established and promulgated as part of Preventive Maintenance System documentation, and in Equipment Support Plans for weight handling systems on specific cutter classes. The guidance in the ESPs will reflect operational conditions of the cutter and equipment usage. The following is generic guidance:

(b) Wire shall be lubricated after quarterly inspections as deemed appropriate. Lubrication type (hand or pressure) shall be locally determined based on condition found.

(c) Pressure lubrication of wire rope working areas is encouraged on at least a semi-annual basis.

(d) All wire shall be pressure lubricated at least annually.

d. Lubrication of Standing Rigging.

(1) The manufacturer initially lubricates galvanized standing rigging wire rope during fabrication. This initial lubrication is compounded with additives to provide lubrication qualities and corrosion protection during storage, shipping, and handling. This factory lubrication alone is typically inadequate lubrication for extended service in the weather. Units shall pressure lubricate all new galvanized wire rope at installation.

(2) Galvanized wire rope shall be top coated or pressure lubricated as dictated by inspection reports. If the surface lubricant has seriously deteriorated, the wire shall be unshipped and shall be pressure lubricated with the lubrication system.

(3) Galvanized wire rope shall be unshipped and pressure lubricated at least every five years.

8. Stowage.

a. When wire is received, and it is not placed in service immediately, it shall be stored in an area protected from the weather and from possible contact with acid or acid fumes. Do not store wire rope in areas where acid is kept. The slightest trace of acid is apt to damage wire rope at the point of contact.

b. To afford protection from acid or other corrosive elements, coat the outside layer of wire rope on a reel or coil with a lubricant.

c. Before placing any wire rope into service a thorough inspection of the rope shall be conducted, and the wire shall be pressure lubricated.

9. Record Keeping.

a. Wire rope measurements shall be recorded for all new wire rope, prior to installation to establish baselines for future inspections.

b. Inspection record files shall be maintained for all wire ropes until the wire rope is condemned or replaced. Written, signed and dated inspection reports shall be maintained in the files to document all inspections, note deterioration and maintenance actions, and provide historical data for trend analyses.

c. Wire rope deterioration shall also be noted in the hull/machinery history card or approved maintenance record logs for the appropriate piece of equipment.

B WIRE ROPE FITTINGS.

1. Spelter Socket Fittings. It is becoming increasing difficult to obtain RR-S-550D (or equal) poured zinc spelter socket wire rope fittings due to material issues and the availability of qualified personnel to make the casts. USN documentation, which is pending distribution, will authorize the use of WIRELOCK™ and SOCKETFAST™ poured resin socket assemblies using CROSBY™ G-416 and G-417 spelter sockets as an accepted alternative to poured zinc spelter socket wire rope fittings. These resin materials are commercially available in kit form for on-site application. Manufacturer's instructions for installation shall be followed. Where the wire and fitting are procured as an assembly, they shall be pull tested and provided with a test certificate.

2. Swaged Socket Fittings. Cold swaged wire rope fittings, such as Crosby / National™ S-501 and S-502 series, or equal, are an acceptable wire rope fitting for weight handling systems, provided that the fittings are supplied as part of a wire assembly which has been hydraulically swaged. Assemblies shall be pull tested and provided with a test certificate.

3. Fiege Socket Fittings. ELECTROLINE™ fiege type threaded compression fittings which utilize tapered wire rope plugs are an acceptable fitting which can be field installed. Per NSTM 613, these fittings have a typical efficiency of 85% of the wire rope, and this efficiency shall be accounted for in the wire rope system design. These fittings have typically been used in ATON weight handling applications, and in safety and lifeline applications.

4. Wedge Socket Fittings. These fittings are currently authorized for use only on WLIC cutters and barges with lattice boom cranes.

5. All wire rope assemblies. shall be inspected, and factory or field weight tested before handling working loads, to ensure the fitting has been properly installed.

C. SHEAVES.

1. Sheaves. Sheaves shall be sized and grooved for the wire rope that will be carried. Improperly sized sheaves can lead to premature wire rope wear and failure.

   a. Sheave diameters of at least 20 times the wire diameter [D/d ratio] are generally preferred on new construction running rigging with 6x37 classification wire; sheave diameters with a D/d ratio smaller than 20 will impact on wire stress levels and the service life of the wire. Some installations may require smaller diameter sheaves to address existing space limitations. On systems with sheaves with a D/d ratio of less than 20, wire rope inspections shall pay particular attention to areas that may receive excessive working over these sheaves.

   b. Manufacturing tolerances for new sheaves are distinctly different from acceptable wear tolerances for sheaves in use. Sheave "wear" gage tools are typically dimensioned to gage the acceptability of worn sheaves. Use of a "wear" gage to inspect a new sheave is a misapplication. A gage may be used to verify that a "new" sheave is of the correct size, but shall NOT be used to inspect "new" sheave tread clearances.

2. Sheave Inspections. Sheave inspections shall be conducted using USCG drawing FL 1702-11, Inspection of Sheaves, as a reference.

   a. New sheaves, and sheaves with less than several hundred hours of service may be inspected for deformities, but shall NOT be inspected for "wear" using a sheave gage.

   b. Sheaves manufactured by roll forging methods may initially appear to have a rougher groove surface than sheaves with a machined groove, but are fully acceptable.

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CHAPTER 630. PRESERVATIVES AND COVERINGS

A. **<u>PAINT</u>.** Coatings and Color Manual, COMDTINST M10360.3(series), prescribes Coast Guard policies and procedures for surface preparation and paint application for Coast Guard cutters and boats. All units shall comply with the requirements of COMDTINST M10360.3 unless otherwise authorized by G-SEN. G-SEN may authorize variance from COMDTINST M10360.3 for color, prototype, and material substitution issues. ELC may authorize variance from COMDTINST M10360.3 for prototype evaluation purposes only. . MLCs may authorize variance from COMDTINST M10360.3 only when material substitutions are required to meet operational requirements. All authorized variances from COMDTINST M10360.3 shall be in CG Letter format addressed to the applicable unit, and copied to G-SEN, ELC and MLC (as applicable). NSTM Chapter 631 and industry publications such as the Steel Structures Painting Manual, Volumes I and II published by the Society for Protective Coatings (SSPC), formerly known as the Steel Structures Painting Council) may be used for additional guidance. Units are required to comply with Federal, State, and local Clean Air and Clean Water regulations, in addition to applicable Volatile Organic Compound (VOC) restrictions.

B. **<u>CATHODIC PROTECTION</u>.** Two methods of hull cathodic protection systems are currently in use on Coast Guard vessels: an impressed current or automatically controlled system (commonly referred to as CAPAC) is installed on all 110’ WPB, 123’ WPB, 225’ WLB and 420’ WAGB cutters; corrosion preventive zinc anodes are installed on all other cutter and boat classes. Each MLC shall develop and promulgate specifications for the inspection, maintenance, and renewal of the aforementioned systems. Information on the equipment, design, installation, and maintenance of zinc anode systems is available in NSTM Chapter 633. Equivalent information for CAPAC systems is available in Coast Guard technical publications for the respective 110’ WPB, 123’ WPB, 225’ WLB and 420’ WAGB cutter classes. Cathodic protection systems shall be evaluated annually in conjunction with either routine drydockings (underwater body inspections) or during diver inspections every non-drydocking year. Findings shall be documented on the Drydocking and Underwater Body Inspection Worksheet (CG-2926) or a letter, and forwarded to the respective MLC.

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CHAPTER 634. DECK COVERINGS

A. **GENERAL.** Each MLC shall develop and promulgate detailed guidance for the removal of existing deck coverings, surface preparation (cleaning and priming), and the installation of new deck coverings. Application, maintenance, and safety procedures outlined in NSTM Chapter 634 and Coatings and Color Manual, COMDTINST M10360.3 (series), may be used for guidance.

B. **AUTHORIZED MATERIALS.** The following table is a list of authorized, interior deck covering materials, applicable conformance standards, and respective areas of use on Coast Guard cutters and boats. NSTM Chapter 634 provides a comprehensive listing of deck-covering materials for specific shipboard areas. All systems must meet the fire performance and specification requirements of MIL-STD-1623, unless specified otherwise herein, or by MLC.

TABLE 634-1 AUTHORIZED DECK COVERING MATERIAL

SYSTEMS	SPECIFICATION	LOCATION
*Cosmetic Polymeric Epoxy Resin	MIL-D-24613: • Type I, Class 1 (w/colored quartz aggregate) • Type I, Class 2 (w/color flake topping) • Type I, Class 3 (w/marble chip aggregate) • Type III (One-step system w/colored quartz aggregate)	Interior passages (adjacent to weather doors or refrigerated spaces), washrooms, water closets, and shower spaces
Ceramic Tile: • Mosaic • Quarry • Porcelain paver	ANSI A137.1	Refrigerated cargo space, galley, scullery, laundry, and pantry
**Resilient Roll or Sheet And Fire-Retardant Tile	• Fire-retardant plastic tiles: ASTM F-1066 • Homeogeneous vinyl tiles:	Mess rooms, passages (serving living, messing food) office spaces, conference rooms, lounges, ship control spaces (pilothouse, chartroom,

	SS T-312, Type III • Rubber tile flooring with molded patterns, studs, or raised profiles: SS-T-312, Type II, or ASTM F-1344, Class IA • Vinyl floor covering with backing : FED SPEC L-F-475, grade A, or ASTM F1303, Grade 1	communication spaces)
***Electrical Insulating	MIL-M-155562: • Type I (Dielectric Sheet) • Type II (Electrical grade mat – smooth surface) • Type III (Electrical grade mat-diamond tread pattern)	Electrical and electronic spaces, operating and servicing areas in way of electric and electronic equipment (for prevention of electronic shock)
****Carpeting	Commercially-available products: pile yarn shall be made of 100 wool or velvet – woven thru back.	Senior staff cabin and stateroom; wardroom lounge.

* Units need to be aware that the one-step cosmetic polymeric system does not require sealing: if sealing is desired, application of sealer coats in excess of what is recommended by the manufacturer may reduce effectiveness of the non-slip properties, and the system will no longer be in compliance with MIL-D-24613.

*Application of MIL-D-24613, Type II and Type III, polyurethane is no longer authorized. Repair and resealing of existing polyurethane decks shall be accomplished by a licensed contractor.

Ships' personnel are **NOT** authorized to handle Type II and Type III polyurethane.

**Material conforming to ASTM F1344 and ASTM F1303 must be asbestos-free, w/flammability >0.45 w/cm2 (ASTM E648)

***Principal differences are that the sheet material is generally more attractive and is easier to maintain. If the compartment is not a designated electrical space but contains electrical equipment such as switchboards, panels or electrical insulated work benches and is not protected with an approved electrical sheet deck covering (Type D), install an appropriate length of mat. Type II or III, on the deck adjacent to the electrical equipment, insulated work benches, and operating and servicing areas of electrical shock hazards: but not less than 3-feet wide. Exposed corners shall be rounded off. Cementing the mat to the deck is optional, except that the material shall be installed without cement on the vicinity of removable deck plates. If a compartment is designated an electrical/electronic space, the electrical grade deck covering shall cover the entire space. Although sheet material, Type I, is recommended for these spaces, matting material, Types II or II, may be used, and should be installed by cementing directly to the deck.

****Velvet materials include, but are not limited to the following fabrics: silk or synthetic, fiber such as rayon, nylon, acrylic, modacrylic, polyester or polypropylene fiber or blends of these fibers. All carpeting materials must meet following fire hazard criteria:

- Maximum optical density of smoke:450, in accordance with ASTM E662.
- Critical radiant flux:0.45 watts/cm2 in accordance with ASTM E648.

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CHAPTER 635. THERMAL INSULATION

A. **GENERAL.** Each MLC shall develop and promulgate detailed guidance on the inspection, repair, and replacement of thermal insulation. MIL-STD-1623D provides a listing of authorized insulating materials and specifications. NSTM Chapter 635 may be used for additional guidance.

B. **ASBESTOS POLICY.** Asbestos Exposure Control Manual, COMDTINST M6260.16 (series), provides detailed guidance on the inspection, repair, removal, disposal and use of asbestos materials. Removal or disturbance of asbestos material by ship's force is not authorized (except for emergencies). With the exception of the newest vessels, asbestos-containing thermal insulation is believed to have been installed on all classes of ships and boats to some degree. Since visual identification is not reliable, all thermal insulation should be considered to be asbestos containing unless known to be otherwise. With the exception of certain gasket material, brake, and clutch linings, the fabrication, installation, and use of new asbestos containing materials is prohibited in the Coast Guard. New asbestos materials, having no acceptable substitutes, shall be approved by G-WKS.

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CHAPTER 640. LIVING AND BERTHING SPACES

A. **HABITABILITY IMPROVEMENT OF CUTTERS.** Commanding Officers/Officers-in-Charge (CO/OIC) may restore or renew existing interior finish materials and furnishings that no longer meet shipboard habitability standards. Improvements shall comply with MIL-STD-1623D, Fire Performance Requirements and Approved Specifications for Interior Finish Materials and Furnishings. In addition to fire performance criteria, MIL-STD-1623D provides a listing of authorized materials for shipboard use.

B. **HABITABILITY IMPROVEMENTS THAT REQUIRE ENGINEERING CHANGES.** CO/OICs shall apply each habitability improvement proposal against the Engineering Change criteria provided in Chapter 041 of this manual.

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CHAPTER 670. STOWAGE, HANDLING, AND DISPOSAL OF HAZARDOUS MATERIALS

A. **GENERAL POLICY.** Hazard Communication for Workplace Materials, COMDTINST 6260.21 (series), requires Commanding Officers/Officers-in-Charge (CO/OIC) to develop and maintain a hazard communication program. Units are responsible for designating a hazardous materials coordinator, who is responsible for developing and maintaining a hazardous materials inventory list and Material Safety Data Sheets (MSDS) for all hazardous materials (general use consumables) in the workplace. Hazardous material coordinators are also responsible for training crewmembers in the proper stowage, handling, and disposal of hazardous materials. Asbestos Exposure Control Manual, COMDTINST M6260.16 (series) provides the Coast Guard policy and procedures for handling asbestos. Hazardous Waste Management Manual, COMDTINST M16478.1 (series), prescribes polices and procedures for Coast Guard vessels and shore activities to comply with Federal hazardous waste regulations. For state and local guidance, units shall contact their respective MLC Environmental Section, Civil Engineering Unit, U. S. EPA Regional Office, or State Hazardous Waste Management Agency. In cases where state and local regulations conflict from federal and Coast Guard regulations, the most stringent shall be the preferred level of compliance.

B. **INVENTORY**. A complete inventory list is required for all hazardous materials. At minimum, the list must include unit name, product name, manufacturer and address, FSN, and the location and use of each product. An MSDS shall also be provided for each hazardous material. Whenever possible utilize HAZMIN Centers to purchase hazardous materials and maintain onboard inventories only at levels required to support a deployment or existing maintenance.

C. **STOWAGE.** Proper hazardous material stowage is essential to cutter and personnel safety. Gasoline shall be stowed in accordance with Chapter 540 of this manual. Additional information on hazardous material stowage may be obtained from Commandant (G-WKS) and MLC (kse). NSTM Chapter 670 provides information concerning stowage requirements for flammable and combustible materials.

D. **HANDLING.** Before using a product, personnel shall review container warning labels and respective MSDSs, which provide information on proper use, potential hazards, protective measures to be taken, and emergency first aid procedures to be followed. Enclosure (2) to Hazard Communication for Workplace Materials, COMDTINST 6260.21 (series) provides a listing of hazardous materials and by-products, which may be found on Coast Guard cutters. Manual I of the Chemical Hazards Response Information System (CHRIS), COMDTINST M16465.12 (series), provide additional information on the compatibility of chemicals, associated hazards, and preventive/precautionary measures to be taken, and recommended action responses.

E. **DISPOSAL.** Hazardous Waste Management Manual, COMDTINST M16478.1 (series), provides guidance on the disposal of hazardous waste materials. Wastes generated while underway shall be turned over for disposal to a supporting shore facility, which has an EPA generator identification number. Independently moored vessel with an EPA generator identification number/permit shall dispose of hazardous wastes in accordance with the provisions of the permit.

F. **<u>ELECTRONIC RECORDS</u>.** Units outfitted with CMplus shall use it as the primary means for managing hazardous materials. CMplus provides an inventory and reporting function for hazardous material. It may also be used to develop an authorized use list that limits the types of hazardous materials used by the unit.

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CHAPTER 700. ORDNANCE, GENERAL

A. **GENERAL.** Ordnance Manual, COMDTINST M8000.2 (series), provides detailed guidance on the administration, operation, training, alteration, and maintenance and NESU support of weapon systems used by the Coast Guard.

B. **COAST GUARD MODULE TEST AND REPAIR (MTR) PROGRAM.** Cutters with major Navy-Owned Ordnance (NAVORD) systems installed and their supporting NESUs have been outfitted with Module Test and Repair equipment to test the condition of circuit cards and electronic assemblies in both NAVORD and HM&E equipment.

1. All suspect cards (HM&E or NAVORD) should be screened by a local MTR facility, if available, prior to removing repair parts from the storeroom or turning in the cards and assemblies for repair. If no local MTR facility exists, the parts should be replaced and the old parts returned without screening.

2. Decisions to repair or return all faulty assemblies shall be in accordance with the assigned Source, Maintainability, and Recovery (SM&R) codes and the ELC Appropriation Purchase Account (APA) Repairable Electronics Program ELCINST 4401.1 (series). Repairs shall not be attempted to assemblies coded for depot repair.

3. All screening actions and repairs shall be reported via the MTR Tracking System (MTRTS). The MTRTS is a database imbedded in the MTR equipment to capture equipment usage. More info on the MTR Program and the MTRTS is contained in Coast Guard Miniature/Microminature (2M)/Module Test and Repair (MTR) Program, COMDTINST 4790.2 (series).

C. **NESU-HELD NAVY-ORDNANCE SUPPORT EQUIPMENT.** NESUs supporting NAVORD-equipped cutters have been issued individualized COSAL manuals listing the tools, materials, and support equipment needed to properly support the NAVORD systems installed on their assigned cutters. The NESUs shall maintain and safeguard that equipment to ensure that it is available when needed by or for their assigned cutters.

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CHAPTER 834. COMPUTER PROGRAMS

A. COMPUTER PROGRAMS FOR ENGINEERING USE.

1. Descriptions. The following software applications are authorized for managing shipboard configuration, maintenance, supply, inventory and stability:

   a. Shipboard Computer Aided Maintenance (SCAMP). SCAMP is an application for managing a cutter's Preventive Maintenance System (PMS), Current Ship's Maintenance Projects (CSMP), ordering and receipt of parts inventory, annual budget, and inventory usage.

   b. Configuration Management Plus (CMplus). CMplus will replace SCAMP functionality and will be used to manage unit configuration, supply/inventory, and maintenance. CMplus is an application which provides key information to other Coast Guard maintenance and logistics applications, such as Management Information for Configuration Allowances (MICA) and Fleet Logistics System (FLS). CMplus software is managed by G-SLS with technical support provided by OSC Martinsburg. Questions concerning the installation of the software should be addressed to the servicing MLC. Software technical questions should be addressed to OSC. Use of CMplus is mandatory for cutters outfitted with the system.

   c. Fleet Logistics System (FLS). FLS is a web-accessible Oracle database application that provides platform information about planned and corrective maintenance, projects, schedules, inventory (total asset visibility), expenditures, and budgets. One of the key outputs of FLS for cutter maintenance planning is the Naval Engineering Project Listing (NEPL). The NEPL is compiled for each cutter area of responsibility and presented in various formats dependent on the user's requirements.

   d. Naval Engineering Technical Information Management System (NE-TIMS). NE-TIMS provides authorized personnel access, through CD-ROM and/or the Coast Guard Intranet, to engineering technical data such as drawings and technical publications. Hardware requirements are SWSIII with either CD-ROM or CGDNT access. No special software is required to view the documents. NE-TIMS is managed by the Technical Information Branch of the Engineering Logistics Center. CD-ROM distribution is automatic and access via the Coast Guard Intranet is password controlled for any activity other than for viewing.

   e. Flooding Casualty Control Software. FCCS provides shipboard and shore based personnel with the ability to quickly evaluate a ship's intact, damaged, and grounded stability. It is described in detail in Chapter 079 of this manual.

B. INSTALLATION AND UTILIZATION REQUIREMENTS.

SCAMP shall be maintained and utilized by all units until replaced by CMplus. Upon installation, cutters shall use CMplus for all their configuration, supply, inventory, and maintenance actions.

C. **DISTRIBUTION OF SOFTWARE.** Commandant (G-SLS) will distribute CMplus via the Configuration Management project.

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CHAPTER 997. DOCKING INSTRUCTIONS FOR CUTTERS AND BOATS

A. CUTTERS.

1. Docking Intervals. The cognizant MLC and operational commander shall coordinate and schedule cutter repair availabilities. Cutter Employment Standards, COMDTINST 3100.5 (series) and Chapter 081 of this manual shall be used for guidance.

2. Drydock Certification.

   a. Using MIL-STD-1625C, Safety Certification Program for Drydocking Facilities and Shipbuilding Ways for U. S. Navy Ships as a guide, MLCs shall ascertain job qualifications of the Dockmaster and workforce of prospective drydock facilities, and assess the capacity, physical condition, and operation of these facilities in regard to their foundation, structure, and supporting auxiliary systems. For facilities where compliance with all the requirements of MIL-STD-1625C is impractical, MLCs shall develop and promulgate alternative compliance and acceptance criteria.

   b. The intact stability criteria of MIL-STD-1625C are extremely important and should be strictly adhered to. Floating drydocks should be able to sustain damage to two adjacent tanks without deck immersion or excessive list and have adequate reserve buoyancy to achieve 12" of freeboard. Marine railways should have adequate stabilizing moment to offset the overturning moment and leave a margin for safety. In addition, prospective drydock facilities shall be certified by a naval architect (professional engineer), tasked with addressing the stability (as described above), drydock strength and material condition along with certification of insurance and classification (i.e. in accordance with ABS, etc.).

3. Availability Guidelines. MLCs shall develop and promulgate detailed guidance for planning and executing commercial availabilities. Guidance shall include procedures for safely docking and undocking cutters, specifications for conducting maintenance, tests and inspections, and general administrative procedures to be followed.

4. Underwater Body Hull Inspection Board.

   a. Convening Authority:

      (1) MLCs shall designate either an administering NESU representative or the appropriate MLC representative as the Underwater Body Hull Inspection Board convening authority for each drydocking of cutters within their respective AOR. Inspection boards shall consist of a MLC/NESU representative, the Commanding Officer/Officer-in-Charge (CO/OIC), the 1ST Lieutenant, and the Engineer Officer/Engineer Petty Officer (EO/EPO).

      (2) The administrating NESU shall serve as the convening authority for "active" cutters drydocked at the Coast Guard YARD (CG YARD). The CO of the CG

YARD shall serve as the convening authority for "inactive" cutters drydocked at the CG YARD. The CO of the YARD shall designate appropriate CG YARD personnel to serve on Hull Inspection Boards for inactive cutters.

b. Inspection Procedures. The board shall make an initial survey as soon as possible after the cutter is drydocked and before any work is done on the underwater body or appendages. Guidelines for conducting inspections are outlined in the Drydocking and Underwater Body Inspection Work Sheet (CG-2926) and the Underwater Body Paint Report (CG-4815). Completed reports shall be forwarded to the cognizant MLC. Copies shall be retained on board the cutter as part of the Hull History File.

5. Cutter Responsibility. Prior to docking, CO/OICs are responsible for ensuring that block arrangements are in accordance with the docking plan. Operational control of cutters shall be shifted to the Dock master as specified in NSTM Chapter 997. While docked, there shall be no shifting of weights, fuel, fresh water or ballast without the express permission of the Dock master. CO/OICs are responsible for keeping an accurate account of all changes and shifts in weight.

B. **BOATS.**

1. Boat Inspection Interval. Boats shall be hauled out of the water, annually, to conduct a thorough boat inspection. Guidelines for conducting inspections are specified in NEM Chapter 090 and the Boat Inspection Report (CG-3022).

2. Boat Availabilities. The annual boat inspection and required report should be performed in conjunction with the annual boat availability. Groups shall coordinate specific repairs and districts shall coordinate availability scheduling. Procedures for planning and executing boat availabilities are documented within the MLC Standard Operating Procedures.

APPENDIX A

COAST GUARD CUTTER STABILITY TEST PROCEDURES

A. STABILITY TEST PROCEDURE. This appendix prescribes a procedure to ensure the accuracy and uniformity of the stability test performed on Coast Guard cutters. The data obtained from the stability test is used to accurately determine the cutter's light ship center of gravity and displacement. These results are then used to prepare a Stability Test Report, which documents the stability test and presents loading conditions other than light ship. Any departure from this procedure must be approved by ELC (023).

B. PREPARATION FOR TESTING.

1. Procedures Review. At least two weeks before the stability test, the NESU Representative, the Stability Test Officer (STO), and the Commandant Representative shall discuss the preparation for and conduct of the stability test. The following information shall be reviewed:

    a. Identification of the vessel

    b. Date and location of test

    c. Verification of Draft Marks

    d. Stability test weight data

    (1) Type

    (2) Amount

    (3) Certification

    (4) Method of handling

    e. Pendulums, including approximate location and length

    f. Anticipated maximum angle of ship's heel to each side

    g. Approximate trim and, if necessary, use of trimming weights

    h. Condition of tanks

    i. Estimated weights to deduct, to complete, and to relocate

    j. Ship mooring for test

k. Other ship preparation, for example, deck shoring

l. Copies of the cutter's line drawings, curves of form, midship section drawings, general arrangements, and tank capacity tables

m. Variable loads for loading conditions

n. Stability Test Team personnel (assignments and communication with)

2. General Condition of Cutter.

a. The cutter shall be as nearly ready for service as possible, including outfit, spares, and repair parts. If the cutter is undergoing construction or major renovation, work shall be completed or as close to completion as schedules permit.

b. The cutter shall be in a good state of cleanliness. Such items as shipyard gear, equipment, workmen's tool boxes, scaffolding, scrap, and construction debris shall be removed from the cutter.

c. Movable weights shall be lashed in place.

d. Bilges shall be dry and decks free of liquids.

e. Liquids in boilers, wet machinery, and piping shall be at the operating level; and the sewage tanks shall be at low suction.

f. Keys to all locked compartments shall be available.

g. A minimum number of personnel shall be on board during the test. No other work shall be in progress during the test.

h. Draft marks shall have been verified while the cutter was in dry dock.

3. List of Weights.

a. A list of weights shall be prepared. It shall identify all items that need to be added to, removed from, or shifted on board the cutter to determine the Light Ship Condition from the condition "As Inclined". The Light Ship Condition is the cutter complete in all respects but without any items of variable load.

b. The centers of gravity shall be referenced to the cutter's baseline, midships, and centerline. Sign conventions shall be positive values above baseline, aft midship and starboard of centerline.

c. If transverse weights are needed, they shall be reported, with their accompanying transverse moment referenced to the centerline plane.

4. Tankage.

a. General.

(1) The liquid loading for the test shall be determined before the date of the test. The number of tanks containing liquids shall be at a minimum to reduce free surface effects.

(2) Because diesel oil tanks might overflow during the test, they shall not be pressed full. They shall be filled at a level such that the free surface effect can be accurately determined.

(3) Within the framework of the above requirements, the cutter's liquid loading must ensure adequate stability for the test.

b. Slack Tanks. Slack tanks shall be avoided if possible. Otherwise, they shall be as follows:

(1) Slack tanks shall be limited to tanks with essentially a rectangular cross section and fuel oil tanks.

(2) Water tanks shall be either full and pressed up, or empty. Slack water tanks can only be allowed if approved by a Commandant Representative.

(3) Deep tanks shall be 20 to 80 percent full.

(4) Double-bottom tanks shall be 40 to 60 percent full. These tanks may be slack, although sounding indicates a full tank. See Figure 1.

(5) The percentages in paragraphs B.4.b. (3) & (4) are intended to prevent pocketing of the liquid, or a change in the dimensions of the free surface throughout the range of heel angles during the stability test. If the tank is of an irregular shape and must contain liquid, then the liquid level shall be such that an accurate free surface determination can be made throughout the range of inclinations.

(6) Slack tanks containing highly viscous liquids that resist free movement, as the cutter is inclined shall be avoided because their free surface effect is difficult to determine. Such liquids include heavy lube oils or Navy Special fuel oil at room temperature. Liquids in tanks may be heated to reduce the viscosity.

(7) Cross connections, including those through manifolds, must be closed. Unequal liquid levels in slack tank pairs can be used as a check against open cross connections.

4. c. Pressed Up Tanks.

(1) "Pressed up," means completely full with no pockets or voids caused by trim or inadequate venting.

(2) Anything less than 100 percent full, as for example the 95 percent condition regarded as full for operational purposes, is not acceptable.

(3) The cutter shall be rolled from side to side to eliminate entrapped air before taking final soundings.

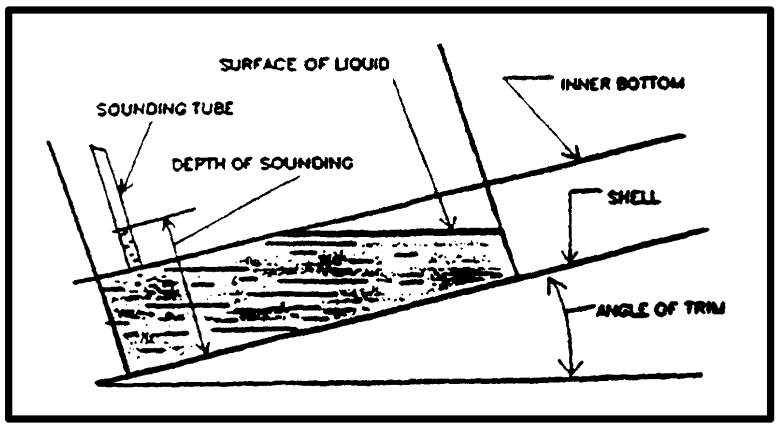

Figure A-1 Double Bottom Tank Soundings

Sketch showing how double bottom tank may be slack although sounding indicates a full tank.

d. Empty Tanks.

(1) All empty tanks, cofferdams, and void spaces shall be inspected. Therefore, all manholes shall be opened and the tanks, cofferdams, and void spaces made "safe for men" in accordance with Navy Publication NAVSEA 0901-LP-920-003.

(2) It is generally not sufficient to simply pump tanks until suction is lost. The exceptions are very narrow tanks or tanks where there is a sharp deadrise, where free surface would be negligible. Otherwise, tanks shall be entered, stripped with portable pumps, and wiped dry.

e. Identification of Liquids. Liquids in tanks shall be identified by their specific gravity.

5. Trim, Hog and Sag.

a. If no tanks are pressed up, a level or nearly level trim is desirable. If tanks are to be pressed up, some trim by the stern will aid in venting and eliminating air pockets. It will also facilitate emptying those tanks that are required to be empty. Where a number of tanks are permitted to be full, press up the aftermost tanks first to provide a favorable stern trim.

b. It is preferred that either the cutter has an even trim or that trim aft shall not exceed 1 percent length between perpendiculars (LPB).

c. For cutters with the trim aft not exceeding 1 percent LBP, hydrostatic properties for the cutter "As Inclined" may be taken from the Curves of Form for the draft, at the longitudinal center of flotation, corrected for hog or sag.

d. For cutters trimmed aft in excess of 1 percent LBP, hydrostatic properties for the "As Inclined" condition must be calculated for the actual trimmed waterline at test. Hydrostatic calculation, if necessary shall be performed utilizing the SHCP program or the GHS program (for boats and cutters up to 120 feet in length based on the hull description provided by ELC (02). Hog or sag and appendages shall be taken into account.

e. Hog or sag is determined by taking freeboard measurements along the length of the cutter, starting at midships and working toward both ends, and plotting them on the outboard profile drawing. The corrections for hog and sag are:

(1) Hog: Subtract two-thirds of the total hog value.

(2) Sag: Add two-thirds of the total sag value.

f. For cutters that have designed drag, special attention shall be given to ensure that the "as inclined" condition waterline corresponds to the waterlines used as the basis for the Curves of Form.

6. List.

a. With stability test weights in the initial position, up to, but not more than; one-half degree of list is acceptable for cutters of usual form.

b. Leveling weights may be used to correct list. These weights must be certified by a STO's master weight document before the test is conducted.

7. Mooring Arrangements.

a. The importance of a good mooring arrangement cannot be overemphasized. The location will depend on many factors. Among the most important are depth of water and wind and current effects. The cutter shall be moored in a quiet, sheltered area and be free of extraneous forces such as propeller wash from passing ships or sudden discharges from shoreside pumps.

b. The depth of water under the hull shall be sufficient to ensure that the hull will be entirely free of the bottom. The tide conditions and the trim and list of the cutter during the test must be considered. Before the test, the depth of water shall be measured and recorded in as many locations as necessary to satisfy this requirement. If marginal, the depth of water shall be spot checked after the test.

c. Cutters shall be moored as shown in Figure 2. In this case, the lines can be kept taut, holding the cutter in place, yet allowing unrestrained heeling. Note, however, that wind or current may cause a superimposed heeling moment to act on the cutter throughout the test. For steady conditions, this will not affect the results. Gusty wind or uniformly varying wind or current will cause these superimposed heeling moments to change, so that additional test points are required to obtain a valid test. The test validity can be determined by plotting test points as they are obtained.

d. Mooring pad eyes shall be installed as illustrated in Figure 2.

e. If the mooring arrangement shown in Figure 2 is unattainable, then an alternative mooring arrangement as described in B.7.f below may be used. Use of the alternative mooring arrangement must be acceptable to the STO and NESU Representative and must not jeopardize the stability test results per the Commandant Representative.

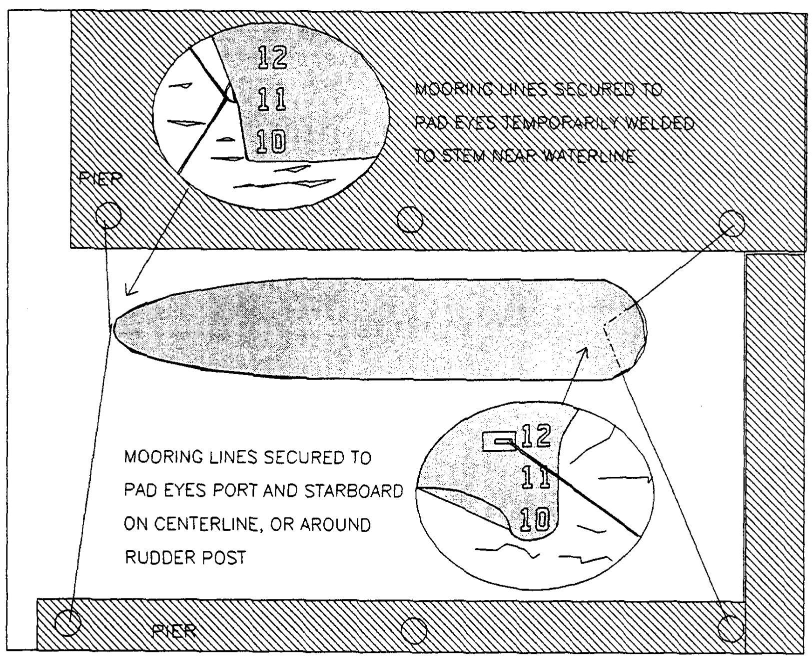

Figure A-2 Sketch of Mooring

f. When a cutter can only be moored to one side, it is generally necessary to supplement bow and stern lines with two spring lines to maintain positive control of the vessel, as shown in Figure 3. The leads of the spring lines shall be as long as practicable. Cylindrical camels shall be provided between the cutter and the dock. If conditions allow, all lines shall be slack, with the cutter free of the pier and camels, when taking readings.

(1) If the vessel is held off the pier by the combined effect of wind and current, and the bow and stern lines are secured at centerline near waterline, they can be taut. This is essentially the same as the preferred arrangement in B.7.c. As in B.7.c above, varying wind and/or current will cause some distortion of the plot.

(2) If a vessel is pressed against the camels by wind and/or current, all lines shall be slack. The cylindrical camels will prevent binding but, again, there may be an unavoidable superimposed heeling moment due to the ship bearing against the camel. This factor must be watched carefully to avoid erroneous test results.

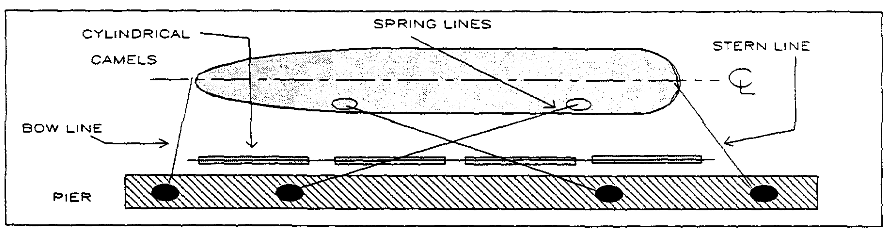

Figure A-3 Line Arrangement

g. If a floating crane is used to handle the stability test weights, it shall not be moored to the cutter undergoing the stability test.

h. The brow shall be removed. Power lines, hoses, and other items connected to the shore shall be at a minimum. Shoreside services required during the stability test shall be kept slack at all times.

8. Personnel.

a. Sufficient personnel shall be available to handle mooring lines and to assist in shifting the stability test weights. Personnel shall remain in their designated area when readings are being taken during the stability test.

b. No one shall be allowed to board or depart from the cutter once the stability test begins. Once the stability test has begun, it shall be completed without interruption.

c. Sufficient personnel shall be provided to record the pendulum readings and to collect all data relative to the experiment. Before the stability test, those recording the pendulum deflections shall become thoroughly familiar with the procedure described in this chapter.

d. Knowledgeable personnel shall be provided to assist in sounding all tanks, bilges, cofferdams, and voids the day of, and just before, the actual experiment.

e. All personnel on board must be directed to a convenient location, preferably on the centerline at the start of the test, and must remain in that position when readings are taken.

9. Weather.

a. The combined adverse effects of wind, current, and sea may result in difficult or even invalid test results because of:

(1) Inability to accurately record drafts and freeboards.

(2) Excessive or irregular oscillations of pendulums.

(3) Variations in unavoidable superimposed heeling moments.

b. The stability test may have to be delayed or postponed until weather conditions improve or until the cutter is moved to a sheltered area where weather and environmental conditions are acceptable. Pre-test planning shall provide for this contingency.

c. Rain, snow, and ice shall be removed from the cutter to the satisfaction of the STO, NESU representative, and Commandant representative.

C. CONDUCT OF TEST.

1. Stability Test Officer (STO) and Commandant representative:

a. The STO shall conduct the stability test in accordance with the stability test specifications. Where the specifications are silent, the procedures within this chapter shall apply.

b. The Commandant representative shall advise the NESU representative if valid stability test results are subject to error or are in jeopardy of being invalid due to improper preparation of the cutter or conduct of the stability test.

c. The Commandant representative will:

(1) Check the adequacy of cutter preparation by conducting a general inspection of the cutter.

d. (2) Ensure that the mooring arrangement is satisfactory and compatible with weather conditions.

(3) Witness the measurement of the pendulums, the soundings of tanks containing liquids, and inspect all dry tanks just before the test.

(4) Witness the reading of draft marks, measurement of freeboards, specific gravity and temperature of the flotation water.

(5) Verify accuracy and acceptability of the test data recorded.

2. Test Weights.

a. The total weight used shall be enough to give an inclination of 1 to 3 degrees to each side, with the larger inclinations necessary to get sufficient deflection of the pendulum on smaller cutters. The inclination shall never exceed 4 degrees.

b. The weights shall be solid, compact, and of such configuration that the center of gravity location may be accurately determined. (Personnel used to sally ship are not acceptable weights.)

c. Each stability test weight shall be marked with an identification number and weight. Either a weight-master's document or a Coast Guard Inspector shall certify the weight. Steel weights are preferred. Weights, such as porous concrete, that will absorb significant amounts of moisture, shall be avoided. If concrete is used, it would be weight certified before and after the stability test, be wrapped in plastic film, and be symmetrical in shape.

d. It must be possible to move the weights rapidly once the test is started, to reduce the likelihood of encountering changing wind and current conditions.

e. Use of the cutter's own weight handling equipment is not permitted. Decks shall be protected with wood dunnage in way of the weights.

f. Precautions shall be taken to ensure that the decks are not overloaded during the weight movements.

3. Pendulums.

a. Figure 4 shows a satisfactory pendulum arrangement. The pendulums do not have to be on centerline.

b. Three pendulums shall be used to increase the confidence level of accuracy of the average pendulum deflections. The pendulums shall be located in an area protected from the wind. An alternative device such as an electronic digital level, micrometer level, or suitably arranged water tubes might be substituted for

b. one of the three required pendulums upon approval by ELC (02). The device shall be demonstrated to have a precision better than a tangent of 0.001 (one tenth of one percent of slope or three minutes of arc). The detailed procedure for using the device shall be submitted for approval. Alternatives to all three pendulums including digital devices, visual sighting with instruments or inclining in air may be specifically approved by ELC (02) for boats where conventional pendulums or procedures are impractical due to considerations such as small size, arrangements or other encumbrances.

c. The pendulums shall be as long as possible. A minimum deflection of 6 inches at the maximum inclination is desirable.

d. The pendulum damping boxes shall be large enough to prevent the bobs from hitting the sides. The boxes shall be filled with new SAE 30, SAE 40, or equivalent oil or detergent solution with sufficient viscosity to damp the pendulum. Water may be used for boats provided that the size and shape of the damping trough and weight provide adequate damping and that it is approved prior to the experiment by ELC (02). Note that water may require a circular bucket, as rectangular troughs sometimes do not damp adequately because the shape of the trough does not suppress sloshing well. The oil level shall be just below the top of the bob.

e. The batten support shall be rigid and able to withstand a severe kick without moving.

f. The batten, shown in Figure 4, shall be marked off in tenths of an inch in such a way that inch and half inch-marks are distinguishable from other one-tenth inch marks. The full inch marks will be numbered sequentially from port to starboard.

g. The bobs shall be suspended by a thin line (fish line) from a washer supported by a knife edge fulcrum; for example, a small triangular file. The line shall be free of knots, kinks, etc. The length from the fulcrum to batten shall be recorded.

h. A pendulum deflection reading shall be recorded when the central control station gives the order to proceed. This order shall be given when all pendulums oscillations are damped and no sooner than 3 minutes after the test weights are positioned.

i. The pendulum deflection value shall be computed by subtracting the reading per test from the average of the readings for the test weight settings, which represent zero heeling moment.

j. Adequate lighting must be provided at each pendulum.

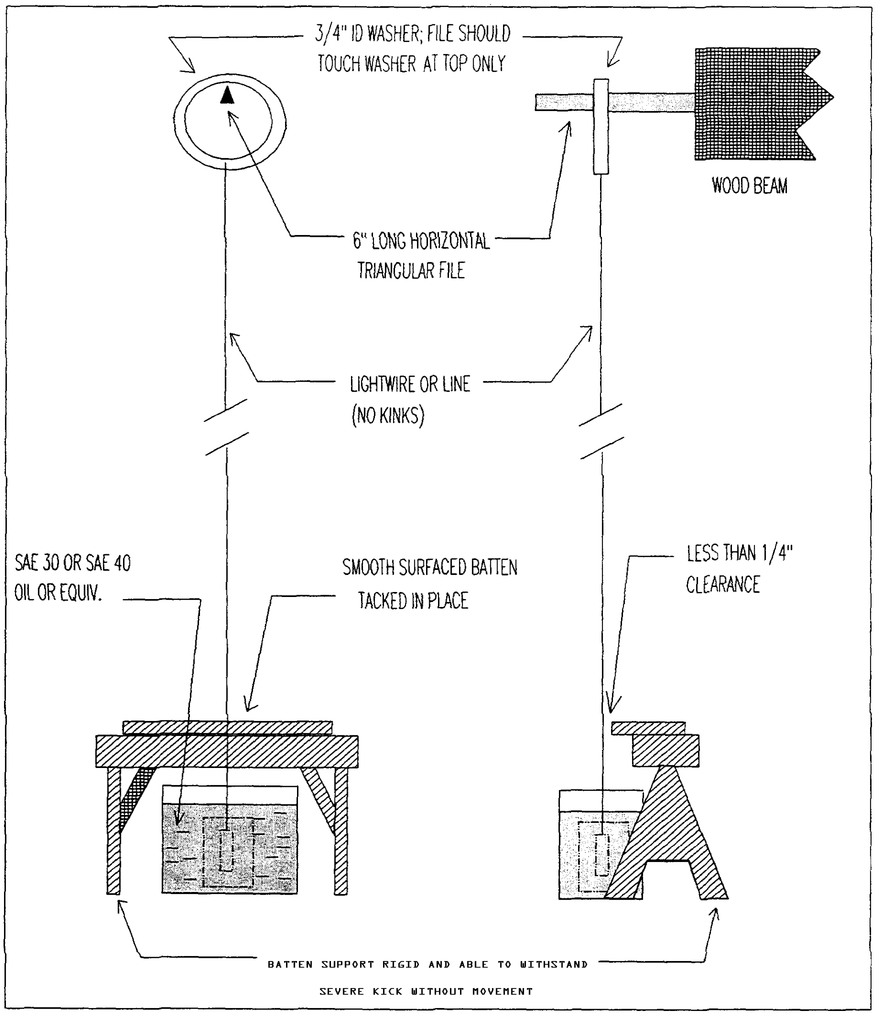

Figure A-4 Satisfactory Pendulum Arrangement

4. <u>Drafts and Freeboards</u>.

   a. Drafts and freeboards shall be read immediately before or immediately after the stability test. All personnel who will be on board during the test shall be on board and in location during these readings. This is particularly important on small cutters and boats. If the readings are taken after the stability test is completed, the cutter must be maintained in the same condition as during the test. Freeboards will be measured amidships on the port and starboard side. If the forward and aft draft marks appear to be unreliable, freeboards shall be taken as a check. For cutters and boats up to 120 feet in length, additional freeboards shall be read port and starboard near the forward and aft perpendiculars from points on the deck or hull surface that can be accurately located, at a minimum. Reading freeboards at additional points along the length is preferred if feasible. A statistical analysis shall be performed on these freeboards using the least squares technique to determine draft, trim and sag or hog from this data.

   b. Drafts shall be read at the forward and aft draft marks and amidships. All readings shall be taken both port and starboard.

   c. The bow and stern freeboards, when required, may be measured on centerline. The fore and aft distance of the readings from fixed reference points on the centerline shall be recorded.

   d. For small cutters and boats, it may be necessary to counterbalance the list and trim effect of freeboard measuring parties. When possible, all readings shall be taken from a boat; however, all persons, or equivalent weights, which will be on board for the stability test shall be on board when draft and freeboard readings are taken.

   e. A small boat shall be available for use when taking drafts and freeboards. The boats shall have a low freeboard to permit accurate observation of the readings.

   f. The specific gravity and temperature of the flotation water shall be measured when the drafts are measured, at several locations and depths around the tested cutter.

5. <u>Communications and Control</u>.

   a. The STO, stationed at a central control station, shall have complete control over all personnel involved in the stability test.

   b. There shall be efficient two-way communications between the central control station and:

      (1) The weight handlers

      (2) Each pendulum station

c. The central control station shall be sheltered from the elements, have adequate lighting, a desk or table, and a chair, so that a plot of tangents versus heeling moments can be made during the stability test. It is desirable that the weight handlers be directly observable from the control station.

d. The order to start recording pendulum readings for each trial shall be loud, clear, and concise to prevent unnecessary restarts.

6. Weight Movements.

a. The standard test employs eight weight movements after initial placing of the weights (Position 1). The fourth and eighth weight movements (Position 5 & 9, respectively) shall return the weights to their initial position that corresponds to zero heeling moment. If conditions change during the test, such as a wind shift, it may be necessary to repeat the earlier moves to eliminate test plot distortion.

b. The weight movements shown in Figure 5 give a good spread of points on the test plot.

c. The moment arm for each weight movement shall be measured to provide for more accurate results if the placement of the weight is changed from the previous set location.

d. After each weight movement, and just before the pendulum locations are recorded, a check must be made to ensure that all personnel are in location and that all lines that shall be slack are, in fact, slack.

e. Weight movements must be made directly athwartship to avoid a change in the trim of the cutter.

7. Test Plot.

a. The test plot shall be made after all weight movements have been completed.

b. Using the deflection and the length of the respective pendulum, the tangent may be calculated and plotted against the test moment, as shown in Figure 5.

c. The test plot shall be large enough to determine if stability test results are acceptable and if any unacceptable errors are present.

e. d. It is advisable to perform a least squares analysis of the moment-tangent data to determine the slope of the moment tangent line and to gauge its accuracy.

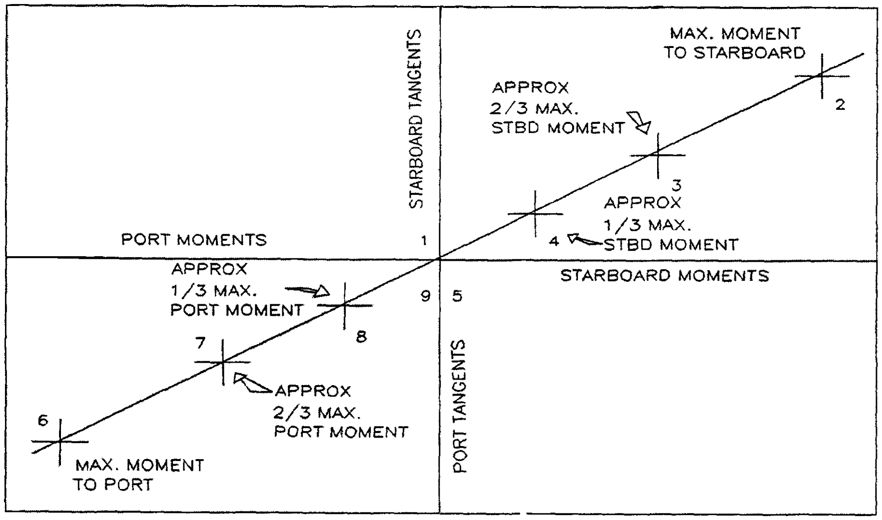

Figure A-5 Tangent Plot

8. Period of Roll Test.

   a. The period of roll test will be performed after the test plot has been found acceptable. At least three people shall time three full roll periods induced by a sufficient weight movement.

   b. All stability test weights must be placed back in their initial position before the period of roll test is conducted.

   c. Rolling is induced by placing a weight off center, then removing it. If a stability test weight is used to induce rolling, the rolls shall be timed only after the weight is returned to its original position.

D. TEST RESULTS.

1. After Test Actions. The following actions will be taken after the test:

   a. On the day of the test after completion of the stability test, the Commandant Representative shall be provided with a copy of all test data. This data shall provide a clear accounting of the condition of the cutter before and during the test and of all test measurements made.

   b. Prior to departing the cutter, the STO, the NESU Representative, and the Commandant Representative shall initial each sheet of the stability test record to indicate their concurrence with the acceptability of the stability test conditions and performance.

This signature does not pre-approve the Stability Test Report to be developed and submitted by the STO and finally approved by ELC (02).

2. Use. The test results will be used for the following:

   a. The test results shall constitute a complete record of all stability test information gathered and data recorded.

   b. The results of the stability test shall be used to calculate the loading conditions outlined below. The first four conditions are defined in the Naval Ships Technical Manual (NSTM), Chapter 096.

      (1) As Inclined

      (2) Light ship (A)

      (3) Minimum Operation Condition (B)

      (4) Full Load (D)

      (5) Any other loading condition specified in the contract specifications.

3. Format. Reports shall be in the format specified below.

   a. The data shall be presented in a Stability Test Report using Coast Guard Form CG-993 (rev. 7-67). If it was determined before the stability test that the transverse center of gravity is required, then the modified Coast Guard Form CG-993 will be used. Presentation of stability test data in any other formats requires prior approval by ELC (02). Format directly output by the HEC stability program is approved and may be used. Both the input file and output file from computer programs, if used, shall be submitted on 3-1/4" 1.44 Mbyte MS DOS format magnetic diskette as well as on paper. For boats and cutters up to 120 feet in length, GHS or the output of spreadsheets such as Excel or combinations of these containing substantially the same information may be used if approved prior to the experiment by ELC (02).

   b. Tank inertia calculations for free surface effect shall accompany the Stability Test Report. Tank inertia data shall be calculated in accordance with a methodology that is comparable to the methodology in the book Principles of Naval Architecture version edited by John P. Comstock.

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APPENDIX B. CUTTERS AND BOAT INTERIOR PAINTING SYSTEMS

A. VESSEL COATING SYSTEMS – INTERIOR.

This appendix presents the required coatings for various interior areas and components of Coast Guard cutters and boats. The coating systems for each area are presented in tabular form. The tables include the surface preparation, primer, intermediate coat if any, and topcoat. The various coatings used for a particular application should be regarded as a system. The coating system shall be obtained from a single manufacturer to ensure that the individual components are compatible and maximize performance. Thickness references apply to the dried film and is abbreviated as DFT (dry film thickness). Subject matter in this chapter is listed alphabetically. References are by paragraph heading and include:

1. Bilges and Cofferdams.
2. Bulkheads.
    a. Bulkheads, Firezone
    b. Bulkheads and Overheads, Uninsulated Aluminum
    c. Bulkheads and Overheads, Uninsulated Steel
    d. Bulkheads and Overheads, Uninsulated Metal (wet areas)
    e. Bulkheads and Overheads, Uninsulated Steel (appearance not a factor)
    f. Bulkheads and Overheads, Uninsulated Aluminum (appearance not a factor)
3. Chain Lockers
4. Condensation, Space Subjected to
5. Deckplates
    a. Deckplates, Steel
    b. Deckplates, Aluminum
6. Decks, Metal Interior and Non-skid Areas
    a. Steel and Aluminum Decks (wet areas)
    b. Steel and Aluminum Decks (dry areas)
    c. Metal Decks, Non-Skid Tread
7. Door, Joiner
8. Electric Cable, Armored
9. Electronics Equipment
10. Furniture and Galley Equipment
11. Inaccessible Areas
    a. Inaccessible Areas, Steel
    b. Inaccessible Areas, Galvanized Steel and Aluminum
12. Insulation Surfaces
13. Ladders, Stainless Steel, Galvanized Steel and Aluminum
14. Machinery, Interior
    a. Machinery, Operating Temperatures Under 200^{o}F

    b. Machinery, Operating Temperatures Over 200°F
15. Piping, Interior
    a. Piping, Insulated and Uninsulated, Under 200°F
    b. Piping, Uninsulated, Over 200°F
16. Plastic Surfaces
17. Tanks and Voids
    a. Tanks and Voids, General
    b. Ballast Tanks
    c. Fuel/JP-5 Tanks, Service, Storage, Overflow, Drain
    d. Grey Water, Sewage, and CHT Tanks
    e. Lube Oil and Fuel Tanks, Unballasted with water extraction systems
    f. Potable Water Tank
18. Transducer Hull Rings
19. Wood, Interior
    a. Wood, Painted Interior
    b. Wood, Stained and Varnished Interior

Warning

PERSONNEL INVOLVED IN THE APPLICATION OF PAINTS, PRIMERS, VARNISHES, OR SIMILAR TREATMENTS, OR THE PREPARATION OF SURFACES FOR THE APPLICATION OF PAINT OR PAINT PRODUCTS, SHALL BE FAMILIAR WITH THE CONTENTS OF CHAPTER 2 OF THIS MANUAL, THE INFORMATION CONTAINED ON ALL APPLICABLE MATERIAL SAFETY DATA SHEETS, AND TECHNICAL GUIDE: PRACTICES FOR RESPIRATORY PROTECTION, COMDTINST M6260.2 (series). PERSONNEL SHALL ALSO BE FAMILIAR WITH THE ENVIRONMENTAL ISSUES ADDRESSED IN CHAPTER 3 OF THIS MANUAL.

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
BILGES AND COFFERDAMS					
Bilges and Cofferdams, Steel		Non-Machinery Spaces: SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5) - or - SSPC-SP 12/NACE NO. 5 (To "WJ-2" and "SC-2") - and - Machinery Spaces: SSPC-SP 11 (1.0) or SSPC-SP 12/NACE NO. 5 (To "WJ-2" and "SC-2")	1) High Build Epoxy 2) High Build Epoxy	5.0-6.0 5.0-6.0	1
Bilges, Aluminum			Do not paint		
BULKHEADS					
Bulkheads, Firezone, Aluminum		Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) MIL-PRF-46081 Intumescent Epoxy 3) MIL-PRF-46081 Intumescent Epoxy	5.0-6.0 5.0-6.0 5.0-6.0	2
Bulkheads, Firezone, Steel	I	SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) High Build Epoxy 2) MIL-PRF-46081 Intumescent Epoxy 3) MIL-PRF-46081 Intumescent Epoxy	5.0-6.0 5.0-6.0 5.0-6.0	2
	II	Same as Option I	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Intumescent Type II, Class 1 3) MIL-PRF-24596 Water Based Intumescent Type II, Class 1	5.0-6.0 5.0-6.0 5.0-6.0	
Bulkheads and Overheads, Uninsulated Aluminum	I	Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 3) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A	5.0-6.0 1.0-2.0 1.0-2.0	3, 4
	II	Same as Option I	1) High Build Epoxy 2) DOD-E-24607 Chlorinated Alkyd Fire Retardant 3) DOD-E-24607 Chlorinated Alkyd Fire Retardant	5.0-6.0 1.0-2.0 1.0-2.0	

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
Bulkheads and Overheads, Uninsulated Steel	I	SSPC-SP 6/NACE No. 3 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 3) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A	5.0-6.0 1.0-2.0 1.0-2.0	4
	II	Same as Option I	1) High Build Epoxy 2) DOD-E-24607 Chlorinated Alkyd Fire Retardant 3) DOD-E-24607 Chlorinated Alkyd Fire Retardant	5.0-6.0 1.0-2.0 1.0-2.0	
Bulkheads and Overheads, Uninsulated Metal- (Wet areas such as washrooms, water closets, shower space, food prep areas and exits to weather)		<u>Steel</u> SSPC-SP 11 (1.0) - and - <u>Aluminum</u>: Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) High Build Epoxy	5.0-6.0 5.0-6.0	
Bulkheads and Overheads, Uninsulated Steel- (Appearance not a factor, i.e., voids)	I	SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-2.5)	1) Inorganic Zinc	2.5-3.5	4
	II	SSPC-SP 6/NACE No. 3 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) High Build Epoxy 2) High Build Epoxy	5.0-6.0 5.0-6.0	
Bulkheads and Overheads, Uninsulated Aluminum- (Appearance not a factor)		Brush blast to bare metal with clean, fine aluminum oxide, garnet or equivalent inert material conforming to A-A-59316, Type I & IV / (1.0-1.5)	1) High Build Epoxy 2) High Build Epoxy	5.0-6.0 5.0-6.0	
CHAIN LOCKERS					
		SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-2.5)	1) Inorganic Zinc	2.5-3.5	4
CONDENSATION, SPACE SUBJECTED TO					
	I	SSPC-SP 10/NACE No. 2 using grit	1) High Build Epoxy	5.0-6.0	5

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
		conforming to MIL-A-22262 / (1.5-3.5)	2) DOD-E-24607 Chlorinated Alkyd Fire Retardant (5.0 wet film thickness) 3) Extended Vermiculite ASTM C-516 (apply while previous coat is still wet) 4) DOD-E-24607 Chlorinated Alkyd Fire Retardant 5) DOD-E-24607 Chlorinated Alkyd Fire Retardant	- - 1.0-2.0 1.0-2.0	
	II	Same as Option I	1) High Build Epoxy 2) Ceramic Insulation Coating 3) Ceramic Insulation Coating	5.0-6.0 10.0-15.0 10.0-15.0	
DECKPLATES					
Deckplates, Steel		Underside and edges: SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-2.5) Top (unpainted): Wire Brush	1) Inorganic Zinc 1) Coat with lube oil weekly and wipe off excess	2.5-3.5	4
Deckplates, Stainless Steel/ Aluminum			Do not paint		
DECKS, METAL INTERIOR AND NON-SKID AREAS					
Steel and Aluminum Decks - wet areas, food preparation areas, exit areas, and areas subject to condensation		Steel: SSPC-SP 11 (1.0) - and - Aluminum: Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) High Build Epoxy	5.0-6.0 5.0-6.0	
Steel and Aluminum Decks - dry areas and low wear areas		Steel: SSPC-SP 3 - and - Aluminum: Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) MIL-PRF-24635 Silicone Alkyd, Type II, Cl. 1	5.0-6.0 2.0-3.0	
Metal Decks, Non-Skid Tread		Steel: SSPC-SP 11 (1.0) - and - Aluminum: Power tool clean using non-	1) MIL-D-17951 Tread Material	-	

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
		metallic abrasive padding, to remove all coatings and contamination			
DOOR, JOINER					
	I	Steel: SSPC-SP 3 - and - Aluminum: Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 3) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A	5.0-6.0 1.0-2.0 1.0-2.0	4
	II	Same as Option I	1) High Build Epoxy 2) DOD-E-24607 Chlorinated Alkyd Fire Retardant 3) DOD-E-24607 Chlorinated Alkyd Fire Retardant	5.0-6.0 1.0-2.0 1.0-2.0	
ELECTRIC CABLE, ARMORED					
	I	Clean with Adhesion Promoter/Cleaner. Break gloss with sandpaper as required.	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 3) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A	5.0-6.0 1.0-2.0 1.0-2.0	4
	II	Same as Option I	1) High Build Epoxy 2) DOD-E-24607 Chlorinated Alkyd Fire Retardant 3) DOD-E-24607 Chlorinated Alkyd Fire Retardant	5.0-6.0 1.0-2.0 1.0-2.0	
ELECTRONICS EQUIPMENT					
Electronics Equipment					6
FURNITURE AND GALLEY EQUIPMENT					
	I	Steel: SSPC-SP 3 - and - Aluminum: Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 3) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A	5.0-6.0 1.0-2.0 1.0-2.0	4, 7
	II	Same as Option I	1) High Build Epoxy	5.0-6.0	

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
			2) DOD-E-24607 Chlorinated Alkyd Fire Retardant 3) DOD-E-24607 Chlorinated Alkyd Fire Retardant	1.0-2.0 1.0-2.0	
INACCESSIBLE AREAS					
Inaccessible Areas, Steel	I II	SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-2.5) Same as Option I	1) Inorganic Zinc 1) High Build Epoxy 2) High Build Epoxy	2.5-3.5 5.0-6.0 5.0-6.0	4, 8
Inaccessible Areas, Galvanized Steel and Aluminum		Roughen mechanically or brush blast to bare metal with clean, fine aluminum oxide, garnet or equivalent inert material conforming to A-A-59316, Type I & IV / (1.0-1.5)	1) High Build Epoxy 2) High Build Epoxy	5.0-6.0 5.0-6.0	8
INSULATION SURFACES					
Insulation Surfaces, Fiberglass Sheet/ Closed Cell PVC Foam	I II	Clean with Adhesion Promoter/Cleaner. Break gloss with sandpaper as required. Same as Option I	1) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 1) DOD-E-24607 Chlorinated Alkyd Fire Retardant 2) DOD-E-24607 Chlorinated Alkyd Fire Retardant	1.0-2.0 1.0-2.0 1.0-2.0 1.0-2.0	4
LADDERS, STAINLESS STEEL, GALVANIZED STEEL AND ALUMINUM					
			Do not paint		
MACHINERY, INTERIOR					
Machinery, Operating Temperatures Under 200°F, Unmachined surfaces		Steel: SSPC-SP 3 - and - Aluminum: Power tool clean using non-metallic abrasive padding, to remove all coatings and contamination	1) High Build Epoxy 2) MIL-PRF-24635 Silicone Alkyd, Type II, Cl. 1	5.0-6.0 2.0-3.0	9
Machinery, Steel, Operating	I	SSPC-SP 3	1) TT-P-28 Heat Resisting Aluminum Paint 2) TT-P-28 Heat Resisting Aluminum Paint	1.0-2.0 1.0-2.0	9

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
Temperatures Over 200°F					
PIPING, INTERIOR					
Piping, Insulated and Uninsulated, Under 200°F		SSPC-SP 3	1) High Build Epoxy 2) MIL-PRF-24635 Silicone Alkyd, Type II, Cl. 1	5.0-6.0 2.0-3.0	
Piping, Uninsulated, Over 200°F		SSPC-SP 3	1) TT-P-28 Heat Resisting Aluminum Paint 2) TT-P-28 Heat Resisting Aluminum Paint	1.0-2.0 1.0-2.0	
PLASTIC SURFACES					
		Lightly roughen; all extraneous matter shall be removed by washing with Adhesion Promoter /Cleaner. Glazed surfaces shall be sanded to promote adhesion.	1) High Build Epoxy 2) High Build Epoxy	Mist Coat 2.0-3.0	
TANKS AND VOIDS					
Tanks and Voids, General		SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B) 2) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B)	5.0-6.0 5.0-6.0	10, 11
Ballast Tanks	I	SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B) 2) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B)	5.0-6.0 5.0-6.0	10, 11
	II	Same as Option I	1) MIL-PRF-23236 Salt Water Only (Type IV, Class 2, Grade A/B) 2) MIL-PRF-23236 Salt Water Only (Type IV, Class 2, Grade A/B)	5.0-6.0 5.0-6.0	
	III	Same as Option I	1) Primer: MIL-PRF-23236 Salt Water Only, 100% Solids, Edge-Retentive (Type IV, Class 2, Grade A/B) 2) Topcoat: MIL-PRF-23236 Salt Water Only, 100% Solids, Edge-Retentive (Type IV, Class 2, Grade A/ MIL-PRF-23236 Grade A when storing, applying, and curing at a temperature range of 20	Follow Manuf. Instructions	

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
			to 50 degrees F.B)		
Fuel/JP-5 Tanks, Service, Storage, Overflow, Drain		SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B) 2) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B)	5.0-6.0 5.0-6.0	10, 11
Grey Water, Sewage, and CHT Tanks		SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5)	1) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B) 2) MIL-PRF-23236 General Use - Fuel and Salt Water (Type IV, Grade A/B) -or- 1) MIL-PRF-23236 Salt Water Only (Type IV, Class 2, Grade A/B) 2) MIL-PRF-23236 Salt Water Only (Type IV, Class 2, Grade A/B)	5.0-6.0 5.0-6.0 5.0-6.0 5.0-6.0	10, 11
Lube Oil and Fuel Tanks, Unballasted with Water Extraction Systems		For new construction, remove mill scale with steel shot	Apply a heavy coat of lube oil		
Potable Water Tank		Steel: SSPC-SP 10/NACE No. 2 using grit conforming to MIL-A-22262 / (1.5-3.5) Aluminum: Brush blast to bare metal with clean, fine aluminum oxide, garnet or equivalent inert material conforming to A-A-59316, Type I & IV / (1.5-2.5)	Potable Water Tank Coating-NSF Approved (See manufacturer's product data sheets for number of coats to achieve total specified DFT) - or - Potable Water Tank Coating-NEHC Approved (three contrasting coats required)	10.0-12.0 (Total) 8.0-12.0 (Total)	12, 13
TRANSDUCER HULL RINGS					
Interior Surfaces		Same surface preparation as the Bilge	Use the same coating system as the Bilge		
WOOD, INTERIOR					
Wood, Painted Interior	I	Remove any loose paint by scraping, sanding, or milling the surface. Apply commercial wood paste filler as necessary to fill dents, holes, and cracks. Allow 18 hrs for drying.	1) High Build Epoxy 2) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A 3) MIL-PRF-24596 Water Based Fire Retardant, Type I, Class 1, Grade A	5.0-6.0 1.0-2.0 1.0-2.0	
	II	Same as Option I	1) High Build Epoxy 2) DOD-E-24607 Chlorinated Alkyd Fire Retardant	5.0-6.0 1.0-2.0	

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

Area or Compartment to be Finished		Surface Preparation / (Anchor Profile in mils)	Coating System	Min DFT (mils)	Notes
			3) DOD-E-24607 Chlorinated Alkyd Fire Retardant	1.0-2.0	
Wood, Stained and Varnished Interior		Remove varnish as necessary by scraping or sanding. Sand surface smooth, wipe clean.	1) TT-S-711 Interior Wood Stain 2) A-A-1800 Spar Varnish 3) A-A-1800 Spar Varnish 4) A-A-1800 Spar Varnish	- 1.0-2.0 1.0-2.0 1.0-2.0	

Notes

1. Bilges susceptible to ballast damage shall be coated with 20 mils of Amercoat 238 or equivalent abrasion resistant epoxy tank coating from MIL-PRF-23236.

2. On existing well bonded coatings, the two coats of intumescent epoxy may be applied over the cleaned old coating.

3. Paint aluminum only as required to prevent corrosion. Always prime aluminum before painting to avoid paint failure.

4. Water-based coatings may only be applied when ambient air and substrate temperature are above 50 degrees F., in order for the water to evaporate completely and form a continuous coating. Water-based coatings will not dry at relative humidity above 80 percent.

5. These coating systems shall not be used to replace thermal or anti-sweat insulation on any piping systems.

6. In general, electronics equipment shall not be painted in the field. Minor touch ups of exposed surfaces may be made using the instructions provided in the equipment technical or service manual. Paint of original matching color shall be used. Information on the proper paint and color can be obtained from the manufacturer. In cases where the equipment requires complete repainting, arrangements shall be made with the servicing MLC Electronics Support Unit.

7. Corrosion resistant steel furniture and galley equipment, decorative plastic surfaces such as those on table tops, porcelain surfaces and interior bright aluminum furniture and galley equipment are not to be painted.

8. All inaccessible voids that bear against the shell shall be welded tight, tested for tightness, and treated by filling and draining with a rust preventive compound conforming to MIL-C-16173, Grade 3. These include rudders, skegs, sealed void spaces at the stem and voids in the bilges or voids constantly exposed to salt water.

9. Working metal surfaces shall not be painted. They shall be coated with a Solvent Cutback Corrosion Preventive Compound, MIL-C-16173, Grade 3, or Thin Film Corrosion Preventive Compound, MIL-C-81309, Type II, Class 1.

TABLE B-1 – VESSEL COATING SYSTEMS - INTERIOR

10. Drying times between coats and final system cure for specified tank coatings other than potable water tanks shall be in accordance with manufacturer's recommendations.

11. Use a coating system qualified to MIL-PRF-23236 Grade A when storing, applying, and curing at a temperature range of 20 to 50 degrees F. Use a coating system qualified to MIL-PRF-23236 Grade B when storing, applying, and curing at a temperature range of 51 to 100 degrees F.

12. All potable water tank coatings must be approved by either the National Sanitation Foundation (NSF) or Naval Environmental Health Center (NEHC).

13. Drying time between coats for potable water tank coatings, including stripe coat, shall be not less than 24 hours at a minimum temperature of 77 degrees F. Final system curing prior to putting tanks back in service shall be not less than 7 days at a minimum temperature of 77 degrees F.

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APPENDIX C.	NAVAL ENGINEERING MANUAL FORMS LIST	
FORM NUMBER	**TITLE**	**REV. DATE**
CG-2580	BOAT RECORD	Sep-85
CG-2616G	MACHINERY LOG	Jun-04
CG-2920	CURRENT SHIP MAINTENANCE PROJECT	Jun-04
CG-2926	DRYDOCKING & UNDERWATER BODY INSPECTION WORKSHEET	Jun-04
CG-2929	MACHINERY HISTORY CARD	Feb-92
CG-2930	ENGINEERS BELL BOOK	Jun-04
CG-3022	BOAT INSPECTION REPORT	Jun-04
CG-3186	OPERATING RECORD MAIN ENGINES	Sep-67
CG-3186A	OPERATING RECORD - MAIN PROPULSION	Nov-76
CG-3485	WATCH QUARTER AND STATION BILL	May-72
CG-3496	RECORD OF THE SHIP STRUCTURE & MACHINERY EVALUATION BOARD	Jun-04
CG-3496A	SHIP STRUCTURE & MACHINERY EVALUATION BOARD INDEX	Jun-04
CG-3496B	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - MEMBERS/CUTTER DATA	Jun-04
CG-3496C	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - FINDINGS/RECOMMENDATIONS	Jun-04
CG-3496D	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - MAIN PROPULSION MACHINERY FINDINGS	Jun-04
CG-3496E	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - AUXILIARY MACHINERY FINDINGS	Jun-04
CG-3496F	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - PRIME MISSION EQUIPMENT FINDINGS	Jun-04
CG-3496G	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - INSIDE COMPARTMENT FINDINGS	Jun-04
CG-3496H	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - EXTERIOR DECK SPACE FINDINGS	Jun-04
CG-3496I	SHIP STRUCTURE & MACHINERY EVALUATION BOARD - HULL EXTERIOR IN DRYDOCK FINDINGS	Jun-04
CG-3765	HULL HISTORY CARD	Jun-04
CG-4428	REQUEST FOR DIRECTIVES	Oct-91
CG-4815	UNDERWATER BODY PAINT REPORT (PAINT PERFORMANCE)	Jun-04
CG-4874	CUTTER ENGINEERING REPORT	Jun-04
CG-5323	REQUEST FOR ALLOWANCE CHANGE	Jun-04
CG-5682	ENGINEERING CHANGE REQUEST	Jun-04
CGHQ-3379	SHIP ALTERATION APPROVAL	Jun-04
DD-2026	OIL ANALYSIS REQUEST	Nov-77
OPNAV 4790/CK	SHIP'S CONFIGURATION CHANGE REPORT	May-84